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Terminological Aspects Concerning Three-dimensional Real Property

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Abstract. *This article discusses terminological aspects concerning definitions of three-dimensional (3D) real property.*

The authors have noticed that researchers from different countries, and even within the same country, use different terminology when describing 3D property. Neither have any general international definition of 3D property been encountered which is possible to use internationally to differentiate forms of 3D property. The aim of this article is to discuss terminological aspects of 3D property, resulting in a working definition of 3D property. The definition is tested and validated against other 3D property definitions encountered internationally.

The basic aspects of terminology in general and legal terminology in particular are studied as a foundation for discussions on forms of 3D property rights and 3D property terminology. Examples of various terms used internationally, in different countries and legal families, are presented, showing the variety and difficulties with standardising the terminology. The problem of existing inconsistent terminology used today is addressed by applying methods from the field of terminology within the 3D real property domain. An overview of 3D property and property rights and what characterizes each of them is also presented. Thereafter the terminological principles are applied on a survey of 3D property rights to create a working definition for 3D property.

Based on the validation, it can be concluded that the studied definitions all have shortcomings from a legal perspective, such as being too narrow or too wide, focusing on use rather than on object, or describing the physical object instead of the legally defined 3D object. This shows that it is difficult finding an accurate and internationally valid definition of 3D property. The authors believe that using unified terms and definitions will act towards a common understanding and thus further the establishment of a domain specific ontology within the field of 3D property.

Keywords: *Three dimensional real property, definition, terminology, ontology, standardization.*

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1 Introduction

1.1 Background

In recent years there have been a number of publications regarding the harmonisation, unification and methodology of law in general, in which attention has been given to terminological aspects, among others (e.g. van Hoecke, 2004). However, there have only been rather few scientific contributions dealing with the use of terminological principles in the real property domain³, including three-dimensional real property and three-dimensional real property rights (hereafter shortened 3D property and 3D property rights) (e.g. Paulsson and Paasch, 2011).

3D property is often considered to be a special type of property, different from the traditional 2D property. The normal case is that all space within the 2D parcel belongs to and can be used by its owner, but the possibility to grant specific rights to a part of this space within the 2D property exists and can take different forms. There is competition for space, especially in the cities, with increasing population and more advanced space-demanding activities that will have to share space within the same 2D property unit. Complex situations where there is a need to separate the ownership within an existing parcel and its space can be found (Stoter and Ploeger, 2002, p. I.2). Different types of 3D property rights have existed for a long period of time (Bugden et al., 1997, [1-000]), but the need for them, as well as use, has increased in recent years (Sandberg, 2003, p. 125).

Therefore 3D property rights have become an important part of the cadastral domain and are fundamental for effective land use and land management. The concept of 3D property has been in focus for some time with the discussion regarding how to secure such rights. For example, the International Federation of Surveyors (FIG) arranged an international workshop on 3D cadastres in 2001, a decade ago. General questions regarding registration of properties in strata (i.e. in layers) were discussed. One of the outcomes of the working session on legal issues concerned the question of what is “3D property” and whether or not it is possible to construct a definition of this concept. The conclusion was that it depends to a large extent on the legal system and cultural background (FIG, 2002). Since then, the problems of finding definitions have been addressed by e.g. Paulsson (2007) and Sherry (2009) during the last decade.

The cadastral domain has nonetheless been subject to a standardized approach for a number of years conducted by both the scientific community and professional organisations. For example, in recent years attempts have been presented to increase uniformity in the cadastral domain through e.g. the presentation of the FIG Cadastre 2014 statement describing a vision for a future cadastral system (Kaufman and Steudler, 1998) and the current development of an international standard for land administration, the Land Administration Domain Model, LADM (ISO, 2011).⁴

³ Domain is in this article defined as a specialised field of activity.

⁴ The LADM is currently in the process of becoming an international standard for land administration. Note: The LADM has originally been published as the Core Cadastral Domain Model by Oosterom et al. (2006) before being renamed as Land Administration Domain Model (LADM).

1.2 Problem description

There is no agreed international definition of 3D property. Most definitions seem to be based on national legislation and its specific, national characteristics of 3D property.⁵

The authors have noticed that researchers from different countries, and even within the same country, use different terminology when describing 3D property, especially when they are writing in non-native languages, such as English. Paulsson (2007) discusses the problem of finding a proper definition of 3D property and the discrepancy in terminology. She concludes that there does not seem to be a simple meaning to this concept. Sherry (2009, pp. 131–132) discusses the differences in terminology in the common law countries and the inconsistency that exists there both nationally and globally. Since the different states of, for example, the United States and Australia have their own legislation for 3D property rights, there can also be a varied terminology within countries. These differences can be considered as a challenge when discussing these issues internationally. Neither are the legal structures behind the terminology shown in this varied terminology. Even if the legal systems are consistent, the terminology might not be as consistent and that makes it more difficult to discuss these systems (Sherry, 2009, p. 132).

1.3 Scope and delimitation

The aim of this article is to discuss terminological aspects of 3D property, resulting in a working definition of 3D property. The definition is tested and validated against other 3D property definitions encountered internationally.

The scope includes a discussion of the problems regarding producing a definition for 3D property as identified by the authors and points to the differences in the terminology and definitions of 3D property that are actually used, encountered during the authors' earlier research.

The article does not present a solution of how to develop and maintain a terminology, but outlines and discusses how to deal with the problems. The 3D property definition presented in this article is not to be regarded as a final definition, but as an input for further research regarding the nature and structures of 3D property. The article is a contribution to the establishment of a domain specific ontology for the 3D property domain. Applying principles from the field of terminology will in the authors' view help to structure this part of the legal domain in regard to cross border transfer of information.

Furthermore, the article does not address any standardization of legislation and the development of optimal sets of legal rules for 3D real property.

1.4 Methodology

In the first part of the article the basic aspects of terminology in general and legal terminology in particular are studied as a foundation for discussions on forms of 3D property rights and 3D property terminology. Thereafter the terminological principles are used in a survey of forms of 3D property rights to create a working

⁵ The same is, of course, the situation for the traditional 2D property as well.

definition for 3D property. The aim is to produce a definition covering the legal aspects of 3D property, since these aspects by the authors are seen as a foundation for 3D property. Without proper legislation, 3D properties cannot be formed at all. The working definition is then validated against a selection of existing 3D property definitions found internationally. The selection is based on research conducted by Paulsson (2007) and supplemented with definitions published during 2007–2011 (FIG, 2010; ISO, 2011). Since there is no generally accepted definition of 3D property, it is neither possible to test the authors' proposed definition, nor the other selected definitions against such a general definition. The purpose of the validation is to investigate whether the working definition agrees with the already existing definitions or descriptions of 3D property, and whether they can be replaced by the proposed working definition, thus creating an internationally applicable definition for 3D property.

2 Terminology

2.1 Basic terminological components

In order to apply a terminological approach the basic components used in terminology must first be studied: *object*, *concept*, *characteristic*, *definition* and *term*. These components are closely related and one is either the result or basis of one of the others. An *object* is anything that is perceivable or conceivable. Some objects are material (e.g. a piece of land), immaterial (e.g. an urban planning zone) or imagined (e.g. a unicorn). A *concept* is a mental construction of the real world formed in our own mind. A concept does not stand alone, but is part of a concept system, where concepts are put in relation to each other according to specific rules. It is the *characteristics* which make us identify the 'real world' when we create our vision of it in our mind as a concept. However, it is not possible to use objects, concepts or characteristics to communicate effectively. A *definition* must describe what is meant with the concept.

A definition must be as precise as possible to avoid misunderstandings and confusions. Ambiguity of words makes it difficult to express precisely what is meant. A general, methodological problem is the use of words. A major task for any undertaking is to apply the correct terminology and ensure the correct understanding of the texts and diagrams describing the topic subject for the description. However, it would be rather complicated to always use definitions when communicating. *Terms* to express them are therefore needed. Terms are the instruments used for communication. A term must have a specific meaning, based on the definition delimiting and describing a concept. Otherwise it would mean different things to different people. However, applying terms is not simply a matter of using one word or another for describing something. Any term must be based on the discussion of our mental pictures of real world objects, delimited by a number of characteristics which are mandatory for the object in question (ISO, 1996; ISO, 2000a; ISO, 2000b and Suonuuti, 2001).

In order to achieve a thorough understanding of a fact, a problem or a semantic network of events, there must be an understanding of not only what

the case is and what it consists of, but also how and why it is the case. It is even limited by our own thoughts, as the symbolism employed when speaking is partly caused by the reference that is made and partly by social and psychological factors (Ogden and Richards, 1923).

The same words can be part of several domains and subject to specific use in specific levels of specialisation. The example below briefly illustrates the use of the term “person” in relation to two, seemingly different, domains; the cadastral domain and the healthcare domain. The examples are hypothetical and do not represent any existing descriptions of the use of the term “person” in the domains.

A term must be specialised for each domain, but nonetheless be based on the same common ground, i.e. the “person” in both domains must be based on the same, basic definition before being used within the specific domains. The term “person” is understood by both domains on a basic level, but might not be used in the same way throughout each domain. A specialisation is added on each level in the hierarchy. The common definition of a “person” may in the cadastral domain be anyone who comes into contact with the domain e.g. real property owner, granted right owner⁶, estate agent, etc. and a patient, legal company, visitor, etc. in the health care domain. In short; it is a human being or a legal person (e.g. a company) who has any contact with one of the domains. A former specialisation of “person” could in the cadastral domain be a person owning a real property and in the health care domain a person requiring treatment for an illness. A further specialisation could be a person owning 3D property or being a patient in the respective domains.

The principle is illustrated in figure 1 below where the same, basic definition of a “person” is used in both domains on a general level, here called domain level 1. Specialised domain-specific descriptions for persons in the cadastral- and healthcare domains are here called domain level 2 and 3. Domain level 3 incorporates the description in domain level 2, whereas the description in domain level 3 is not part of the description in domain level 2.

The three domain levels used in the example above are only illustrative. The level of specialisation can consist of 1 to n domain levels, depending on how general or detailed the domain level is.

2.2 Legal terminology

Terminology is regarded as an important instrument within the legal domain. For example, Ekelöf stated more than six decades ago that ‘it is even of rather huge practical importance that certain and clear-cut terms are commonly accepted as representatives for different elements in the process of legal deduction’ (Ekelöf, 1945, p. 221).⁷ An agreed terminology would, in other words, contribute to the ‘matching’ of 3D property legal systems with their corresponding counterparts existing in other national legal systems. It would e.g. be possible to compare a 3D property, ownership or a 3D property right in country ‘A’ with the corresponding

⁶ Granted rights are e.g. easements and leasehold.

⁷ Authors’ translation from Swedish.

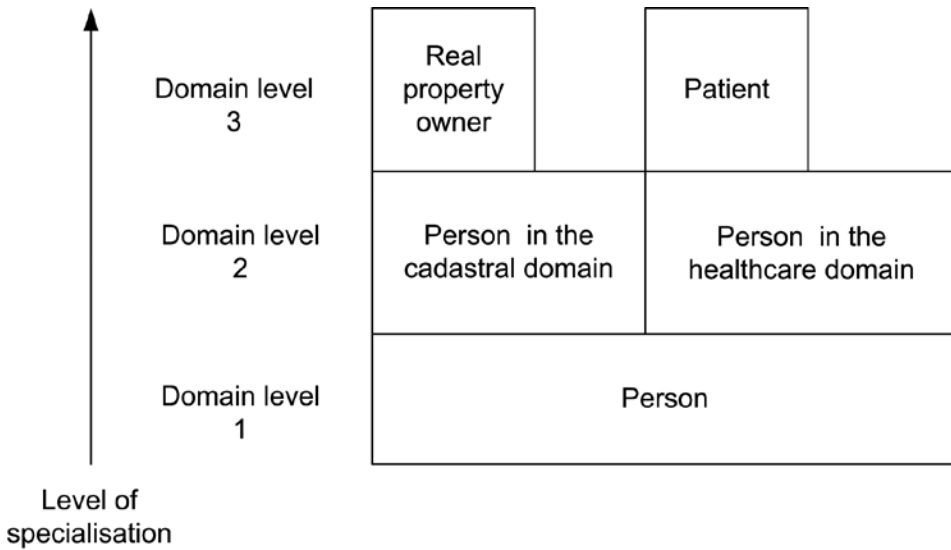


Figure 1. Examples of different levels of terms interacting with each other on different levels of specialisation.

counterpart in country ‘B’, since both rights share the same characteristics since they mean the same thing, even if they are not called the same in the national legislations.

The interpretation, explanation of similarities and differences within the legal domains and exchange of legal concepts and ideas have occupied legal scholars for centuries. A proper understanding of different legal concepts is of utmost importance for e.g. trade between countries. Knowledge about which rules and regulations that apply is needed. Such common understanding of these “legal standards” is equally important as the use of technical standards and standardized measurements, etc.

The first step in being able to apply a standardized approach towards the legal domain is to have means to be able to study it and compare its different parts. It is sometimes even spoken of “the legal system” – as if there existed one single, unitary system of meanings which at least all lawyers share. The common nominator for all legal families is that they are expressed in natural languages. With natural languages there is always the risk of misunderstanding, since natural languages are not predefined and clear systems of communication. Words might mean one thing on one legal domain level and another thing on another legal domain level. Therefore, any comparison of legal systems must include a study of to what extent the words used in the legal systems which are subject for comparison bear the same meaning (van Hoecke, 2004, p. 175).

There is no “natural” or universal form of law. All forms of law reflect the aspects of the culture and values of the society to which they belong. Neither is there any universal language to express law. Within any community where a particular natural language is spoken, narrower groups may differ from each other

in the particular ways in which they use language. These professional languages may even differ within themselves, e.g. a legal area might use (slightly) different expressions and vocabulary than another area within the same professional domain (Jackson, 1995). The legal domain is therefore not a homogenous body, but a patchwork of different legal domains based on different national legislation and cultural heritage.

It is necessary to understand the terminology in each specific language used for the compared systems. It makes it more difficult for legal comparatists to use a third language with a terminology not familiar to any of them (Bogdan, 1993, pp. 42–43). Bogdan considers it to be one of the greatest risks, when making comparative studies of other legal systems, to take it for granted that the legal concepts in one's own legal system can be used in the same way in the studied foreign system. Many foreign legal terms and concepts do not even have any equivalent in one's own language (Bogdan, 1993, p. 52). A legal term can also bear a different meaning when used outside legal terminology but within the same language. Bogdan questions whether it is at all possible to find just one word to translate certain legal terms. He suggests that special legal dictionaries or dictionaries where the words are explained in the same language might be helpful to understand the content of the term (Bogdan, 1993, p. 54). Without any agreement, it is impossible to achieve any effective communication or comparison (Ogden and Richards, 1923).

There have been several contributions towards the ontology and terminology of the cadastral domain during the recent years, see e.g. Paasch (2005, 2007, 2008), Ruonavaara (2003) and Stuckenschmidt, Stubkjær and Schlieder (2003). Ruonavaara discusses the terminology problem and points out that comparing forms of housing tenures between countries is a difficult task due to the 'bewildering variety of kinds of housing tenure' (Ruonavaara, 1993, abstract) and the fact that the tenure forms that are formally the same will in fact vary in content in the different countries where they exist. It is not only a problem of comparison, but also of translating the national form of tenure into one term that is understood in another country with other terminology and other forms of tenure. Ruonavaara suggests that tenures are just formal categories where the content is determined by the nationally and historically specific social relations of housing. As a solution to the problem of translating and comparing he proposes moderate constructivists' way of looking at tenure on two levels, one being general ideal types that are defined by some necessary features and the other being specific historically and geographically actual forms. He suggests that even though the types of tenure are changing historically and geographically, the variation of the rights and duties connected to these forms is bound by certain limits. Since the various types share certain characteristics within the specific categories, which cannot be extended to other forms without losing their distinctive nature, Ruonavaara argues that it is really possible to make an international comparison of national forms of tenure on a general level and to translate the categories specific for a country or legal system into terms that can be used and understood internationally. More detailed investigations can then be carried out by grouping the forms into some specific

types and then comparing them by using a specific scheme with certain dimensions (Ruonavaara, 1993, p. 18).

3 3D property

3.1 3D property terminology

There is no agreed terminology for the general 3D property concept. It seems that “3D cadastre” sometimes is used just to describe the actual cadastre, or property registration system, that cadastre stands for, but also as a general term for three-dimensional property. Another common term is “3D property”, which is used mainly in this article. The authors have encountered many other terms for this concept as well. Not all of them include “3D” or three-dimensional” as a component. Some of them refer to “multi-functional” or “multiple”, which puts the use of the land parcel in focus and the different activities and/or actors involved. Others involve “space” or “volume”, referring to the extension of the parcel, not just related to land. Another focus is the delimitation of the parcel, such as “horizontal subdivision”. The subdivision and form of ownership is also an important aspect in the common law legislation, stemming from the Australian legislation, which uses the terms “stratum” and “strata title”. The Swedish “*tredimensionell fastighet*” translates into “three-dimensional property unit” (Mattsson and Österberg, 2007, p. 348).

If referring more specifically to apartment/flat ownership or condominium, which is also a form of 3D property, again a number of different terms can be encountered. These are often related to the building and the subdivision of it into apartments. In some cases there is a clear difference between the forms independent 3D property and condominium, both in the legislation and in the terminology, in other cases only one of these form exists, or a mixture, or, as in the Swedish case, where the condominium is just a special type of 3D property unit intended to contain nothing but one single residential apartment (SFS, 1970:994, chap. 3, s. 1a).

Mentioning a few of the terms to be found internationally, there are terms such as “apartment ownership” or “flat ownership”, “ownership of storeys” or “horizontal property”, “condominium”, “condominium ownership” or “condominium property”, “strata title” “horizontal property”, “ownership of flats”, “multi-storey building”, “compartmented ownership of buildings”, “sectional ownership”, “unit ownership” or “unit title”, “ownership of space”, or older terms such as “division of houses according to storeys and apartments”, “co-ownership of houses according to storeys”, “houses in common ownership”, “community of houses divided by storeys” and “a house with various owners” (van der Merwe, 1994; Christudason, 1996). The list could be expanded further with other examples.

3.2 Types of 3D property rights

When discussing the problems connected with defining 3D property rights and the terminology used for it, the different types of 3D property rights that exist around

the world must be studied, since these forms and their nature are closely related to the terminology that is being used.

Internationally it is possible to find different types of 3D property rights, i.e. rights associated with 3D property. A property right is in this article defined as an “action, activity or class of actions that a system participant may perform on or using an associated resource” (ISO, 2011, p. 5). These rights usually have different names and functions. They gradually range from ownership to granted rights (such as e.g. leases). Even though there are no clear boundaries between 3D property rights, it is still possible to make a categorisation into some forms of such rights. The main types, as categorised by Paulsson (2007), are the independent 3D property, the condominium form, indirect ownership and granted rights. The independent 3D property is the subdivided part of the volume that the 2D property contains which is individually owned and often consists of a larger part for infrastructure purposes, for the residential or the office part of a building, etc. The condominium is apartment ownership, where smaller parts of a building, such as a residential apartment for one family or a office, are owned through direct ownership of that specific part or through a user right to that apartment provided by owning the building in common with the other residents. The term indirect ownership (Paulsson, 2007) refers to ownership through a legal person, such as an association, which is the formal owner and stands between the resident and the property. Examples of this type are tenant-ownership and the limited company system. Granted rights include forms such as leasehold or servitude, with no real ownership.

A suggested categorisation of these rights can be found in table 1 below. A difficulty with this categorisation is that there is no clear division between the rights. Many of them include similar elements and there are also differences related to the legislation in the various countries where these types exist.

The (1) independent 3D property is the type of property which usually contains larger units and that is relatively unattached to surrounding properties, compared with the other types. It may contain just a volume of air, as for the (1a) air-space parcel, or be connected to and included in a building or some form of construction, which Paulsson (2007) calls a (1b) 3D construction property. The (2) condominium usually stands for some form of apartment ownership, connected to a building. In most cases it consists of the apartment, a share in common property within and surrounding the building and membership in an owners' association that will manage the common areas. There are two main condominium types, the (2a) condominium ownership and the (2b) condominium user right. Condominium ownership signifies that the occupant of an apartment individually owns the specific part of the building which consists of the apartment in which that person lives. All occupants own the remaining parts of the building, the common parts, jointly by shares. Regarding the condominium user right, on the other hand, the occupants jointly own the apartment building, and the shares by which they own it give them an exclusive user right to a specific individual apartment.

A common feature for the group of 3D property rights called (3) indirect ownership is that there is an association, a company or other form of legal

Table 1. *Types of 3D Property Rights Generally (Paulsson, 2007, p. 32).*

| | |
|-----------------------------|------------------------------|
| (1) Independent 3D property | (a) Air-space parcel |
| | (b) 3D Construction property |
| (2) Condominium | (a) Condominium ownership |
| | (b) Condominium user right |
| | (c) Condominium leasehold |
| (3) Indirect ownership | (a) Tenant-ownership |
| | (b) Limited company |
| | (c) Housing cooperative |
| (4) Granted rights | (a) Leasehold |
| | (b) Servitude |
| | (c) Other rights |

person that stands between the occupant and the apartment. The occupants have membership or shares in the association or company, which gives them the right to use a specific apartment in the building. The (3a) tenant-ownership type is common in Sweden, a form where an association owns the apartment building, and members of the association by providing capital to this association obtain the right to use their respective apartments in the building. Finland has a similar type, the (3b) limited company system, where a joint stock company owns the building and by acquiring shares in that company, it is possible to obtain the right to exclusively use one of the apartments in the company-owned building.

(4) Granted rights, such as (4a) leasehold and (4b) servitudes can also be types of 3D property rights, but cannot be included in 3D property or 3D property units. Even the rented apartment can be considered as a form of 3D property right, since it is the right to occupy a three-dimensionally delimited volume, but it is usually not included when discussing 3D property rights.

4 Definitions of 3D property

4.1 Working definition of 3D property

Focusing on the three-dimensional aspect of the 3D property, a three-dimensional object can be defined as something that has an extent in length (height), width and depth. This does not mean, however, in comparison that a 2D property is flat and only includes the surface of a parcel. It is also in many jurisdictions considered to be three-dimensional in its extension and in theory extending infinitely upwards into the sky and downwards to the centre of the earth (see e.g. Powell and Rohan, 1993, Vol. 2A, 263.3[1a]). Thus, the three-dimensional aspect of 3D property is not so much the extension of the property, but rather the delimitation of it. The 2D

property is normally delimited in just one plane, while the 3D property is delimited in both the horizontal and in the vertical plane. The term ‘three-dimensionally determined property’ is related to this aspect of the 3D property concept.

Traditionally, 2D property is registered by x and y coordinates and the 3D property by x, y and z coordinates. A definition of 3D property focusing on the delimitation aspect could therefore be ‘property delimited both horizontally and vertically’, i.e. in length, width, and also height and/or depth. A proposed definition of 3D property focusing mainly on the extension would be of greater use internationally than one dependant on the specific legislation. One disadvantage with such a definition is that it does not explain or define what 3D property is.

However, the purpose of a definition of 3D property is mainly to focus on the 3D aspect and what separates it from the regular 2D property. The property concept itself is related to the legislation, which, as mentioned, varies between countries. The authors want to focus on the legal aspect of the 3D property instead of e.g. referring to it as a volume that is delimited. To focus on the legal side of 3D property and not only the volume, 3D property can be defined as ‘*real property that is legally delimited both vertically and horizontally*’. Such a definition would distinguish the 3D property from the 2D property, and still be able to include different types of 3D property in different legal systems.

4.2 Validation of working definition of 3D property

When looking at the legislation of different countries and scientific literature, a number of different definitions and descriptions of the term 3D property and what it consists of can be noticed. Some of these definitions will be presented and discussed below as examples of various types.

In order to validate the working 3D property definition, it is suitable to start by briefly discussing real property in general. It is not an easy task to define what real property is, see e.g. Mattsson (2003, p. 24). Real property is not a standardised and homogenous term and the definitions presented vary between the authors. Real property is usually defined as something distinct from personal property. This distinction is still important, even though the law for these property types has been assimilated to a great extent (Chappelle, 1992, pp. 4–5). The “real” part of the “real property” term is usually associated with something solid, fixed and permanent and is related to land (Mattsson, 2003, pp. 24–25). However, realty and land is not the same thing, since there are interests in land that are not real property (Chappelle, 1992, p. 4). Often the Latin term *in rem* is used in reference to real property. Rights *in rem* refer to real property rights as opposed to personal contractual rights. Such rights can consist of both rights in land and other assets (Arruñada, 2001, p. 5). Larsson (1997, pp. 8–9) claims that real property, or real estate, are terms that refer to land in the broad sense consisting of a physical area and fixtures, but also the rules, institutions and socio-economic characteristics that it is connected with. Real property is also not just defined through its physical characteristics, but also by the legislation, stating what powers in the land that the owner does not have (Mattsson, 2003, pp. 25–26). However, e.g. in the Swedish legislation no real definition of real property can be found. According to the Land

Code, real property is land, and land is divided into property units (SFS, 1970:994, Chap. 1, s. 1).

The FIG working group on 3D cadastres⁸ points out that to determine what a 3D parcel is in its broadest sense depends on the legal and organisational context in the specific country or legal system. The objective of the working group is to establish a common understanding of the terms and issues involved in 3D cadastre, building on the content of the coming ISO standard.⁹ The organisation describes the 3D parcel as spaces of legal objects, including land and water spaces, both above and below surface. Their suggestion for a definition of a 3D parcel is “the spatial unit against which (one or more) unique and homogeneous rights (e.g. ownership right or land use right), responsibilities or restrictions are associated to the whole entity, as included in a Land Administration system. FIG describes the definition as “quite abstract” (FIG, 2010, p. 1). This definition seems rather complicated and focuses more on rights than ownership, as well as the cadastral registration aspect of the 3D property. It should be possible to include more than one type of right, e.g. different ownership to the same unit. It does not say anything about the limitation of the parcel and since there is no mentioning of the three-dimensional delimitation of it, it could just as well include also the regular 2D property.

Stoter et al. have studied, above all, the technical aspects of 3D cadastre. They present a definition of a 3D property unit as “a (bounded) amount of space to which a person is entitled by means of real rights” (Stoter et al., 2004, p. 2). This is a wide definition, which could include also a regular 2D property. The specifics of 3D property rights are not mentioned here, more than that it is somehow bounded. A specific term used is ‘stratified property’, which they explain by several users using an amount of space limited in three dimensions and positioned on top of each other within one surface parcel or crossing parcel boundaries, and where real rights are established to entitle persons to the separate volumes (Stoter et al., 2004, p. 2). This is a more accurate description of 3D property, although rather long and complicated. It is also too narrow, since it is possible to find forms of 3D property not fitting into this description.

Julstad (1994, pp. 17–18) discusses enjoyment of three-dimensional property in Sweden, in her study made before 3D property was introduced into Swedish legislation, and is using this term inclusively, both for independent ownership of three-dimensional space in land or buildings and other structures in the form of real or personal property, and for the right that comes with owning a property to use land or buildings on another property unit. She describes more the process of 3D property formation, as all methods available for the creation of three-dimensional property enjoyment through property formation, which thus involves changing the property rather than the 3D property unit that is obtained by making this change. It is not possible to use this as a definition since it does not really say what 3D property is, but is more focused on ownership and the property formation

⁸ See the FIG 3D working group website: <http://www.gdmc.nl/3DCadastres>

⁹ See the FIG 3D working group website for more information: <http://www.gdmc.nl/3DCadastres/index.html>

process. Taking Swedish legislation as an example, a definition of 3D property can be found in the Swedish Real Property Formation Act (and Land Code), based on the characteristics of this Swedish form (SFS, 1970:988, Chap. 1, s. 1a; SFS, 1970:994, Chap. 1, s. 1a). The definition in these Acts states that a 3D property unit is a property unit which in its entirety is delimited both horizontally and vertically. Since forms of 3D property exist in other countries that are not included in such a definition and not delimited as a whole, this definition would be too narrow for constituting an internationally valid definition. The Swedish governmental bill for the 3D property legislation describes 3D property enjoyment as the exclusive use of different horizontal planes or floors of a property unit for mainly separate purposes (Proposition 2002/03:116, p. 26). Such a description can include also other types of rights, not just ownership, and does not mention any physical delimitation into property units.

Another term connected to 3D property is “airspace”, used for example in American legislation. Powell and Rohan (1993, Vol. 2A, 263.1[1]) present this as a term for independent units of real property that are created when real property is horizontally subdivided, with the definition “the space above a specified plane over, on or beneath a designated tract of land” This definition focuses more on space than on what 3D property is, and it is not clear whether subsurface space is included. A part of a 2D property unit can also be comprised by this definition, because it does not include any delimitation. Like the authors suggest, the airspace must be described in three dimensions with reference to a specific locus in order for airspace to mean 3D property (Powell and Rohan, 1993, Vol. 2A, 263.1[1]).

The Land Administration Domain Model (LADM) uses a concept of “face” to present a 3D boundary. An example provided in the LADM is that “[b]oundary faces are used where unbounded volumes are not applicable. Boundary faces close volumes in height (e.g. every apartment floor), or in depth (e.g. an underground parking garage), or in all other directions to form a bounded volume. The volumes represent legal space (in contrast with physical space)” (ISO, 2011, p. 3).¹⁰ The LADM does not provide a legal 3D property definition, but describes 3D property as 3D representations of objects (spatial units). The LADM is based on the existence of so-called basic administrative units. A basic administrative unit is an “administrative entity consisting of zero or more spatial units against which (one or more) unique and homogeneous rights (e.g. ownership right or land use right), responsibilities or restrictions are associated to the whole entity, as included in a Land Administration system”. A spatial unit is defined as a “single area (or multiple areas) of land or water, or a single volume (or multiple volumes) of space”. The LADM description is not a definition. The description fits the proposed 3D property definition presented in this article by focusing on the legal aspects and not the physical object as such. However, the delimitation is based on the rather technical concept of “faces”, which can be difficult to understand without the proper technical background.

¹⁰ Some of the words, e.g. spatial unit, are highlighted in the LADM, but not in this article.

5 Conclusions

We all have an understanding of the world around us, but are, however, limited by our own interpretation of the things we want to describe. Using a standardized terminology is a step towards a common understanding of what we want to exchange information about. This is especially important when exchanging information with receivers who might not have the same background, being trained in the local terminology and concepts applied to describe the domain. This also applies to the legal domain in general and to the real property domain in particular, being the result of centuries of natural legal and cultural development. This article deals with the terminological aspects of defining 3D property. It presents an overview of 3D property and property rights and what characterizes each of them. Examples of various terms used internationally, in different countries and legal families, are presented, showing the variety and difficulties with standardising the terminology. The problems with creating a uniform definition of 3D property are also discussed, by providing examples of such definitions from different countries and evaluating their inadequacies.

Internationally different terminology for 3D property can be found, of which this article shows various examples. The terminology depends to a great extent on the national terminology used in the legislation, which makes it difficult to standardise it and determine one specific term for each type of 3D property to be used internationally.

In this article 3D property is defined as '*real property that is legally delimited both vertically and horizontally*'. Such a definition would distinguish the 3D property from the 2D property, and still be able to include different types of 3D property in different legal systems.

The proposed working definition was validated against selected existing definitions and descriptions of 3D property. The definitions all have shortcomings from a legal perspective, such as being too narrow or too wide, focusing on use rather than on object, or describing the physical object instead of the legally defined 3D object. This shows that it is difficult finding an accurate and internationally valid definition of 3D property. Another reason for the difficulties in finding an internationally suitable definition is the different meaning of 3D property as a legal object due to the different legal contents in the national (or state) legislations. A result of the validation is that several existing definitions can be incorporated in the working definition.

The authors are of the opinion that standardized vocabularies or descriptions based on an agreed terminology are tools furthering cross-border real property information. Using unified terms will act towards a common understanding and thus further the establishment of a domain specific ontology within the field of 3D property.

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