Co-ownership shares in condominiums – A comparison across jurisdictions and standards[1]

Volkan ÇAĞDAŞ, Turkey, Erik STUBKJÆR, Denmark, Walter Timo de VRIES, Germany, Cornelius van der MERWE, South Africa, Jesper PAASCH, Jenny PAULSSON, Sweden, Nadja SCHWERY, Switzerland, Hendrik PLOEGER, The Netherlands, Ümit IŞIKDAĞ and Abdullah KARA, Turkey

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SUMMARY

Condominium is one of the prevalent forms of three- dimensional (3D) property rights (Paulsson, 2007, p. 32). The condominium concept common to a number of jurisdictions consists of three elements: (a) individual ownership of an apartment, (b) co-ownership (joint ownership) of the land and the common parts of the building, and (c) membership of an incorporated or unincorporated owners' association (van der Merwe, 2015, p. 5). The ownership shares of condominium unit owners in the common property are here referred to as co-ownership shares; yet, alternative terms include ownership fraction, condominium share, participation quota, share value, and unit entitlement. The co-ownership share determines the proportional contribution to the common expenses and the share of common profits, as well as the voting power of each condominium unit owner in the administration of the condominium. The most common approaches to the determination of the co-ownership shares are based on equality, relative size or relative value of each condominium unit, or a combination of such (van der Merwe, 1994, p. 57-58). The literature presents detailed descriptions and comparative analysis related to condominium systems in different jurisdictions (e.g. van der Merwe, 2016; 2015; Paulsson, 2007; EUI, 2005; UNECE, 2005); however, the technical and procedural aspects related to the allotment of co-ownership shares still need to be further investigated. This paper aims to compare methods and procedures applied for the allotment of co-ownership shares of condominium systems in the following seven jurisdictions; Denmark, Germany, South Africa, Sweden, Switzerland, the Netherlands, and Turkey. Also, international geographic information standards are analyzed to assess the extent to which they facilitate allocation of co-ownership shares. The main purpose is to clarify the legal provisions and methodologies related to the determination of co-ownership shares in national condominium systems and bring new insights to countries, which are trying to revise their national provisions for fairer implementations.

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1. INTRODUCTION

Condominium is one of the prevalent forms of three-dimensional (3D) property rights (Paulsson, 2007, p. 32). The condominium concept common to a number of jurisdictions consists of three elements: (a) individual ownership of an apartment, (b) co-ownership (joint ownership) of the land and the common parts of the building, and (c) membership of an incorporated or unincorporated owners' association (van der Merwe, 2015, p. 5). The ownership shares of condominium unit owners in the common property are here referred to as co-ownership shares; yet, alternative terms include ownership fraction, condominium share, participation quota, share value, and unit entitlement. The co-ownership share determines the proportional contribution to the common expenses and the share of common profits, as well as the voting power of each condominium unit owner in the administration of the condominium. The co-ownership share is also used in the distribution of compensation received in the event of the property being expropriated or in the division of insurance money if the building is destroyed (Chen, 2016, p. 8). Lastly, but more importantly, it specifies ownership shares in the parcel if the condominium scheme has been terminated, and thus will be the main determinant for further decisions, such as the construction of a new condominium building and sharing its units. This requires the development of clearly defined, societally accepted, and fairly applied methodologies for determining, modifying and altering co-ownership shares.

The most common approaches to the determination of the co-ownership shares are based on equality, relative size or relative value of each condominium unit, or a combination of such (van der Merwe, 1994, p. 57-58). In value- and floor area-based approaches, the co-ownership share is determined by dividing the unit's value or floor area to the aggregate value or the aggregate floor area of all condominium units, respectively. In some countries (e.g. Singapore) a number of factors showing usage level of joint facilities can also be taken into account (cf. Christudason, 2008). According to Ngo (1987), the value basis has the advantage that it represents the capital investment of the owner of the condominium unit, and therefore a more valuable condominium unit entitles the owner to a larger share in the parcel in the event of the termination of the condominium scheme (p. 313). However, the floor area basis may be more equitable in allocating shares for the common property since it provides certainty and clarity by being simple and easy to implement, also enabling the democratic management of common property and sharing common expenses (Chen, 2016, p. 10). The relative advantages of the value and floor area basis, and their practical implementations are open to discussion.

The literature presents detailed descriptions and comparative analysis related to condominium systems in different jurisdictions (e.g. van der Merwe, 2016; 2015; Paulsson, 2007; EUI, 2005; UNECE, 2005). Also, a recent FIG publication stresses the importance of legal aspects of 3D cadastre, and calls for an interdisciplinary approach, including also legal expertise (van Oosterom, 2018). This paper responds by addressing the legal aspects related to the allotment of co-ownership shares, as this issue still needs to be further investigated. Thus, there should be a clear description and discussions concerning the types of area and value (e.g. total floor area, gross external area, market value, and cost value) used as the basis of co-ownership shares, criteria and methods for measuring and appraising area and value of different types of buildings (e.g. residential, commercial, and mixed use), the roles of stakeholders (e.g. owners, developers, valuation experts, and registrars), the relationship between co-ownership shares and management of the common property, and the conditions for altering or modifying allocated co-ownership shares. The clarification of the legal provisions related to the determination of co-ownership shares may provide a clearer understanding about national condominium systems and bring new insights to countries, which are trying to revise their national provisions for fairer implementations.

This paper aims to compare methods and procedures applied for the allotment of co-ownership shares of condominium systems in the following seven jurisdictions; Denmark, Germany, South Africa, Sweden, Switzerland, the Netherlands, and Turkey. The following section briefly describes the condominium regimes in the selected jurisdictions and jurisdiction-specific provisions for the determination of co-ownership shares. International geographic information standards (i.e., ISO LADM, OGC LandInfra/InfraGML) are analyzed in Section 3 to assess the extent to which they facilitate allocation of co-ownership shares. Section 4 concludes the paper.

2. THE CO-OWNERSHIP SHARES IN SELECTED CONDOMINIUM SYSTEMS

This section provides a general overview of the condominium systems in Denmark, Germany, South Africa, Sweden, Switzerland, the Netherlands, and Turkey, and compares legal provisions and methods applied for the allotment of co-ownership shares. All jurisdictions selected belongs to the civil law legal system, except for South Africa, which applies a 'hybrid' legal system.

2.1 The co-ownership shares in the Danish condominium

The condominium concept was introduced in Denmark by the Act on Owner Apartments (*Ejerlejlighedsloven*), which came into force 1. July 1966 (presently LBK nr 1713 16/12/2010). Of Denmark's 2 119 399 units of real property, 277 342 were condominium units, most of these, namely 237 126, residential condominiums (Skat, 2011).

The Kingdom of Denmark includes Denmark, Faroe Islands and Greenland. In 1970, the Parliament of Faroe Islands, Løgting, adopted the Danish Condominium Act with minor adjustments. However, the notion of co-ownership shares (*býtistali*) of condominium units (*eigaraíbúðir*) was instituted as in Denmark (Faroese Law-Site).

The Act on Owner Apartments applies the principles of a 'dualistic system' which integrates the individual ownership of an apartment and co-ownership of the common property into a composite ownership (van der Merwe, 2015, p. 6). A co-ownership share determines ownership of joint land, building and facilities, as well as rights and obligations relative to a mandatory owner association. If no ownership share is defined, condominiums are equal (sec. 2). The provisions of the act apply to residential apartments, as well as to shops, offices, stores and other delimited room space (sec 1). The condominium unit is considered real property, and recorded at the Land Registration Court (i.e. Land Registry) (sec 4).

The management of the owner association, including accounting and auditing, shall proceed according to an order issued by the Minister for Industry, Business and Financial Affairs, unless a similar bylaw is established and recorded at the Land Registry. Shared costs, including costs concerning the land parcel, access road and sewers, insurances, maintenance of facilities, etc. are incurred by the individual owners according the co-ownership share.

The owner of the original real property has to declare the establishment of condominiums in a statement to the Land Registration Court, before condominium deeds can be recorded in the Land Registry. The statement has to be accompanied by a condominium scheme and maps depicting every condominium. The condominium scheme and maps have to be attested (de facto prepared) by a licensed surveyor. A condominium may consist of more non-contiguous building parts, to be detailed in the condominium scheme. The areas have to be surveyed with an accuracy which grants a correct amount of rounded sq. meters.

The Act on Owner Apartment regards 'delimited room space' (sec 1). This means that e.g. carports, parking lots and garden lots cannot be included into a condominium. Such areas may be assigned to specific condominiums through provisions in a section of the bylaws of the owner association, replacing the general ministerial order (cf. above sec 5-7), or through an easement, granted by the owner association to the condominium owner.

The ministerial circular notes regarding the establishment of co-ownership shares that the act leaves this question open. The circular holds that a fair arrangement implies that the shares reflect the relative value of the condominiums. Condominium area is suggested as a point of departure, when condominiums are used for same purpose, e.g. residence, but relative market value should be used for relating e.g. residential and commercial condominiums.

As outlined above, co-ownership shares are in Denmark established by the owner of the original property, yet contributions by other professions seem likely. The documents with shares have to be recorded at the Land Registry, before condominium buyers are entitled to discuss the shares. This is possible because of the interplay between commercial banks and mortgage credit banks. The former finance property development, but have their loans returned when condominium buyers finance their acquisition through mortgage banks (cf. Gjede, 1999, p. 8).

If the distribution of co-ownership shares is considered problematic, the owner association may change the distribution, but only through unanimous consent, as established through several court rulings (Blok, 1995, p. 393; Dreyer & Simiab, 2016, p. 91f, 178f). A prudent condominium buyer will seek compensation through the purchase price offered (cf. Blok, p. 225). Thus in Denmark we find discussions regarding the *use* and possible *change* of co-ownership shares, while discussion of *establishment* of co-ownership shares did not appear from the investigations made.

Co-ownership shares matters in the following contexts (Blok, 1995, p. 85):

- distribution of shared costs, cf. above description of sec. 5-7 of the act.
- distribution of votes at the general assembly of the owner association, cf ministerial order on owner associations (BEK nr 1332 af 14/12/2004), and
- owner's share of the value of joint land, building and facilities, cf. sec 2 of the act. Tax authorities may use this for deriving taxable value.

Distribution of shared costs need not cover all housing costs. For example, bylaws may declare costs for consumption of heating, water, power, gas, etc., which can be individually and objectively measured, to be paid individually (Blok, 1995, p. 223). Similar individual payment may be installed for use of laundry, guest rooms, and parking lots (Blok, 1995, p. 226). Ordinarily, such arrangements are spelled out in the specific bylaw of the owner association, recorded at the Land Registry (Blok, 1995, 222ff). The maintenance of balconies has been an issue, since they are typically used exclusively. Court rulings have considered balconies being load-bearing parts of the building construction, and consequently allocated such maintenance to shared costs (Blok, 1985, p. 213-14). Maintenance of supply lines is a shared cost, but the consumer part is to be paid individually. The latter applies e.g. to radiators, water taps, wash basins, and toilet bowls (Dreyer & Simiab, 2016, p. 38).

2.2 The co-ownership shares in the German condominium

The legal basis for a condominium right is dual. Besides the main German law dealing with how to own property, which is dealt with in third book of the German Civil Code (in German: Bürgerliches Gesetzbuch, abbreviated as BGB), the condominium ownership is captured by a separate law, the so-called Condominium Act (in German: *Wohnungseigentumsgesetz* – or short: WEG). It is a law which originated in 1951, but the current updates are from 2014.

The rights to a condominium can be obtained through property registration. Registration of the property is done through the ex officio creation of a separate Land Register folio (Register of Apartment Ownership (Wohnungsgrundbuch), Register of Unit Ownership (Teileigentumsgrundbuch) for each co-ownership share. The separately owned property corresponding to the co-ownership share shall be entered on this folio and the separate ownership rights (Sondereigentumsrechte) corresponding to the other co-ownership shares shall be entered as a restriction on the co-ownership share. The Land Register folio relating to the plot of land (prior to the condominium rights registration) shall be closed ex officio. (§ 7, (1) WEG). Attached to the registration are (§ 7, (4) WEG):

- an architectural drawing (“partition plan”) bearing the signature and seal or stamp of the building authority and showing the partition of the building as well as the location

and size of the sections of the building constituting the separately owned property and the jointly owned property; all separate rooms which are part of the same apartment shall be given the same respective number.
- a certificate issued by the building authority confirming that the requirements have been met.

The partition plan usually determines the general function of the apartment house which may be only a residence house or also serve as commercial building. It is thus for the co-owners to decide, if a certain unit may also be used as a restaurant. Parking spaces in a garage, for example, are considered to be self-contained areas where their surface area is identifiable through permanent markings, and can thus be granted separate ownership. (§ 3, (2) WEG). The apartment ownership is established by the so called partition plan (Teilungserklärung), which must be registered in the Land Register. The partition plan usually determines the general function of the apartment house which may be only a residence house or also serve as commercial building. It is thus for the co-owners to decide, if a certain unit may also be used as a restaurant. In case of destruction of the whole building, the condominium right and the associated interests on it continue to exist.

Mortgaging a condominium right is also possible. It does not require the consent of the other owners. The land may be subject to other restrictions, however, for example servitudes granting the right to use the land as a whole in certain respects (e. g., an easement of access), but also land charges and other interests in land may restrict the full ownership. The majority of the co-owners may resolve on the reconstruction of the building, unless more than half of it has been destroyed and the damage is not covered by insurance; in this exceptional situation a single apartment owner may even demand the dissolution of the community.

In general the German civil code (BGB) already recognizes multiple types of ownership, including the *co-ownership* (Miteigentum, §§1008-1011 BGB) and *joint ownership* (Gesamteigentum, §§718, 719, 1408, 1415, 2023 BGB). Co-ownership refers to two or more persons owning a portion of a single property together, whereas joint ownership refers to partners (e.g. spouses) who together own a single property. Under the Condominium Act an apartment ownership is possible which consists of a co-ownership of a portion of a property combined with an individual ownership of a flat. The Act provides the creation of a title to an apartment (Wohnungseigentum), and title to units (Teileigentum) in respect of non-residential areas of a building (§ 1(1) WEG).

The WEG makes a difference between a *Wohnung* (=apartment) and *Gebäude* (=building or flat). This difference is relevant for the kind of rights connected to it. Title to an apartment comprises the separate ownership (Sondereigentum) of an apartment together with a co-ownership share (Miteigentumsanteil) of the jointly owned property (gemeinschaftliches Eigentum) of which it is an integral part. (§1(2) WEG).

The "Community of Apartment Owners" (in German: Wohnungseigentümergemeinschaft) exercises the collective rights of the apartment owners and fulfil the collective obligations of the apartment owners, as well as other rights and obligations of the apartment owners insofar

as these can be asserted jointly or are to be fulfilled jointly (Ch. 2, section 10, (6) WEG). The plot of land as well as those parts, facilities and installations of the building are subject to jointly owned property. Co-ownership of the plot of land may be restricted by way of a contract between the co-owners such that, each co-owner is granted separate ownership of a specified apartment or of specified non-residential areas of a building constructed, or to be constructed, on the plot of land. The common ownership has however also a number of implications and limitations regarding the use of the property. The Condominium Act itself provides just a few mandatory rules regarding the rules between the co-owners. Instead, one of the implications is that co-owners are free to set up rules governing their relations. As a result, condominium by-laws are created by all apartment owners. Such by-laws become applicable to future owners under the condition that these are registered within the Land Register, such that these can be traced back for any future co-owner (§ 10 II WEG).

A "Community of Apartment Owners" has the capacity to sue and be sued before the courts. (§ 10, (6) WEG). In relation to all aspects of administration of the jointly owned property, the community of apartment owners itself can acquire rights and be subject to obligations against third parties and the apartment owners. (§ 10, (6) WEG). The administrative assets of the Community of Apartment Owners consist of the things and rights created by law and acquired in legal transactions in connection with all aspects of administration of the jointly owned property, as well as any obligations which have arisen. The administrative assets include in particular the claims and powers based on legal relations with third parties and with apartment owners, as well as moneys received. (§ 10, (7) WEG). The condominium by-laws may also provide a regulation as to the distribution of the shared costs as, e.g. a per capita distribution, a distribution per square meters, in deviation from the distribution according to the percentage of the co-ownership share (§ 16 (2) WEG).

2.3 The co-ownership shares in the South African condominium

Sectional ownership was introduced in South Africa by the Sectional Titles Act of 1971 modelled on strata title legislation of New South Wales. This rudimentary Act was modernised by the second generation Sectional Titles Act of 1986, and eventually by the third generation sectional title legislation of 2011 which divided the Sectional Titles Act into the Sectional Titles Act which retained technical and registration provisions, and the Sectional Titles Schemes Management Act in which the management and administration provisions were re-enacted. Simultaneously, the Community Schemes Ombud Service Act 9 of 2011 ushered in a new sectional titles dispute resolution mechanism.

A sectional titles scheme is established by the developer requiring an architect and land-surveyor to prepare a draft sectional plan. The sectional plan consists of 5 sheets namely the title page which contains a description of the land and buildings included in the scheme; a block plan which indicates on a map, the location of the external boundaries of the land and buildings in the scheme; floor plans in respect of each storey in the buildings; cross-section plans indicating the height of all sections and a participation quota plan indicating the participation quotas of all the sections. This draft sectional plan must be approved by the Surveyor-General and then submitted to the land registry for registration and the opening of a sectional title register.

The main component, a ‚unit' consists of a section and an undivided share in the common property apportioned in accordance with the share value. The boundaries of a 'section' are the median lines of the walls, floor and ceiling of the section. A section may include adjoining parts such a balconies and also non-adjoining parts for example storage areas in the basement of the building. 'Common property' is defined exclusively as the land and parts of the building not included in a section. Examples are the external crust of the building, the foundations and roof, corridors, staircases and lifts inside the building and the swimming pool, gardens and communal buildings outside the sectional title building. An 'exclusive use area' is a part or parts of the common property for the exclusive use by the owner or owners of *one or more sections* for example parking bays and garden areas.

A management corporation (the body corporate) is established automatically from the date on which any person other than the developer becomes an owner of a unit. The body corporate is not subject to the Companies Act of 2008, but is a special kind of juristic person endowed with legal capacity. The main functions of the body corporate are to establish a administrative and a reserve fund and to collect contributions from the owners to stock the funds; to insure the building to its replacement value against fire and other risks; and to maintain the common property in accordance with the 10 year maintenance, repair and replacement plan. The main powers of the body corporate are to appoint agents and employees; to acquire, mortgage or lease units; to borrow moneys and to secure such loans; and to invest moneys in the administrative and reserve fund.

The main organs of the body corporate are the general meeting and the trustees (executive committee). The general meeting governs the scheme by the adoption of ordinary, special or unanimous resolutions. The first general meeting must be held within 60 days after the establishment of the body corporate and thereafter annual general meetings must be held yearly. Special general meetings are held on the authority of a trustee resolution or on the written request of 25% in value of the members or 25% in number of the bondholders.

The trustees (executive committee) conducts the daily management of the scheme. They are elected annually and exercise all the functions and powers of the body corporate subject to the provisions of the Act, the management and conduct rules and directives of the general meeting. They are assisted by managing agents to whom they delegate some of their functions. The members have the choice of appointing an executive managing agent to replace the trustees as the executive arm of the body corporate.

From the establishment of the body corporate. a sectional titles scheme is regulated by means of prescribed management and conduct rules containing governance and behavioral rules respectively. These rules may be altered by the developer on application for the opening of a sectional title register or later by a unanimous (management rules) or a special (conduct rules) resolution. Any alteration must be approved by the chief ombud who will only do so if the altered rule is reasonable and appropriate to the particular scheme.

Although arrear contributions may be enforced by an application to the ombud service, the most efficient mechanism is an embargo on the transfer of a unit unless a conveyancer certificate stipulates that all amounts due by the transferor have been paid. However, in such a case, the claim of the body corporate is trumped by the secured claim of a bondholder of the unit. In the case of members or occupiers cause a nuisance, the complainant may approach the ombud service for an order to stop the nuisance.

The Sectional Titles Act has adopted a unique twofold basis for calculation of the co-ownership share of a unit. For residential units the formula is area-based on the size of the unit, whereas for non-residential sections the calculation is in the discretion of the developer. For residential sections, the share is objectively determined by dividing the floor area of a particular section in square meters by the aggregate floor areas of all the sections, without any stakeholders or actors playing a part (s 32(1)). The result is indicated on the last sheet of the sectional plan as a percentage expressed to four decimal places (s 5(3)(g)). For non-residential sections, the developer assisted by a conveyancer, determine of the co-ownership share of a particular section, correct to four decimal places (s 32(2)(a)).

For a mixed-use scheme, the developer must allocate a percentage, say 60% of the total quotas (share values), to the residential sections and then divide the total of the quotas allocated by the developer to the residential sections among them in proportion to their relative floor areas (s 32(2)(a)). The remaining 40% allocated to non-residential sections must be divided amongst the non-residential sections as determined by the developer for each non-residential section.

The share value determines the value of the vote of the owner of each section for the adoption of *ordinary resolutions* at a general meeting. The quorum for a general meeting of a scheme consisting of four or more sections requires the presence in person or by proxy holding one third of the total votes of members in value (co-ownership shares) (STSM Regulations Annexure 1 rule 19(2)(b)). A sectional owner's quota is also relevant in determining the percentage (25 %) of owners to convene a special general meeting (STSM Regulations Annexure 1 rule 17(4)(a)). Note for the adoption of a special resolution a 75% majority in value *and number* (STSMA s 1(1) "special resolution" and Sectional Titles Schemes Management Regulations Annexure 1 rule 20(1)(b)) is required for instance for carrying out improvements or alterations reasonably necessary to the common property of the scheme.

Area-based in case of residential sections

Co-ownership shares in case of residential sections are based on the floor area of each section measured by an architect on actual measurements at the time when all sections in the scheme are completed and as indicated on the floors plans of each storey (floor).

Points of criticism of the floor area method are (1) to obtain more accurate results, the measurement of the floor area of each section should be rounded off to four decimal places instead of to the nearest square meter (STA s 5(3)(e)); (2) the floor areas of adjoining and non-adjoining parts of a section should not be allocated the same weight as the main parts of a section, but should rather for instance be given a weight of 50%; and in scheme buildings

containing sections of different heights (see cross-section sheet) cubic area instead of floor area should be taken into account (see van der Merwe, 1987).

Value-based in case of non-residential sections

For non-residential sections the calculation of Co-ownership shares should be value based. There is, however, no provision in the Sectional Titles Act which requires the developer to use objective criteria when allocating quotas or indeed to disclose the formula he employed to arrive at the allocations. The allocation is in his sole discretion. This problem can be overcome by an amendment of the STA to incorporate the provisions of the Uniform Common Interest Ownership Act of the United States (2014 version) which requires that the developer must state the formulas used to establish the allocation of the co-ownership shares of the non-residential units. (S 2-107(b)). This means that incorrect allocations in terms of this formula, may be challenged in court.

The STA provides for the alteration of two other aspects of the ownership share, namely the weight of the vote of a sectional owner, and an owner's proportionate contributions (levies) to the administrative and reserve fund. The developer may effect such modification by adding a rule to this effect when submitting an application for the opening of a sectional title register the members may introduce such a rules by special resolution (STSMA s 11(2)(a)). Modification by the body corporate is subject the provision that where a sectional owner is adversely affected by such resolution, his written consent must be obtained (STSMA s 11(2)(b) and (c)).

In the case of subdivisions and amalgamation (STA s 22(1)(f) and 23(1)(e)) and the extension of sections (STA s 24(7)), the new sections are re-measured and the original sectional plan adjusted to indicate the altered co-ownership shares. In the case of the demolition of residential sections, the co-ownership shares of the remaining sections must be readjusted to reflect the present position. For the creation of new sections in terms of a development right under section 25 of the STA, the participation quotas of the existing sections must re-adjusted to reflect the present position. This is very difficult where the share values of non-residential section must be readjusted due to non-disclosure of the formula by the developer.

A major objection is that the provisions on co-ownership shares are too inflexible because they attempt to regulate three utterly divergent matters by one and the same formula (see Risk, 1968). The three matters regulated, do not necessarily operate in the same direction: a relatively high co-ownership share increases the weight of voting rights at general meetings and enhance the share in assets on dissolution of the scheme, but it is a marked disadvantage during the life of the scheme due to increased contributions to common expenses.

Contributions to the maintenance and administration of common facilities should rather be calculated according to the benefit derived from each amenity by a particular sectional owner as well as the use he makes of such amenities for instance the common swimming pool or the lifts (see Vallée-Ouellet, 1978). It is questionable whether the allocation of shares in the common property in South Africa is in accordance with the conflicting goals envisaged by such an allocation, namely first, to provide a simple criterion, which will remain constant over

time, by which an owner can easily determine his share in the common property at any given moment, and, secondly, to guarantee that a sectional owner will receive a fair return on his investment upon termination of the scheme (see Judy & Wittie, 1978). If the share in the common property allocated to a particular unit is easily determinable, valuation of the unit is facilitated and if the sectional owner is guaranteed a fair return on his investment on termination, the mortgagee is also assured of the soundness of his security.

A valid criticism against an allocation based on one formula is that a disproportionate rise in the market value of a particular residential section on account of interior decorations would not be reflected in the share value. This problem can only be solved by legislation providing for periodic reappraisals and recalculation of the relative par values of sections. The relatively high cost of periodic reappraisal would have to be weighed against any resultant advantages.

2.4 The co-ownership shares in the Swedish condominium

The concept of 3D property was introduced in the Swedish Land Code, SFS 1970:944, in 2004 and the legislative basis for forming condominium units (apartments, in Swedish: ägarlägenhetsfastighet) was added to the Code and other related Acts in 2009. The demand for condominium has been rather limited so far, but there seems in recent years to be an increased interest in larger urban areas.

The Swedish condominium belongs to the dualistic condominium ownership type, meaning that each resident owns the physical part of the building where the apartment is located and in addition has a share in the common property of the building and land. A condominium unit is in the Land Code (and Real Property Formation Act, SFS 1970:988), defined as a three-dimensional real property not intended to contain more than one single apartment for housing purposes. Statutes regulating the formation and management of condominiums are mainly found in the traditional body of legislation regulating ownership, use and management of land. These forms and connecting regulations are included in existing legislation, e.g. the Land Code, the Real Property Formation Act, the Joint Facilities Act, SFS 1973:1149, and the Joint Property Unit Management Act, SFS 1973:1150. A condominium unit is regarded as real property in the same way as traditional 2D property exempt that its spatial extension even is regulated in the third (Z) dimension and with the addition of some other specific regulations. For example, a number of specific regulations concerning the creation of 3D property and condominium.

Although there is no compulsory form of cooperation between the condominium units provided in the legislation, normally a joint facility and/or a joint property unit is formed and is in fact required if joint facilities or joint property units are formed, which is nearly always the case and means that in most cases this will be the standard solution. The condominium owners have shares in a joint property unit (in Swedish: *samfällighet*) and joint facility (in Swedish: *gemensamhetsanläggning*), in order to secure co-ownership of the land the condominium is located upon and of common facilities, such as the above mentioned stairs, and other installations intended for common use. The condominium unit can also be granted the right to use individual parts of the joint property through easements, where the condominium owners have the right to use parts of another property unit containing the

necessary facilities. A joint property unit is land legally attached to two or more real property units. The shares are not attached to the actual owners, but to the involved real properties. The condominium units are individually owned by the shareholder(s). The plot of land on which the condominiums are located is normally converted into a joint property unit by the cadastral authority when they are created. Each condominium unit has a share in this joint property. A joint property unit may also include features of common interest, such as construction details like load-bearing beams, within the building. The co-ownership of the land the building is erected upon and areas of common interest are thereby secured for the (owners of the) condominium units by being part of a joint property unit.

The management of physical installations of common interest for the condominium (such as an elevator or heating central) are being secured by creating joint facilities which is a right to own and maintain one or more constructions (facilities) beneficial for two or more real property units on another real property. A joint facility can, for example, be a private road or a parking area, or other facilities where there is a mutual interest from owners of several properties in using or maintaining the facility, such as staircases and other installations beneficial for the condominium. Even roofs and facades may need maintenance and should be included in a joint facility for condominium. The share in the joint facility follows the condominium unit, i.e. the stakeholder property, when sold. Usually, one joint facility is formed for each condominium building, but if needed there can be several joint facilities within the same building complex, or one joint facility but with differentiated shares for separate parts of the condominium building.

The joint facility also regulates other issues such as how construction and maintenance costs are divided among the shareholders. There are two different ways of managing a joint facility: Directly by the shareholders if there only are few shareholders (in Swedish: *delägarförvaltning*) or by a joint property association created for the purpose of managing the joint facility. If the shareholders directly manage the joint facility, they will have to agree on all decisions. A joint property association is a legal person consisting of the owners of the shareholder properties. The association manages the joint facilities in which the participating real properties have shares. A joint property association is created by the cadastral authority, holding a founding meeting where the co-owners in the joint facility become members of the association and select a governing body and the articles of the association are decided. A yearly fee is normally to be paid by the members. The association articles describe what facilities that have to be managed, the responsibilities of the governing body and how the annual general meeting of shareholders shall be conducted. A revision of the association articles can only be done at the annual general meeting which is the highest decision-making authority of the association.

The condominium owners automatically become members of the association and have the right to vote. In the case where two persons co-own a real property having part in a joint property unit, they only have one vote since the share system is based on the participating real properties, not its individual owners, in accordance with the so-called method of principal number (in Swedish: *huvudtalsmetoden*). However, if the issue subject for the vote is of economic significance the votes shall be based on the shareholder properties' actual

participatory shares in the joint property unit (in Swedish: *andelstalsmetoden*). This principle may lead to undemocratic decisions, if it was not for the limit that an individual member cannot execute more than 20% of the votes.

The participatory shares in a joint facility can in some situations be changed by the steering committee of the joint property unit association, if they have been granted permission to do so by the cadastral authority. Other situations resulting in change in shares are when the shares are changed in cadastral procedures for a joint facility (*anläggningsförrättning*) or due to changes in the division of property units. A participatory share in a joint facility is calculated for each condominium unit, based on how beneficial the joint facility is estimated to be for the condominium unit. In addition to this, a participatory share in the financial costs for operating and maintaining the joint facility is also calculated, based on to what extent the condominium unit is expected to use the facility. Swedish legislation only specifies that the shares shall be divided fairly among the shareholders, but does not specify any method or parameters for calculating the shares. Neither do the existing guidelines for 3D real property formation or joint facilities from the cadastral authorities specify any methods. As a result, different methods for calculation of shares is used by the cadastral authorities (Blomberg and Söderqvist, 2017). One method is that condominium units in a building are given the same participatory shares in the joint facility. Another method is that shares are calculated based on the condominium area, indicating that a larger area is equivalent with more people using the condominium unit, thus generating more wear on the common facilities in the building than smaller condominium units. Another example, again according to Blomberg and Söderqvist (2017), is that the floor number where the condominium is located has been used as parameter in the calculation, based on the principle that common installations such as stairs and elevators are used more frequently by residents and visitors accessing condominium units located higher up in the building than units on lower floors, thus generating more wear.

2.5 The co-ownership shares in the Swiss condominium

In Switzerland, the concept of condominium was introduced in 1965. According to the legislative intent, it is based on the general co-ownership provisions of the Swiss Civil Code (SCC), as a specially designed form of co-ownership, and regulated in sections 712a–712t SCC. Section 712a (1) SCC defines condominium asa co-ownership share in immovable property which gives the co-owner the special right to use and equip certain parts of a building exclusively. This means that the Swiss Civil Code, retaining the so-called unitary system, does not provide absolute exclusive ownership of the condominium unit as many other European countries do. Instead, it constitutes a right akin to ownership of a condominium unit (in German: uneigentliches Stockwerkeigentum). A condominium owner is simply a co-owner in relation to the whole building divided into condominium with a special right to use his or her own condominium unit exclusively (in German: Sonderrecht, see BGE 132 III 9/11 cons. 3.1; Schmid/Hürlimann-Kaup, 2017, para. 1013).

This right akin to ownership of a condominium unit leads to a different perception of the condominium share, compared to other jurisdictions. In Swiss law, the condominium share is defined in section 712e (1) SCCas follows: «The deed of constitution shall indicate the spatial segregation and the share of each condominium unit in the value of the property or building

right, expressed as fractions with a common denominator.»That means that according to Swiss jurisprudence and doctrine, the condominium share is a numerical quantification of a condominium owner's share in the whole property (and not only in respect of the common parts of the property, as this is the case in other jurisdictions, see Meier-Hayoz/Rey, 1988, section 712e SCC para. 4 ss.).

The condominium share plays a fundamental role in different areas: It has to be taken into consideration before a condominium owners' meeting, for instance, as the condominium share may be a condition for the quorum of the general meeting. Section 712p (1) SCC states that the condominium owners' meeting is only quorate if half of all the condominium owners, half of whom must be entitled to a share, but at least two condominium owners, are present or represented. The condominium share also constitutes the numerical basis for the determination of financial obligations since condominium owners must contribute to the expenses in respect of the common parts of the property and to the costs of the communal administration in accordance with their shares (section 712h (1) SCC). Eventually, the condominium share may also matter in the case of the cancellation of the condominium in terms of section 712f SCC, since it determines the condominium owner's undivided share regarding the land and the building.

According to the wording of section 712e (1) SCC, the share and the value that each condominium unit represents are inextricably linked: «The deed of constitution shall indicate (…) the share of each condominium unit in the value of the property or the building right (…)». Therefore, the value of the land and the building in general and the relative value of each condominium unit in particular play a role in the determination of the condominium share (even though they do not have to be congruent). This leads to the question of how the value of a condominium unit is to be determined:

a) In terms of section 712e (1) SCC, the value of the building and the land are relevant. Therefore, the developer's initial capital investment would provide a reliable (though not necessarily sufficient) indicator, as it might provide a reference as to the quality of the housing (especially the quality of the construction material used and the quality of the construction work performed). One limitation that should be mentioned, however, is that the market value should be taken into account with caution as it depends on the laws of the real estate market and is therefore rather volatile (see the decision of the Swiss Federal Supreme Court BGE 116 II 55/60 cons. 5b; Stadlin, 2017, 85). Condominium shares, though, should be determined with a long-term view.
b) As the jurisprudence and the doctrine recognise the importance of the diligent determination of the condominium shares, they have established (non-mandatory) methods to calculate and allot condominium shares.

- As a first step, the condominium share is determined with reference to so-called quantitative-objective factors. These may include primarily the relative size of the condominium units, which is usually specified with reference to the floor area of the different units. However, the cubic area may also be taken into account. The number of rooms and the rent value, though, are usually not taken into consideration.
- As a second step, so-called qualitative-subjective factors would apply to refine the results calculated on the basis of the quantitative-objective factors. These qualitative-

subjective factors include the location, infrastructural advantages, sufficient light and view (Stadlin, 2017, p. 86).

c) c) As the diligent determination of the condominium shares is not only fundamental, but also, time and again, a source of conflict between condominium owners, a parliamentary initiative is now being discussed in Parliament. The law commission is considering, amongst other measures, introducing a provision that obliges the developer to disclose the formula by which he determines the condominium share in the Swiss Civil Code (Caroni, 2014).

This has constituted a short overview of the definition and determination of Swiss condominium shares. As mentioned above, they should be determined with a long-term view and should therefore not be altered easily. This being said, circumstances that call for an alteration of the size of a condominium share may occur. For such cases, section 712e (2) SCC states that changes in shares require the consent of all parties directly involved and the approval of the condominium owners' meeting. However, if the directly involved parties do not consent or if the condominium owners' meeting does not approve, then each condominium owner is entitled to seek rectification, but only under one of two conditions, namely that either the condominium share has been defined incorrectly by mistake or that, due to structural modifications to the building or its surroundings, the condominium share is no longer accurate.

2.6 The co-ownership shares in the Dutch condominium

The possibility to create apartment ownership and its legal alternatives, were discussed by Dutch legal experts in the first half of the 20th century (Beekhuis, 1940; Ploeger, 1997, p. 221, Van Velten, 2017, nr. 337-339). The need for apartment ownership became really urgent after the serious losses of buildings faced by several Dutch cities during World War II. The construction of apartments offered an solution for a fast reconstruction of Dutch cities (Van Velten, 2017, nr. 340).

Per 1 December 1952 the Dutch Civil Code was supplemented with the articles 638a-638t, offering the possibility to create apartment ownership (or to be more correct: the splitting of a building with land into 'apartment rights'). In 1972, based on the first experiences, this regulation was amended on a number of points. Important changes were the introduction of a mandatory association of owners and need to register a drawing (splitting drawing, in Dutch a *splitsingstekening*) in the land registry. In 1992 the existing law became part of the New Dutch Civil Code, as Title 9, Book 5 (articles 106-147, Book 5). Since then the rules have been updated several times (in 2005, 2011, 2017) on minor points in order to solve practical problems or needs. E.g. from 2005 onwards it is possible to create apartment rights for land without any buildings (e.g. parking spots or harbor units). Also several articles are introduced to stimulate that the apartment complex will be kept in good maintenance. In addition the Dutch Housing Act contains some provisions relating to the regulation of maintenance of apartment complexes.

In everyday language anyone will speak about an 'apartment owner', and also the Dutch Civil Code itself uses this expression (e.g. article 106, Book 5 Civil Code). However this is from a

legal point of view misleading, because the Dutch system is based on the unitary system. The right of apartment in Dutch law is based on common ownership of the whole building and the land, and therefore the ownership of an apartment as such is unknown in the Netherlands. Each holder of a 'right of apartment', created by the 'transformation' (the splitting) of the real estate, holds a share in a co-ownership of building and land.

An right of apartment is therefore a property right with special characteristics. To be more precise, the right of apartment includes three core elements (Akkermans, 2008, p. 286-287; Van Velten, 2017, nr. 343-347):

- a share in the ownership of a building (or buildings) and the land (the 'apartment complex');
- the exclusive right to use a certain part of that complex, called the 'private part'. This use right is not a property right itself (and cannot be sold or transferred as such), but is an accessory right to the share in the community;
- the mandatory membership of the association of owners (*Vereniging van Eigenaars*, VvE).

The property rights (the rights of apartment) are created at the moment of registration of the master deed (*splitsingsakte*, literally. 'deed of splitting') in the land register. This deed must be drafted by a Dutch civil law notary. Before registration of the master deed the Netherlands Kadaster will issue the notary a 'complex number'. In some sense this replaces the existing parcel number(s) of the land that will be splitted in apartment rights. Each apartment right is individualized in the land administration by reference to a cadastral number. E.g. Amsterdam D, 1329, A1. In this system the first number is the complex number (here 1329), followed by the apartment index number (A1, etc). This master deed must include a description of the separate private parts, also by reference to the mandatory drawing that provides (on scale) an overview of the complex and the boundaries of the private parts. Also in the drawing each private part must be numbered. These numbers are used in the master deed and the land administration to individualize the 'apartment rights'.

According to article 113, paragraph 1 Book 5 Civil Code the property shares are in principle the same. Also the obligation to contribute to the common debts and costs is in principle the same for every apartment owner (article 113, paragraph 2, Book 5 Dutch Civil Code). However the master deed can specify different shares. This will indeed be the case in most apartment complexes. However, nor the Civil Code, nor the applicable cadastral instructions, give any guidance how to calculate the shares. Article 113, paragraph 1 Book 5 Civil Code just stipulates that the master deed must provide the basis on which the property shares are calculated. However for the division of the shares in the common debts and costs such an obligation is even absent.

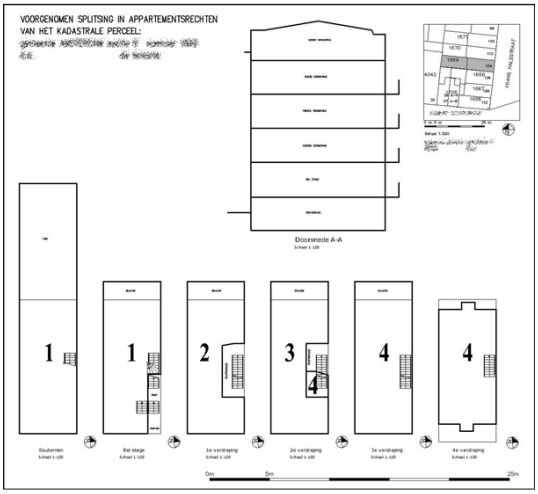

Figure 1. Example of a drawing ("splitsingstekening") of the apartment complex. The boundaries of the private parts are in thick black lines.

In practice for the property shares reference will be made to more or less objective standards, such as floor size, or the original selling price of the apartment (Van Velten, 2017, nr. 430). In most cases the distribution of the common debts and costs will be based on the same share each apartment owner holds in the community. But this is not necessarily. The contribution can be arranged in such a way that different types of costs are borne by different owners. Such a distribution of costs is particularly justified if the costs are related to the use of a certain part of the apartment complex. E.g., it is possible to have the costs of maintenance of a common elevator only be paid by the apartment owners who will use the elevator.

However for the common debts and costs it often proves difficult to find a good basis for the distribution. This in particular the case if not all private parts have the same use (e.g. homes, offices and business premises), or are located in different buildings.

2.7 The co-ownership shares in the Turkish condominium

The Turkish condominium is regulated by the Condominium Act (*Kat Mülkiyeti Kanunu*, KMK) 634 of 1965 and further amendments made in this act. It corresponds to the principles of 'dualistic system'.

The condominium unit is regarded a type of immovable property in the Turkish Civil Code (*Türk Medeni Kanunu*) of 2001. Currently, 19 390 637 condominium units, which constitute about 25% of 77 025 340 immovable properties of Turkey, are registered by the General Directorate of Land Registry and Cadastre[2].

In the Turkish condominium, the immovable property where condominium is established is termed as the main property (*ana taşınmaz*) and the structure itself as the main building (*ana yapı*). The Condominium Act categorizes the legal parts of the main property as the condominium unit (*bağımsız bölüm*), common place (*ortak yer*), and accessory part (*eklenti*) (KMK, Article 2). These legal parts are explicitly specified in the architectural drawing,

[2] https://www.tkgm.gov.tr/tr#

which is one of the constitutive documents for the establishment of condominium. The condominium unit is the part of the main property intended for independent and exclusive use, such as an apartment, office, shop, store, cellar, and warehouse. A condominium unit may consist of more than one contiguous or non-contiguous division on the same or different floors provided that these divisions are of the same use type or need each other to perform the function of the condominium unit. The next legal part is the common places which are co-owned by the condominium owners proportionally to the co-ownership shares of their condominium units. The common places may be determined in the condominium deed. However, the act provides a list of building components and installations which are, in any case, deemed to be common places as follows; (a) structural components (e.g. the foundations and walls, ceiling and floors), (b) joint facilities (e.g. common laundries, common garages), and (c) installations located outside condominium units (e.g. sewers, central heating, water, gas and electric supply, and telecommunication networks) (KMK, Article 4). The last legal part is the accessory part that is outside the condominium units but directly allocated to the exclusive use of a specific condominium unit. An accessory part can only be allocated to one condominium unit and is considered as the inseparable part of that unit.

The condominium is created by the registration made to the condominium book (*kat mülkiyeti kütüğü*) by the land registry (KMK, Article 11). Each condominium unit is registered in a separate folio of the condominium book. The following documents are required for the registration: (a) The architectural drawing (*mimari proje*) which is prepared by the project architect, approved by the relevant public authorities and signed by the owners of main property (KMK, Article 12a). (b) The bylaw (*yönetim planı*) which determines the method of management, manner of use, the remuneration of the manager(s) and auditors, and other details regarding management (KMK, Article 12b, 28). (c) The condominium deed (*sözleşme*) which is an authenticated document for the establishment of a condominium is prepared by the land registry according to the application documents and signed by the owners of main property (KMK, Article 13). As for the cadastral registration, cadastral plans should have been prepared before the establishment of the condominium. These plans include the building layout plan (*vaziyet planı*) and the condominium unit plan (*bağımsız bölüm planı*) which are prepared by (licenced or private) cadastral surveyors and approved by the cadastral organization.

A condominium is a special form of ownership which is related to the co-ownership shares (*arsa payı*) and common places in the main property (KMK, Article 3). The condominium unit and its co-ownership share are inextricably linked (KMK, Article 5). The co-ownership share is the main determinant for the use of common places, management of the main property, and the contributions to the cost and expenses made for the main property, as detailed below.

The co-ownership share determines the ownership shares of the condominium units in the common places. The owners of the condominium units have the right of use to the common places in proportion to the shares of their units, unless otherwise specified in the condominium deed or the bylaw (KMK, Article 16). The general meeting of the assembly of condominium owners is quorate if attended by more than half the owners representing more

than half the total co-ownership shares (KMK, Article 30). The following issues require decisions to be taken by a majority of the owners with more than half the total co-ownership shares: (a) Appointing a manager or managerial board, (b) appointing an auditor or an auditory board, and (c) renewing and making additions to common places (KMK, Article 34, 42). The expenses made for maintenance, protection and repairing the common places, operation costs of the common installations, and salaries of managers are generally shared proportionally to the co-ownership shares. In terms of the insurance of the main property, the condominium owners are obliged to contribute to the charges in proportion to their co-ownership shares (KMK, Article, 21). Also, revenue gathered from the common places is distributed to the owners according to the co-ownership shares. Lastly, the co-ownership shares will specify ownership shares of the condominium owners in the parcel and building, when the condominium deed is terminated or the main building has been destroyed.

KMK stipulates that the co-ownership share is calculated according to the values of condominium units at the date of registration of the condominium. The co-ownership share of each condominium unit is calculated by dividing the value of condominium unit to the aggregate value of all condominium units in the main property. Both the values and the co-ownership shares are determined by the project architect and shown in the architectural drawing. The co-ownership shares determined by the project architect are subject to the approval of all condominium owners at the date of establishment of the condominium in the land registry. If the co-ownership shares have not been allocated proportionally with the values of condominium units at the date of registration, owners may apply to the court to alter their co-ownership shares. The co-ownership shares cannot be modified due to any increases or decreases in the values of condominium units in future (KMK, Article 3).

Neither the type of value nor the method of valuation to be applied is defined in the act. In practice, the relative values of condominium units are taken as the basis for the calculation of co-ownership shares. The valuation date is the date of the registration of condominium; therefore, any changes made in the condominium units after the registration cannot be taken into consideration. Only the two criteria of location and size are mentioned in the act in terms of the valuation of condominium units. However, the jurisprudence indicates other criteria that should be taken into account, such as the type of condominium units (e.g. residential and commercial), floor area, location, heating system, lighting, view, allocated accessory parts, and external effects; e.g. daylight and wind.

The way in which the co-ownership shares are calculated is probably one of the most controversial issues of the Turkish condominium system. Even though the act clearly indicates that the co-ownership shares must be based on the relative values of the condominium units, a scientifically sound and societally acceptable valuation methodology has not been developed to date. Therefore, the valuation of condominium units is open to the subjective judgements of the project architect. In practice, their determination is generally based on the floor areas of the condominium units used for residential purposes and on the discretion of the project architect for commercially used units in mixed use condominiums.

3. THE CONDOMINIUM SYSTEMS IN INTERNATIONAL GEOGRAPHIC INFORMATION STANDARDS

3.1 LADM of the International Organization for Standardization (ISO)

The ISO 19152:2012 Land Administration Domain Model (LADM) is an abstract conceptual model that focuses on the legal and geographical aspects of land administration. It consists of Administrative Package, Spatial Unit Package, and Party Package. The Administrative Package defines the recording units of land administration (LA_BAUnit); and rights (LA_Right), restrictions (LA_Restriction), and responsibilities (LA_Responsibility) established on basic administrative units. The Spatial Unit Package and its Surveying and Representation sub-packages deal with spatial units (e.g. cadastral parcels, legal space building units, and legal space utility networks), and their geometric/topological representation based on ISO and OGC standards. Its specialized subclasses LA_LegalSpaceBuildingUnit and LA_LegalSpaceUtilityNetwork allow for the representation of legal spaces related to building units and utility networks, respectively. Finally, the Party Package includes the LA_Party class, which represents natural and legal persons, and the LA_GroupParty class representing the groups consisting of a number of parties both of which play a role in land administration.

The above-mentioned LADM classes, their attributes and relationships support modeling legal divisions of the condominium (e.g. condominium units), their spatial representations, relevant parties (i.e. condominium owners), and documents related to condominium (e.g. condominium deed). The main class of LADM, LA_BAUnit enables representation of individually owned or exclusively used condominium units which may consist of one or more non-contiguous spatial units. LA_SpatialUnit and its specialized LA_LegalSpaceBuildingUnit subclass are used for the modeling of these spatial units. LADM also includes a code list class, LA_BuildingUnitType which includes more generic values (i.e. individual and shared) for the legal classification of the building parts or divisions. As for the boundary representation of the legal parts, LA_BoundaryFace class can be used. But as indicated by Atazadeh et al. (2017), LADM does not provide semantically rich specifications for the boundaries of condominium parts. Accordingly, neither boundary types (e.g. wall boundary surface, ceiling boundary surface), nor boundary location (e.g. interior, exterior or median of the physical structure) used in architectural drawings or partition plans can be defined by LADM (p. 96). However, via LA_SpatialSource, the LA_BoundaryFace can obtain the actual geometry and topology information, including the boundary location, from architectural drawings or partition plans.

LADM may also allow representation of parties in the condominium (e.g. condominium owners, owner association, body corporate or joint property association, community of apartment owners) through LA_Party and LA_GroupParty classes, and representation of condominium documents (e.g. condominium schemes, condominium deeds, bylaws, deed of constitutions, sectional plans, architectural drawings or partition plans) through LA_SpatialSource and LA_AdministrativeSource classes. However, code lists specified for these classes do not accommodate values for the identification of different types of parties and

documents related to the condominium. The intention is that the generic code lists of LADM are further extended when needed.
As regards co-ownership share, an adequate modelling is being discussed. The co-ownership share is generally allocated according to the relative area or the relative value of condominium units. The area of legal building units are modeled with the area attribute defined in LA_SpatialUnit class. LADM also provides a LA_AreaType code list class which accommodates different types of area including calculated area, non-official area, official area and surveyed area. However, a further categorization is needed for more detailed area types (e.g. gross floor area, net floor area) used for the calculation of co-ownership shares in different jurisdictions. As for the information needed by the value-based allotment systems, LADM presents an external valuation class (ExtValuation) which is expected to be developed by further studies. An ongoing project which aims at developing a LADM based Valuation Information Model (Kara et al., 2017) may fulfill this gap.

LADM is now being revised by ISO TC211. It is hereby suggested to include in the revised second version of LADM the co-ownership share. Furthermore, semantically richer code lists for legal division types (e.g. condominium unit, accessory parts), boundary types (e.g. interior, exterior or median), party types (e.g. owner association, body corporate or joint property association) and document types (e.g. condominium deed, bylaw, deed of constitution) related to condominium should be considered in the revision.

3.2 LandInfra / InfraGML of the Open Geospatial Consortium (OGC)

The Open Geospatial Consortium (OGC) - synchronized with concurrent efforts by buildingSMART International - initiated in 2012 a standardization effort which resulted into the Land and Infrastructure Conceptual Model Standard (LandInfra) in 2016 and a set of OGC InfraGML LandInfra Encoding Standards in 2017. Compliance with the InfraGML XSDs, specified in the schema repository of the OGC, allows for interoperable exchange of e.g. condominium data. Provisions of these standards concerning condominiums are found in LandInfra's sections on *Land division*, which addresses cadastral and condominium issues.

LandInfra divides land into *LandDivisions*. These can either be public (political, judicial, or executive) or private in nature. The former are *AdministrativeDivisions* and the latter are *InterestsInLand*. The shape and location of these *SpatialUnit*s is modelled independently from their administrative or legal status (LandInfra, section 7.10.1).

3.2.1 LandInfra on Interest in Land

The abstract class *InterestInLand* refers to ownership or security towards real property and is documented by a *Statement*. *InterestInLand* types include *PropertyUnit*s and *Easement*s (LandInfra, section 7.10.2). *PropertyUnit*s are further specialized into *LandPropertyUnit* which specifies ownership to a part of the surface of the Earth, identified through one or more *LandParcel*s, and into *CondominiumUnit*s, which comprise one or more *BuildingPart*s.
A *Statement*, a specialization of *Document*, documents the establishment or acquisition of an *InterestInLand* in accordance with the specific *StatementType*, e.g. *condominiumScheme-Establishment* or *condominiumAcquisition*. A *Statement* document is signed by one or more

Signatories, each with a specific *SigningRole* (LandInfra, section 7.10.4). LandInfra also models *Professional* and *Ownership*, but has no general Party concept as LADM.

LandInfra defines *SpatialUnit* as a contiguous geometrical entity, which is delimited and located on or close to the surface of the Earth through its *BoundingElement*s. *AdministrativeDivision*, *LandParcel*, and *BuildingPart* all refer to *SpatialUnit*. The dimension of SpatialUnit is specified by its DimensionType: 2D, 3D, or liminal (LandInfra, section 7.10.6, Figure 66). *SpatialUnit* is specified through one or more *BoundingElement*s, which allow for an array of representation methods not detailed here (cf. LandInfra, Figure 67).

3.2.2 LandInfra on Condominium

The standard conceives Condominium as concurrent ownership of real property that has been divided into private and common portions. Condominium unit owners must be members of a mandatory owners' association and engage in the maintenance of joint facilities according to a specified share (LandInfra, section 7.11).

The *CondominiumScheme* subdivides the floors of a multi-storage *CondominiumBuilding* into *BuildingPart*s according to management and use, thereby drawing upon the IfcSpatialZone class (with reference 5.4.3.51) of IFC. *BuildingPart* attributes include *floorArea*. Those intended for exclusive ownership have either type *condominiumMainPart* or *condominiumAccessoryPart*. The joint facilities are either of type *jointAccessFacility* e.g. staircase, lift, or *jointOtherFacility*, e.g. laundry, heating facility. Each of the exclusively owned units has access to building entrance through one or more *jointAccessFacilities* (LandInfra, section 7.11.4; Figure 69). *BuildingPart* refers to *SpatialUnit*, which again is specified through one or more *BoundingElements*. Condominium boundary types (e.g. interior, exterior or median) may be indicated through an optional *BoundingElement* attribute: *description* of type CharacterString (LandInfra, section 7.10.7), but probably the application of other parts of LandInfra, e.g. *PhysicalElement* and the corresponding *PositioningElement* (LandInfra, section 7.3.1.5-7), provides for a more appropriate solution in accord with the Industry Foundation Classes of buildingSMART International. - Exclusive rights for specific *CondominiumUnit*s to parking lots, garden lots, or similar, may in terms of a bylaw annex be included among the *Statements* to be submitted to the Land Registry (cf. LandInfra, section 7.11.5).
The *CondominiumUnit* has among other attributes: *shareInJointFacilities*: the fraction by which the CondominiumUnit is bound to engage in the maintenance of joint facilities, including roof, outer walls, access areas, technical installations, and the *LandParcel* on which the building rests (LandInfra, section 7.11.1). The *CondominiumBuilding* is located on a *carrierParcel*, one of the possible *LandParcelState*s (LandInfra, section 7.10.2.5).

4. CONCLUSION

This paper focuses mainly on description of legal issues related to allotment of co-ownership shares which is probably the most important but often ignored aspect of the condominium. The methods applied for the allotment of co-ownership shares are documented for Denmark,

Germany, South Africa, Sweden, Switzerland, the Netherlands and Turkey. Except for South Africa, which applies a 'hybrid' legal system, all jurisdictions described belong to the civil law legal system. It also appears that Denmark, Germany, South Africa, Sweden, and Turkey have regimes that comply with the principles of 'dualistic system' where a condominium owner has an exclusive ownership right in the condominium unit and a undivided share in the common property. A 'unitary system' are applied in Switzerland and the Netherlands in which a condominium owner is a co-owner of the whole immovable property divided into condominium, and has only a special right of use with regard to the condominium unit concerned. The concept of co-ownership share in Switzerland and the Netherlands means therefore the share in the whole property consisting of the land and of all the condominium units, while in other investigated jurisdictions, it is understood as the share in the common property. This legal concept is also represented by the terms of 'participation quota' in South Africa, 'participatory share' in Sweden and 'condominium share' in Switzerland.

The comparison demonstrated that the co-ownership shares are determined by a number of actors in the investigated jurisdictions, namely the owner of original property in Denmark (as advised by professionals), the developer in South Africa and Switzerland, the project architect in Turkey, the civil law notary in the Netherlands and the cadastral authority in Sweden. Aside from Sweden, co-ownership shares are calculated on the basis of the values of condominium units in Switzerland and Turkey, and a combination of the areas and the values of condominium units in Denmark and South Africa. In Sweden, participatory shares are calculated based on estimated benefits derived from joint facilities. A few jurisdictions indicate criteria to be taken into account in the valuation of condominium units, such as Switzerland and Turkey, yet the existence of a formal, standardized and uniform valuation methodology which may enable a fair calculation of co-ownership shares has not been observed. In the Netherlands the section of criteria is left to the notary (and ultimately his client, in most cases a developer). A step towards a more formalized approach is taken by the United States, requiring the developer to state the formulas used to establish the allocation of the co-ownership shares (see p.11 above). Similarly, the Swiss law commission is considering a provision that obliges the developer to disclose the formula applied (p. 16). International valuation organizations may see a challenge in developing guidelines for appropriation of co-ownership shares, which are scientifically solid and acceptable from a social point of view, as this may provide a basis for the development of national provisions for fairer allotment of co-ownership shares. Moreover, in order to prevent malpractices, jurisdictions may be concerned that licensed professionals, who have to comply with professional standards and ethical norms, become authorized to determine co-ownership shares.

This paper also recorded the extent to which land administration related international geographic standards addressed the representation of condominium and co-ownership shares. For this purpose, the ISO Land Administration Domain Model (LADM) and the OGC Land and Infrastructure Conceptual Model Standard (LandInfra), which model both the legal and the spatial aspects of the condominium, have been investigated. While the former is an international land administration standard covering aspects related to surveying and recording of immovable properties, the latter is related to civil engineering infrastructure facilities, surveying, and related aspects of land development. The investigation showed that both

standards model condominium and condominium parts. However, LandInfra provides semantically richer modeling and code lists, e.g. *condominiumMainPart*, *condominiumAccessoryPart*, *jointAccessFacility*, *jointOtherFacility* for the description of condominium parts, while a corresponding code list class in LADM: LA_BuildingUnitType, presents a more generic classification (i.e. individual and shared). LADM allows for representation of parties (e.g. condominium owners, owner association, body corporate or joint property association) in the condominium through LA_Party and LA_GroupParty classes, and representation of condominium documents (e.g. condominium schemes, condominium deeds, bylaws, deed of constitutions, sectional plans or architectural drawings) through LA_SpatialSource and LA_AdministrativeSource classes. Yet, the code lists specified for these classes should be supported with values which will enable identification different types of parties and documents related to the condominium. The co-ownership share is modelled in LandInfra with a *shareInJointFacilities* attribute defined for the *CondominiumUnit* class, which is not made explicit in LADM.

The above observations suggest that LADM, which is now being revised by ISO TC211, should be supported with an optional co-ownership share attribute. Also semantically richer code lists for legal division types, boundary types, party types and document types related to condominium should be accommodated by the next version of LADM. LandInfra/InfraGML seems to comply with the spatial aspects of condominium documentation needs of the described jurisdictions, and is aligned with the Industry Foundation Classes of buildingSMART International.

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CONTACTS

Volkan Çağdaş
Yıldız Technical University, Department of Geomatic Engineering
34210 Esenler, Istanbul
TURKEY
Phone: +90 212 383 5313
E-mail: volkan@yildiz.edu.tr
Website: http://yildiz.edu.tr/~volkan/

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