

# Real Property Transactions: Challenges of Modeling and Comparing

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**Key words:** land transactions, cadastre, modeling, transaction costs and international comparison

## SUMMARY

Since 2001 a group of people, mainly from European universities, has been working in the framework of the COST Action G9 'Modelling Real Property Transactions' on describing and understanding the processes involved in transactions in land and other real estate within a number of European countries. The group includes information specialists, lawyers and economists, but is largely made up of land surveyors specialized in cadastral issues.

The main objectives and first results of the project have been presented within a FIG-setting before; (Stubkjær 2002) and (Stubkjær 2003a). Especially during 2004 a lot of progress was made within the project in all of the three Working Groups (1: Law and Models, 2: Cadastral Science, 3: Economy). In the paper this progress will be presented, with the emphasis on the progress related to the topics on the border of Working Group 1 and 2.

The methodologies for describing and modeling real property transactions will be introduced, including some examples. Modeling is mainly done in UML activity diagrams. However, use is also made of class and use case diagrams. Attention will be given to the lessons learnt and complications still encountered in comparing models between countries. Attention will also be given to underlying questions that have emerged. An important one relates to the different societal objectives cadastral systems are serving within different countries.

The main challenges remaining for the rest of the project (most likely completing early 2006) will be indicated in relation to what has been accomplished and learned so far.

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## 1. INTRODUCTION

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## 2. WORK SO FAR

### 2.1 Stated Goals

At the start of the project Terms of Reference were written (<http://cost.cordis.lu/src/pdf/G9-e.pdf>). The following goals of the project can be derived from there:

- Improve transparency of real property markets
- Provide a stronger basis for reduction of costs of real property transactions by
  - Preparing a set of models of real property transactions (correct, formalized and complete)
  - Assessing economic efficiency of these transactions
- Use the models also for education and (re-)engineering.

It was already foreseen that it would not be easy to reach those goals, for instance because of the differences between countries. Even neighboring pairs of countries have remarkable

differences. This makes it a challenge to elicit a common set of concepts and models (ToR, p. 4).

## 2.2 Different Focuses in Modeling

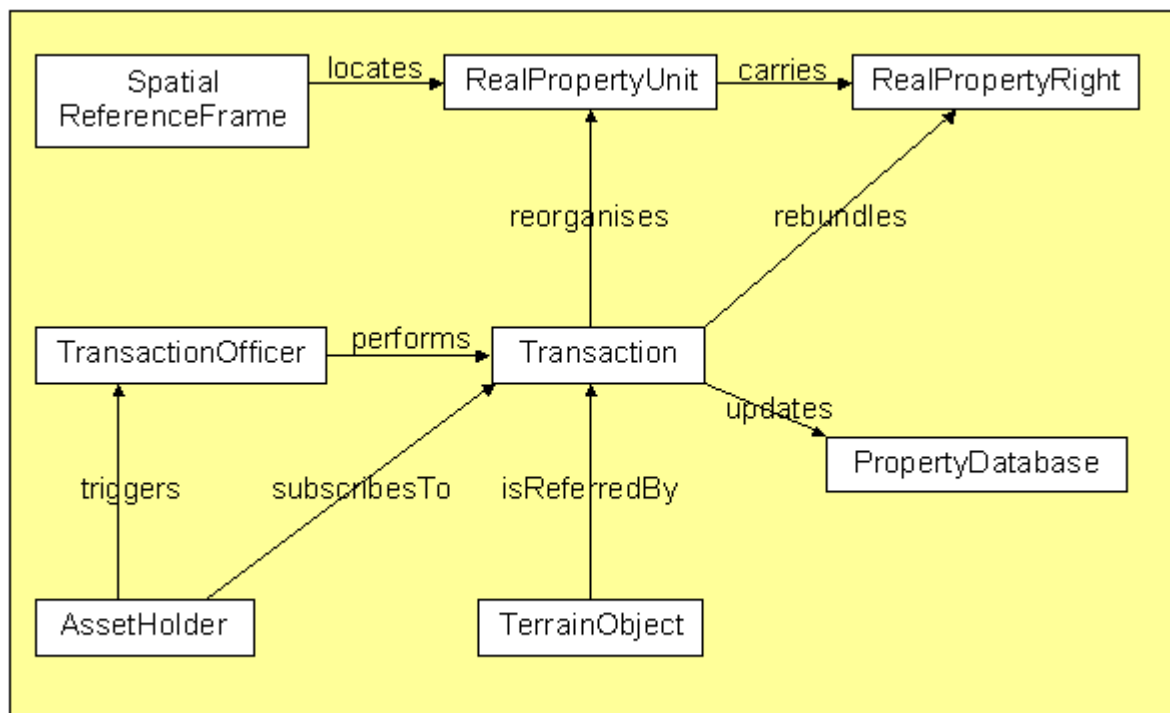
Originally methods and tools to come to formalized models (that are correct and complete as well) were looked for in the sphere of ontology and metaphysics (this was the topic of the 2001 Workshop in Bremen (see Stuckenschmidt et al. 2003)). However, little result came out of this, mainly due to the differences in the level of development between the two groups (ontology experts and cadastral domain experts) at that time. Instead of the more top-down knowledge engineering approach that was suggested in Bremen, an approach was adopted, where we worked 'upwards' from the routinized behavior of the actors (parties and their advisors).

In the end we were successful in the application of tools that are often used in the preparatory phases of design of information systems, most specifically the different types of modeling that UML supports. Although some used this from the very beginning (even at the 2001 meeting in Bremen Šumrada presented some models by using use case diagrams (see Šumrada 2003; 2002, it was only later in the action that for most participating countries the real property transaction processes were depicted in the form of UML activity diagrams.

In parallel to the above the development of a core cadastral domain model as a UML class diagram was undertaken under the guidance of Christiaan Lemmen and Peter van Oosterom, within the framework of FIG (Van Oosterom/Lemmen 2002a; 2002b; Lemmen/Van Oosterom 2003, Lemmen et al. 2003). Several partners of the COST G9 action got involved in this as well, and this resulted in the joint FIG and COST G9 workshop in Bamberg in December 2004 (Bamberg 2004).

There seem to be people who favor the use of class diagrams to express a core cadastral domain model (focusing primarily on the static side), whereas some others favor more process descriptions in use case and activity diagrams (focusing primarily on the dynamic side). For the authors of the present paper it has become clear that neither of those on their own will be expressive enough to be called a domain model (e.g. Zevenbergen 2002: 4). The cadastral domain can not do without the more data (set) oriented way of thinking, which the class diagrams represent, but neither without the process approach representing the constant flow of changes in man-land relations that calls for updating those data sets. It appears that strong believers of either approach are aware of the other approach as well, but somehow hesitate to embrace more explicit use of the other.

One might conclude based on the above, that a core cadastral domain model would consist of a set of diagrams of different types (at least class and activity diagrams). And although that seems a way of dealing with the situation, a more abstract and holistic way of expressing a true domain model is a model that combines the most important elements of the domain, being objects, actors, procedures and some other elements. A model of this kind can be found in the figure below, which is derived from (Stubkjær 2003b), and for which further developed is foreseen.



Cadastral Core Packages

Which of the diagrams is best suited can not be answered presently in general terms, but depends very much on what the model is being used for. For introducing people to the cadastral domain, be it in (political) awareness building or educating future professionals for working in the domain, the last, more holistic, model seems to be the best one to start with.

For detailing the roles of a certain group of professionals or other actors, for instance in on-the-job training or re-training, the process driving diagrams like the activity diagram are very valuable (especially with the “swim-lanes” for each actor depicted, see two pages down for an example taken from (Vaskovich 2004)). For preparation and design of databases and further software the class diagram seems a logical place to start.

Although comparison of ‘cadastral systems’ as such is not a prime goal of the COST G9 project, an interesting question is which of the approaches will make it easier to describe different countries or jurisdictions in such a way that comparison is really possible. There seems to be a notion that the main data objects are likely to be similar and that therefore class diagrams would be more comparable. On the other hand good results have been reached with more processes based descriptions for comparisons, both in the context of EULIS (Tiainen 2004) and COST G9 (e.g. the presentations at the 2004 WG 2 meeting in Székesfehérvár on [http://costg9.plan.aau.dk/SzekesfehervarSept2004/PresentationsCOSTG9\\_WG2meeting\\_Sept2004.html](http://costg9.plan.aau.dk/SzekesfehervarSept2004/PresentationsCOSTG9_WG2meeting_Sept2004.html) by Mattsson, Stubkjær, Šumrada and Vaskovich).

## 2.3 Process Descriptions and UML Activity Diagrams

For most participating countries the processes of a few types of real property transactions have been (verbally) described and also modeled as UML activity diagrams (see the next page for an example taken from Vaskovich 2004). One should remember that UML is a tool assisting one in expressing oneself, and does not provide us with an approach or methodology for coming to the descriptions and models.

Making the descriptions has been a rather cyclic affair. Someone with knowledge of the process starts to write it down, and later discusses the result with other experts from the same country (including those working in practice). But this is not enough. The description should also be discussed with at least one expert from another country. Within the Action a lot of these discussions were facilitated by so called Short Time Scientific Mission, which made it possible for someone from one participating institute to visit another participating institute for about one week. More than ten of these missions have been undertaken so far (for reports see e.g. Zevenbergen 2003b and Vaskovich 2004).

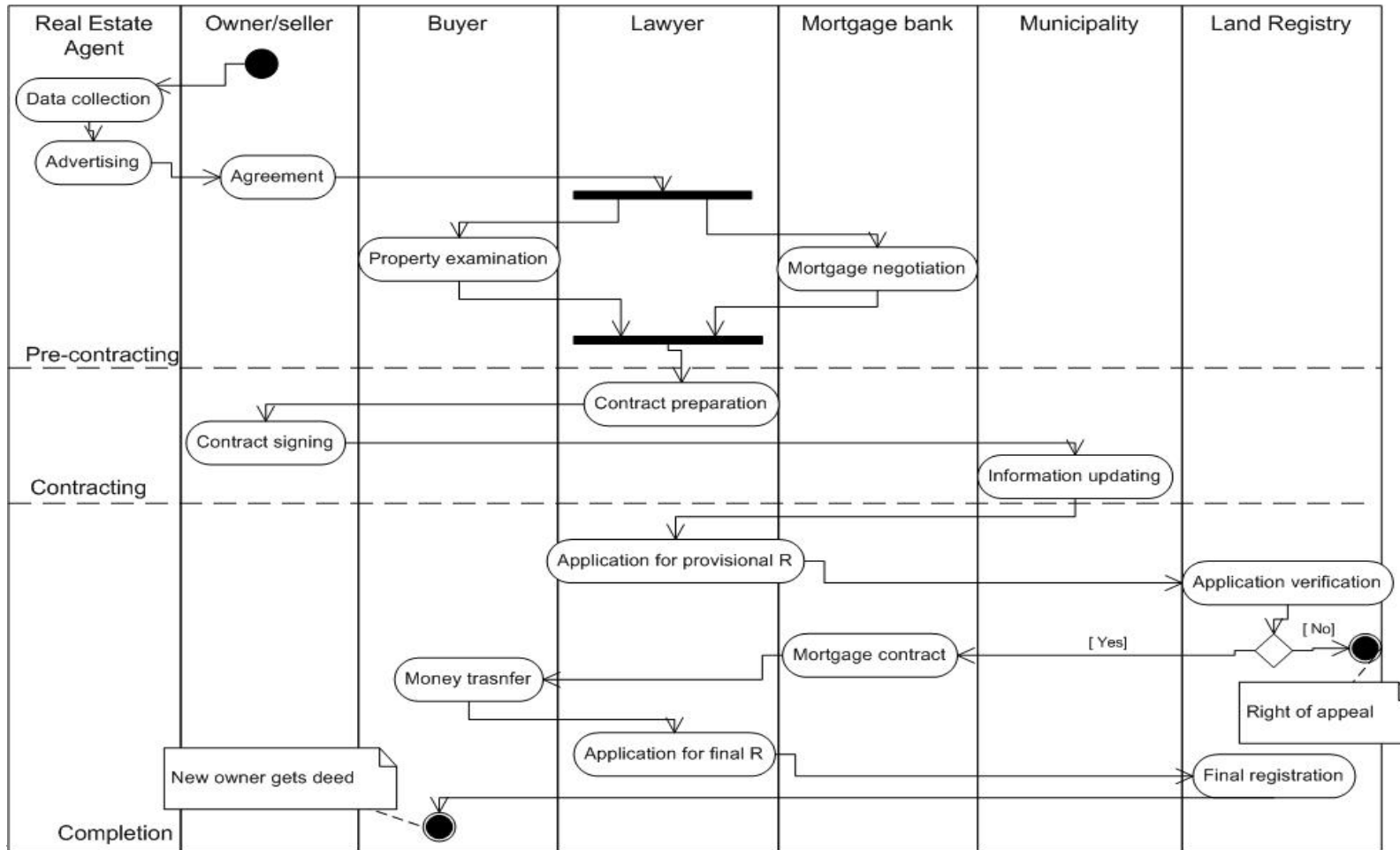
Based on the foreign experts study of the available process description, he or she should discuss this description with a number of experts from the described country (both from surveying and legal side, and preferably both from academia and from practice). Many underlying principles and ideas, as well as relevant legislation and involved organizations (persons and offices) should be discussed. Items to be addressed are also what types of rights and interests need to be registered by law in which register and with what legal consequences. From personal experience (e.g. Zevenbergen 2003b) it became clear that even more than expected beforehand the questions asked by the foreign expert force the national experts to look at their system in –for them– unconventional ways. Regularly the answer was preceded by a conversation among the national experts (in their native language) to come to the appropriate way of answering the question. Such discussions are very enlightening, not only for the foreign expert, but also for the national experts. This is strengthened when there is a combination of theory and practice, as well as of the surveyor's and lawyer's perspective around the table.

The descriptions and modeling have concentrated very much on the two main transaction types of sale and subdivision (compare Zevenbergen 2003a: 129-130). With regard to the determining of the related transaction costs typical cases have been described, although not all countries have produced the involved costs for those in a similar format.

It is believed that other transaction types (like vesting of easements and land consolidation) are likely to be more difficult to compare, since these tend to be more complex or aim at a wider range of nationally set objectives than sales and subdivisions.

Of course the bulk of the real property transactions relates to sales and subdivisions, certainly when transactions in apartments are included in this. This bulk also represents the largest economic value and is of vital importance to the economy. However, some of the other transaction types, are more related to the more social or environmental objectives that cadastral systems usually also serve (see in 2.5), and that might have a great impact on society and the landscape.

# Denmark Sale



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## 2.4 Comparing between Countries

The STSM-missions (and other possibilities for experts from different countries to sit together) also form the base for the real comparison work. After the detailed description (and depiction in diagrams) of certain activity clusters, we need to generalize to the right level for comparison. This level focuses on the functions that the procedure with its sub-activities is accomplishing. Attention is also paid to who (what person or organization), with which training, authority and responsibility is performing which part of the activities. An example can be found in the table on the next page taken from Stubkjær 2002).

It appears that comparing all participating countries might be a step too far, certainly to begin with. Clusters could be made. Related to subdivision this would be:

- countries with very simple subdivision (FIN, NL, UK)
- countries with state surveyor
- countries with private surveyor (sub-groups with surveyors with authority and which are mainly technical experts).

Related to transfers a first difference would be between countries with and without notaries.

With regard to the comparing of models between countries, an important question is why we are comparing. Different objectives of comparison most likely need different strategies for comparing. Therefore it was important that we looked back to the COST G9 goals, which mention transparency, as a base for transaction cost comparison, and for educational purposes (see 2.1). In comparing we need to look primarily for the commonalties, and not focus too much on the differences, although –as usual– the devil is in the detail.

For most of the participating countries –Denmark, England and Wales, Finland, Greece, Hungary, the Netherlands, Slovenia, and Sweden– the transaction processes are described in some detail, and based on this different types of comparisons could be made. And although the formalization process was more difficult than anticipated at the start of the Action, it is suggested we should avoid keeping refining the descriptions. Instead we should use the richness of data we have gathered to be able to answer research questions, both the ones following from the goals of the Action and new ones (for instance in a follow-up of the Action).

Although transaction cost comparison is one of the stated goals, only a few countries – Denmark, Finland, and Slovenia– have estimated the transaction costs in a comparable way so far. This of course falls within Working Group 3 of the COST G9 Action, which focuses on the economic aspects. With regard to these economic aspects of the system of real estate transactions, two approaches are being undertaken. The first one relates to the transaction costs for the users (‘clients’) of the system, whereas the second one relates to the money involved within the system as part of the national economy (the issue of ‘Satellite Accounts’ in terminology of Systems of National Accounts as applied by the national Statistics Bureaus). After a slow start in the first years of the Action, good progress has been made in this area in 2004, and the authors are hopeful this will continue for the remainder of the Action.

<b>Denmark: Subdivision recorded in Cadastre</b>	<b>Finland: Subdivision recorded in Cadastre and Land Registry</b>	<b>Slovenia: Subdivision recorded in Cadastre and Land registry</b>
<b>Context</b>  The owner sells a parcel of his unit of real estate, e.g. to allow for building construction on the parcel	<b>Context:</b> The owner sells a parcel of his unit of real estate. 1. The owner and the buyer agree upon a contract of sale 2. The appointed notary checks and verifies the contract of sale 3. The buyer pays the transaction tax to the government, and forwards the request for title registration to the land registry. 4. The Land Registry checks and records the new owner of parcel.	<b>Context</b>  The owner sells a parcel to the buyer, which is a subdivided part of his unit of real estate.
<b>Actors, active:</b> Cadastral surveyor, owner, cadastral authority <b>Passive:</b> Holders of rights in the unit, municipality, other local authorities, land registry, neighbours	<b>Actors, active:</b> Buyer, cadastral authority, cadastral surveyor, land registry, owner. <b>Passive:</b> Holders of rights in the unit, mortgagors, neighbours, notary, municipality, other local authorities incl. Land Court.	<b>Actors, active:</b> Buyer, cadastral authority, responsible surveyor, land registry, owner <b>Passive:</b> Holders of rights in the unit, local authorities incl. municipality, mortgagors, neighbours, notary
<b>Trigger:</b> Owner requests the service of the cadastral surveyor	<b>Trigger:</b> The land registry sends the approval to the cadastral authority.	<b>Tg:</b> The owner or the competent authority request the subdivision from a licensed surveyor (company).
<b>Sub-activities</b> 1. Surveyor accepts and files the case 2. Surveyor collects and investigates data, and chooses a strategy for the specific case 3. Surveyor establishes boundaries, marks new boundaries and certain existing boundary points; measures boundaries and buildings, etc. w.r.t. national co-ordinates 4. Surveyor settles property rights that interfere with the subdivision 5. Municipality (and other local authorities as needed) approves case with respect to spatial planning, etc. 6. Surveyor submits case to cadastral authority. 7. Cadastral authority checks and approves case, and issues the case approval to surveyor, land registry, and municipality. 8. Cadastral authority sends relevant data to municipal property register and land registry 9. Surveyor completes statement on allocation of easements among new and old parcels and sends it to the land registry 10. Owner pays fee to surveyor 11. Surveyor delivers documents (cadastral map of parcel) to the owner	<b>Sub-activities</b> 1. The cadastral authority checks and files the approval of the land registry. 2. The cadastral authority appoints a cadastral surveyor to carry out the process of subdivision. 3. The surveyor informs the buyer that he has an assignment to prepare the case. 4. The surveyor collects and investigates the data on the boundaries, easements, etc. 5. The surveyor calls the interested parties (actors) to a meeting where he: - checks accordance with spatial plans, etc. - establishes, marks and measures boundaries - settles property rights interfering with the subdivision - allocates easements among to new and old parcels 6. The surveyor prepares a detailed report (minutes of the above meeting and a cadastral map of the parcel) on the subdivision. 7. The surveyor gives parties information on their right to appeal to the Land Court. 8. The surveyor sends the documents to the cadastral authority after the appeal period. 9. The cadastral authority updates the cadastral database (JAKO), sends the relevant data to the land registry, and the documents (cadastral map of parcel and report) to the owner. 10. The Land Registry updates the land register (registration of new unit of real estate). 11. Fee to the cadastral surveyor is paid.	<b>Sub-activities</b> 1. The actual owner requests the subdivision from the selected surveyor, who checks, accepts and registers it (ident, date). 2. The surveyor collects the required data 3. The surveyor submits a request for subdivision permission to the municipality unit concerned, which issues a subdivision permission. 4. The surveyor investigates data and prepares a specific strategy (workflow) for the case. 5. The surveyor establishes and marks new boundaries and certain existing boundary points; measures w.r.t. national co-ordinates 6. The surveyor prepares a detailed report (lots established and measured boundaries w.r.t national co-ordinate system, agreements etc.) and also prepares a subdivision invoice. 7. The owner (seller) pays the subdivision costs to the surveyor. 8. The surveyor delivers detailed report (documentation, cadastral map and enclosures) to the owner. 9. The owner, or at his request the surveyor, submits the subdivision case to the cadastral authority, and pays the fee for subdivision. 10. The cadastral authority checks the fulfilment of various conditions, the technical quality of the submitted case (report), including approval of definitive boundaries and their registration. 11. The cadastral authority updates the cadastral database, issues the case approval to the owner (or surveyor) and to the land registry, and sends the relevant data to the Land registry. 12. Following registration of title of new ownership, the land registry sends a decree on the approval to the cadastral authority and the new owner (or surveyor).
<b>Related activities</b>  I. Registration of title follows subdivision. II. Municipality updates Property Register (ESR) and, if applicable, Building and Dwelling Register.		<b>Related activities:</b> Registration of title: 1. The owner and the buyer make (with possible legal assistance) a signed sale contract. 2. The buyer settles the real property sales tax to the municipality concerned. 3. The appointed notary checks and verifies the sale contract (valid, subdivision completed, tax paid, ..).



## 2.5 A Cadastral Domain Ontology Revisited

With the above-mentioned, fairly rich array of descriptions and models of real property transactions available, it becomes time to once more look for formalized terminology, and ultimately ontology.

It is suggested to use the nouns from the activity descriptions as potential candidates for classes in a kind of ‘class diagram’. By modeling this way, we loop back to further formalize the activity descriptions. Stubkjær gave this the motto “From UseCases to Classes and back” (Stubkjær 2004: 8).

What pops up here is that we need to look at the functional objectives the activities are supposed to achieve in the countries. Four functional objectives that can be seen in most of the participating countries with regard to subdivision are:

- reorganize the rights in the plot and its surroundings according to the wish of the parties,
- without compromising the rights of passive (and active) holders of rights,
- in compliance with spatial, environmental and agricultural legislation, etc, and
- maintaining the clarity and efficiency of registration, by i.a. establishing systematically identified plots of land (cf. Stubkjær 2002).

Although these four objectives can be seen in most of the countries, the order in which they are taken into account, and the actor dealing with them, clearly differs. Another group of countries, however, does not include all of these four objectives. In general it is not even easy to determine which functional objectives are present in a country, because they are usually not all explicitly stated. They are usually based on different rules and partly grown in practice.

Especially the third objective just mentioned, could also be labeled as ‘social burdens’ on the system. It often seems tempting for the legislator to burden real property transactions with various types of social goals. Whether this is a good idea or not seems mainly a political question, especially since it is not easy to assess the costs and benefits of such institutions, because costs and benefits usually arise to different masters and at different times (Frank 2004: 13-14). The incentives to the parties for undertaking real property transaction inside the formal systems should at least weigh up to the ‘burdens’ placed on the transactions inside the formal system (Zevenbergen 1998).

Ultimately the combination of the ‘ontology’ (kind of class diagram) and the functional objectives are likely to be able to describe the cadastral domain.

Now that an explicit description of the cadastral domain is in sight, the question on what cadastral science is, is reiterated. It was suggested that further research could focus on the risk that is taken within the system, and who is taking (or getting) which risks during which part of the activities. Furthermore the question is how the situation is before and after the change, and how the moment of change is arranged.

### 3. FURTHER WORK

The description and modeling work has reached a level that we should now aim at consolidating the information as consistent as possible. For the descriptions and estimates created in the Action so far, we intend to have national reports describing the real property transactions in the participating countries, as well as a book, which intends to summarize Action outcomes, including the topics discussed in this paper related to approach, methodology, modeling and comparison. Much of the information is available in terms of presentations at workshops and working group meetings, and some of it is in the process of being elaborated into reviewed articles.

There are several ideas circulating for follow-ups of the COST G9 Action after it has ended, but it is too early to tell which one(s) will be taken up. The authors believe there is a continuing need for multi-disciplinary research in the cadastral domain in its widest sense. Input from non-engineering disciplines, like social sciences, jurisprudence and economy is absolutely necessary to really understand, evaluate, improve, design and teach cadastral and other land administration systems.

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## BIOGRAPHICAL NOTES

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Prof., Lic. Agro. Stubkjær is professor in Cadastral Science at the Aalborg University. He originated the idea and performed the preparation of the COST-action G9 and serves as its chairman. He is member of the Danish Association of Chartered Surveyors, and of the IT-section of the Society of Danish Engineers.

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