

# ArcCadastre and EULIS – New tools for higher value and increased efficiency in the property market

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**Key words:** SDI, cadastral mapping, GIS, surveying, land information, international transactions.

## ABSTRACT

Spatial Data Infrastructure, SDI is emerging as the framework for a number of different spatial related information services. Land information is one basic pillar within this context covering all aspects of the property market, from creating single land parcels to land reform programs and the financing of investments in land and infrastructure. Managing land information is therefore of great importance regardless the stage of development in each particular jurisdiction.

Sweden has a very long history of mapping and cadastral activities, with Lantmäteriet's history going back to 1628. This also means that we have a long experience in the field of using up-to-date technology and working methods.

In recent decades the IT-development has had an increasing influence on the business of land information on the cadaster evolution. The Internet boom has created a new and rapidly changing environment for the further development. This paper deals with two examples of how the new technique can help promoting services within our business in the future.

In order to increase efficiency in handling all kinds of spatial data Sweden's Lantmäteriet is now developing ArcCadastre together with its partners ESRI and Leica. ArcCadastre is being developed to be a tool specially adapted for cadastral and mapping activities with different kinds of spatial management in different situations around the world. ArcCadastre is a unique solution that extends mapping functionality with survey and cadaster functionality.

Although land administration systems and records vary in format and content from country to country, they all have at least one requirement in common, namely, the need to satisfy the requirements of the land market. The demand for land registration services and associated data is increasing year by year together with a need for systems that can be used to efficiently manage the considerable volumes of data and also make it available to a wide range of users.

ArcCadastre is designed to support cadaster surveying activities, to handle geographical data and for map production. It is well suited for customer / country-specific extensions. The core product is the basic cadastral software and the tool for all mapping activities in the fields of large scale, small scale and utilities map production. The product contains all functionality needed for surveying and mapping purposes and for the greater part of the functionality that is common to cadastral workflow in different countries. ArcCadastre has been designed as a

multi-purpose tool for handling geographic data together with non-spatial data from other databases.

Functionality, which may vary between different user categories, or from country to country because of different local legal or other requirements, can be added by customisation. Hereby ArcCadastre can meet the needs of many user categories and for a wide range of applications such as municipal mapping, management of cadastral systems and the production of cadastral index maps.

To an increasing extent the European market is becoming more integrated. So far property transactions have remained quite national, and complaints have been made about the lack of a single mortgage market. In order to speed up the integration process Lantmäteriet has initiated a project for providing the market with a single entrance to land information across borders. This project, EULIS, is carried out together with a number of European countries.

Today there are major divergences between the national markets for mortgage credit, which result in difficulties in establishing more open and competitive markets. One of the reasons for this is lack of – or difficulties in finding – adequate land information as a basis for selling and buying real properties or handling mortgage loans in other countries.

The EULIS project aims at proposing how an electronic European Land Information Service can be designed in order to promote a more open and competitive European market for real properties and mortgage credits. A more developed single market in this area would function as a driving force for growth and new jobs, while maintaining a high level of consumer protection and lower costs for mortgage credit.

The EULIS project aims to develop a co-ordinated approach for this public sector information. The project will support cross-border use of land information, but will also give important input for the development of the national services. Benchmarking and exchange of experiences between the participating countries will contribute to the development of efficient services in the involved countries as well as other countries.

A cross border service for land information will widen the market for real property. It will be easier to sell and buy properties between members of different countries. It will be easier to discuss a loan based on a mortgage credit with a bank in another country. The competition between banks and credit institutions will be sharpened, which will have positive effects for the consumers.

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## **1. INTRODUCTION**

Spatial Data Infrastructure, SDI is emerging as the framework for a number of different spatial related information services. Land information is one basic pillar within this context covering all aspects of the property market, from creating single land parcels to land reform programs and the financing of investments in land and infrastructure. Managing land information is therefore of great importance regardless the stage of development in each particular jurisdiction.

Sweden has a very long history of mapping and cadastral activities, with Lantmäteriet's history going back to 1628. This also means that we have a long experience in the field of using up-to-date technology and working methods. Swedish organisations within the different fields of surveying have been something of pioneers in developing and using e.g. Land Information Systems (e.g. through the introduction of the Land Data bank System) and GIS (as Lantmäteriet e.g. was one of ESRI's first customers).

In recent decades the IT-development has had an increasing influence on the business of land information on the cadaster evolution. The Internet boom has created a new and rapidly changing environment for the further development. This paper deals with two examples of how the new technique can help promoting services within our business in the future.

Lantmäteriet is highly involved in two international development projects that will result in new tools for the property market. These tools aim at, in different ways, creating higher value and increased efficiency for their users. The following describes the functions and benefits for spatial management tasks with these new tools, ArcCadastré and EULIS, and also some of the challenges for Lantmäteriet and others involved with the projects.

## **2. ARCCADASTRE**

### **2.1 The background**

As part of our experience in the development of tools for carrying out the tasks of Lantmäteriet, in-house software for topographical and cadastral mapping was developed at a very early stage. The information contained in various cadaster and legal land registers, utilities registers and map databases is a key, infrastructure component with an immense capital value, in both the public and private sectors of a nation's economy. A well-functioning map and land administration system is one of the essential corner stones in a market economy. So it has been quite natural to make sure that we have good and reliable tools when building up such registers and databases.

These original systems for this (the AutoKa family) have been enhanced over the years, and many new facilities have been added. Three years ago we decided to develop a totally new product, and to replace the existing ones in order to increase efficiency in handling all kinds of spatial data. The prime target group was of course to be Lantmäteriet itself, and other users carrying out the same activities in Sweden, i.e. within the municipalities. The intention was to provide the software solutions for capturing, maintaining and managing survey data and cadastral information.

After some initial planning we realised that we could gain considerably by establishing partnerships for this development. Lantmäteriet has therefore developed ArcCadastre together with its partners ESRI and Leica. With such international partners it was soon obvious that the product should be developed with not only a Swedish focus, but with a more global target group. Bearing in mind that AutoKa products already have a number of users in different parts of the world, the international focus was quite logical for Lantmäteriet as well.

## **2.2 The product**

ArcCadastre has now been developed to be a tool suitable for cadastral and mapping activities with different kinds of spatial management and in different situations around the world. Although land administration systems and records vary in format and content from country to country, they all have at least one requirement in common, namely, the need to satisfy the requirements of the land market. The demand for land registration services and associated data is increasing year by year together with a need for systems, such as Geographic Information Systems (GIS), that can be used to efficiently manage the considerable volumes of data and also make it available to a wide range of users.

ArcCadastre is designed to support cadaster surveying activities, to handle geographical data and for map production. It is well suited for customer / country-specific extensions. The core product is the basic cadastral software and the tool for all mapping activities in the fields of large scale, small scale and utilities map production. The product contains all functionality needed for surveying and mapping purposes and for the greater part of the functionality that is common to cadastral workflow in different countries. With ArcCadastre you work sequentially from field measurements via computation, processing, presentation of various maps and reports, to a final storage in object oriented databases. ArcCadastre has been designed as a multi-purpose tool for handling geographic data together with non-spatial data from other databases. ArcCadastre's extendibility is excellent due to the technology that was chosen for its development.

Functionality, which may vary between different user categories, or from country to country because of different local legal or other requirements, can be added by customisation. Hereby ArcCadastre can meet the needs of many user categories and for a wide range of applications including municipal mapping, managing cadaster systems, the production of cadastral index maps, public utilities companies, surveying and mapping, major real estate owners, land taxation purposes and land use planning.

## 2.3 The technology

ArcCadastre has been built on the latest, proven high technology platforms that are available within the respective technological fields:

- ArcGIS from ESRI Inc., has been used as the base for the development of ArcCadastre.
- Survey Analyst from Leica Geosystems AG is used for survey and computation functionality.
- FME from Safe Software Inc. is used for import and export to and from various data formats.

ArcCadastre stores geographic data in Geodatabases. A Geodatabase is a relational or object-relational database that has been enhanced by adding geographic data storage, referential integrity constraints, map display, feature editing and analysis functions. Geodatabases on any supported relational database manager operate identically. This facilitates the use of a single database manager throughout a whole organisation.

The data model that is provided with ArcCadastre is object-oriented and open for extensions. The core product will be delivered with two basic data models: one object-oriented and one geometry-oriented for cadaster and large-scale mapping. The basic data models should be looked upon as an example that can be modified to suit user requirements. Existing features can be changed or new features added to the basic data models.

ArcCadastre is unique in the way it is extending GIS functionality with survey and cadaster functionality, as well as supporting mapping. ArcCadastre adds a Survey Database into the Geodatabase for storage of survey data from field measurements and maintains links between the stored measurements and survey points.

Survey points are created and updated from measurements through a set of computations, and can be linked to features. ArcCadastre includes data storage models and components for survey measurements including point attributes, such as point name, mean square error, quality information, method of determination, validity, etc.

Geographical access areas are used to facilitate the sharing of the same central database in different areas by different organisations with maintained secure data handling.

The handling of cadaster data is often regulated to follow predefined processes. In this way, data integrity, from a legal aspect, is preserved. When working within a process, a predefined workflow is followed. A number of documents may be produced and sent to the involved parties. Likewise, a number of features in a database may be subject to changes. Several data files may be used as input and/or output. This emphasises the need for methods for organising the work in order to keep track of all elements of it.

In ArcCadastre, a job is the basic mechanism and all work in ArcCadastre is executed within the context of a job. The function of a job is to keep track of all relevant information and settings that belong to a certain job, for example, program settings such as custom toolbars, data sets and features in Geodatabases, as well as amendments and references to documents

belonging to the job. Furthermore, a job has a lifetime and supports the overall handling of all items affected by it. Jobs are saved with unique names and a job has a workflow.

Access to a job is regulated by the overall access rights system. This facility can be used to restrict access to a complete job, or parts of a job, to specified users.

In Sweden, like in many other places, we have a large number of co-ordinate systems in use, often very locally. ArcCadastré is supplied with a number of predefined co-ordinate systems. The user can also define custom co-ordinate systems.

In ArcCadastré the user can view and work with data from different co-ordinate systems. It is also possible to do permanent transformations, which rewrite the co-ordinates to a new co-ordinate system, or on-the-fly transformation, which show the co-ordinates in the display's current co-ordinate system. Transformations can be done to features, layers, databases and files. The product does of course support different kinds of transformations.

ArcCadastré can handle different kinds of measurements and computations, such as adjustments of control networks and height traverses and the computation of the position of points. In ArcCadastré it is also possible to compute setting-out-data which can be exported to field equipment for setting out details on the ground.

ArcCadastré supports GPS and TPS, including in real-time observations and recordings. The user can import measurements made in the field using, for example, a TPS, into ArcCadastré. Survey points are created and updated from these measurements through a set of computations. Import and export between ArcCadastré and different TPS instruments is supported through data converters. A number of formats are supported.

The user can generalise and simplify features in ArcCadastré. This functionality is required when producing small-scale maps. The user can choose either to replace a generalised feature or save it as a new feature.

Annotation is used to enhance map presentation, for example to annotate features, to present information about the data on the map, as descriptive text or to present a title for the map. It is possible to steer the font, colour, style and size of the text of a label as well as its placement angle.

## **2.4 Presentation**

The possibility to present maps is an important function in ArcCadastré. It is easy to create a presentation either on screen, as a printout or as an export file. A predefined map template can be used for the layout. The appearance of a map is defined by a plotting style that describes how each layer in the map is to be drawn.

A flash-map is an important concept in ArcCadastré. Flash-maps are mainly used for rapid on-screen drawing. When a flash-map has been read into memory drawing is almost instantaneous. Flash-maps can be created, drawn and deleted.

Flash-maps for AutoKa-View, which is a program used for quick viewing of maps, printout and quick search for information, is created in this way.

## **2.5 Conclusion**

As ArcCadastré is based on COM technology, it provides a completely open solution for developers and is, therefore, fully customisable by both end-users and developers.

COM allows these components to be reused at a binary level, which means that third party developers do not need to have knowledge about or access to source code, header files, nor object libraries to extend the system, even at the lowest level. Any development tool supporting COM, such as Visual Basic, Visual C++ or Delphi, can be used to develop components.

All this makes ArcCadastré very open for customisation and also for communicating with external applications.

And more important: it has been developed in a cadaster and mapping environment. In Lantmäteriet we take pride in stating that ArcCadastré has been built by users for users.

## **3. EULIS**

### **3.1 Background**

To an increasing extent the European market is becoming more integrated. So far property transactions have remained quite national, and complaints have been made about the lack of a single mortgage market. In order to speed up the integration process Lantmäteriet has initiated a project for providing the market with a single point of access to land information across borders. This project, EULIS, is carried by nine organisations from different parts of Europe. They are:

- Lantmäteriet (Sweden)
- National Land Survey (Finland)
- HM Land Registry (for England and Wales)
- Registers of Scotland (for Scotland)
- State Land Cadastre (Lithuania)
- Kadaster (the Netherlands)
- Ministry of Justice (Austria)
- Norsk Eiendomsinformasjon as (Norway)
- University of Lund (Sweden)

### **3.2 The Project objectives**

A well-functioning property market is generally considered as being fundamental for economic growth and prosperity. The opportunities for access to credit that are created through the use of real property as collateral is of great importance in this respect. In order for the market to function properly it is necessary to have access to information about, among

other things, ownership, encumbrances and property values. Good access to information contributes to making it possible for all actors in the market to participate on equal terms, to increased transparency and to keeping transaction costs down. The need for professional involvement in transactions of different kinds can, for example, be reduced as the citizens themselves have easier access to relevant and up-to-date information.

The EULIS project aims at proposing how an electronic European Land Information Service can be designed, what obstacles there might occur and how these can be overcome, as well as showing the functionality of the proposed outcome through a pilot system/demonstrator that will be launched. In this way it will be possible to illustrate the positive effects of having information readily available across borders.

Although it is envisaged that a single route to securing access to the same basic information from participating countries will have little impact on existing technical systems, the development of a pilot solution means that any need for modifications among the participating organisations and their computer systems is identified. The need for support in understanding and interpreting the various national records will be analysed.

The main sub-objects of the project are:

- Investigation of current legislation related to real property transactions, register systems, meta-data systems, and definitions and terms as a basis for setting up standards and common definitions needed for establishing a pan-European land information service;
- Development of a well functioning demonstrator including the core system, which will be the interface between the data providers and the users, the communication components between the core system and the national systems, and the interface towards the security system and the payment system;
- Development of basic principles for allowing accesses to information in accordance with national legislation on privacy in relation to land information;
- Investigation of user needs as a basis for the development of the land information service and development of awareness and knowledge within the potential user community;
- Development of security arrangements and methods for the handling of payment;
- Investigation of how the real estate markets in Europe will be affected by an across-border land information service.

### **3.3 The situation today**

Land information is produced as a result of land registration carried out in courts or government offices in each particular jurisdiction. In a number of countries the information is found in national land information systems, for which a government agency is responsible.

The member states of the European Union have reached very different stages of development when it comes to land registration and processing of land information. In the candidate countries considerable efforts are being put into the establishment of a property market, not least through restitution or privatisation programmes. Many countries have also come quite far when it comes to using IT in land registration and other land related matters.



The computerised information is generally made available through the efforts of the responsible agency, directly or through distributors/resellers. The use of the information is regulated through, among other things, legislation on public access to government records and privacy. In the most developed countries there is, when it comes to land information systems, now a very fast process going on concerning services and applications. This development is however restricted to the national level. The possibilities, first and foremost concerning the area of greatest interest for individual citizens, i.e. transfer and mortgaging of a family home, to transact across national borders are however small – mainly because of the high transaction costs. This also contributes to the fact that the number of e.g. financial actors in the national markets, and thereby also the competition, is in fact kept down.

Land law is, and will for a foreseeable future remain so, a national issue, but there is good reason for improving the availability of and access to information in order to, among other things, taking away obstacles that might exist for financial institutions. The European Mortgage Association has also pointed this out. The execution of what the proposed project finally proposes can therefore be seen as a measure to eradicate trade barriers, at the same time as the possibilities for private sector companies to exploit public information is increased.

Up until now real property transactions have been national in the sense that few actors have worked across national borders. This has meant closed markets, often decreased competition and difficulties for the consumers when comparing costs, etc. Those who have chosen to own real property in different countries have experienced trouble and high costs when attempting to mortgage property situated in another country, as well as when actually buying the property.

The development of Internet banks and telephone banking does however mean that a radical change of the market has started. New opportunities for the single individual to compare conditions, etc. are provided. Many Europeans can now get a loan and borrow money without setting a foot in a bank office. The possibility to get a mortgage for a family home on the Internet already exists. But the problems associated with accessing information about land – such as who is the registered owner or title holder of the property, what encumbrances exist or where the property is registered – still exist. The establishment of a European Land Information Service seeks to address this problem.

### **3.4 The market for the service**

As part of the preparations for the EULIS project, the individual participants made limited, national market studies. The results of these studies show that:

- The present lack of information, both for individual properties and on the legal conditions in a specific jurisdiction, means that there is an unwillingness to do business with properties in other countries.
- The information about e.g. ownership of real property or security in real property in other countries is often collected through the assistance of local experts.
- Even though national experts still must be used to understand the meaning of the information, improved access to information will be of help in order to put more specific

questions to such experts, and also make it easier to be able to refuse a loan application at an early stage.

- It is very time-consuming to obtain the information.
- It is easier to get hold of information if the bank has offices of its own in a country, or there are established contacts with local experts.
- The institutions seek the information that is necessary to give an impression of the physical and legal conditions of the real property before any decisions about granting of loans and conditions of the loans.
- The more information the institutions have access to the greater chances to get involved in the local market.
- The European Land Information Service should provide information about, registered ownership, rights, easements, site leasehold grant/ possession, particulars of the rights of users, mortgages, earlier conditions, tax assessment value, purchase price, building information, encumbrances, environmental pollution and approval from authorities.
- The information is needed for decisions about loans/credits, property analysis and valuation, acquisition of property, exercise of authorities and property management.
- The information must be reliable, accurate and trustworthy and therefor preferably from a government-related organisation.
- It would be very convenient if the information could be obtained through “one-stop-shop” service, irrespective of the type of organisation.

The study indicates that there is most certainly an increasing interest among consumers in the real property financial market to be able to carry out international transactions more frequently. This does however require that there is an easy way to get access to up-to-date and reliable information on land/real property across national borders. There is also a need to unify legislation, e.g. on repossession procedures to make it easier to do mortgages business across borders.

There are a number of different customer groups for the existing national services of this kind, the main ones being banks, credit institutions, property brokers, municipalities, and state authorities. Although their business areas differ, their information requirements are relatively similar. Information about ownership, mortgages, value and any restrictions affecting the property are generally the most common items asked for. The basic land information is also often the basis for storing other kinds of information, which is used for business development, statistics, environmental planning, etc.

The main users of the service can be found within the sectors, which are the main users of the existing national land information services. The information may, however, initially mostly be of interest within the financial sector, e.g. banks and other kinds of credit institutions. Additionally, it can be envisaged that across border land information will to an increasing extent be of interest to users within the public sector and for more public purposes. The need for information for environmental purposes is perhaps a prime example of this.

The project will therefore be able to high-light the need for the establishment of multi-purpose cadastres across Europe, and how a vast range of users within a number of different user communities have a need for such information.

### 3.5 Project contents

The EULIS project will include the following key activities in order to reach the overall objectives:

1. Analysis of the existing land information that is available on-line among the participating organisations.
2. Analysis of the users and their demands now and in the future. What international land information is required and requested? How can and will the information be used in different sectors – among lenders, real estate companies, solicitors and notaries, property investors – and how and at what price do the users want to access the information? This will be done based on a market survey common to all participants.
3. Based on the findings of the first two steps, carry out trials and develop a specification for an European Land Information Service that is of interest for access by a broad spectrum of users. The specification will comprise:
  - Identification of core information
  - User interface
  - Interface for exchange of data
  - Charging and billing procedures
4. Analysis of proposed solutions towards regulations of protection of privacy
5. Development and implementation of a functioning pilot demonstrator, using the Internet
6. Proposal for long-term solution for the operation of the service
7. Elaboration of an exploitation plan for the service

In order to carry out these activities, and thereby making it possible to reach the objectives within the allotted budget and on time, the work has been divided into ten workpackages. The work of each workpackage is led by one of the members of the consortium.

Two reference groups will be linked to the project, one with participants representing main user groups of the service and one with participants from other organisations in Europe responsible for providing land information.

The timetable spans over a period of 30 months, from January 1 2002.

### 3.6 Policy contributions

The EULIS project has received EU funding, as it will make considerable contributions to a number of EU policies. The funding comes from the eContent programme, which is under DG Information Society. The project will demonstrate how the utterly important public sector land information can be pan-European accessed. The project has a concrete and hands-on approach and will open up access to data already available in digital form. The problems we face today with use of different formats in different countries, the lack of visibility and accessibility of existing data resources, and the lack of transparency of pricing policies, security policies and other conditions to obtain the information will be promptly addressed.

The project also reflects and supports emerging EC policy issues, such as the development of

the single market, i.e. the free movement in the EU of goods, persons, services and capital. The project intends to support the achievement of the EC goal of a fully integrated and functioning financial service market. The project also supports other emerging EC policy issues, such as development and use of European digital content on the global networks and promotion of the linguistic diversity in the Information Society.

The proposed project will support the accession process with regard to the handling of issues related to land administration. Experiences from the project will be of specific interest for candidate countries in the process of reform and adjustment of their legal system, standards, and technical solutions concerning the handling of land information.

The objectives of the EU's environmental policy are to preserve, protect and improve the environment, protect human health, use natural resources prudently and rationally and promote international efforts to improve the environment. The EU's environmental policy has gradually been strengthened, and the Amsterdam treaty stipulates that sustainable development is a general objective of all Community policies.

The information hold in land registers is already today of great importance for environmental protection and control. The proposal from the Commission on a new directive on public access to environmental information, which was presented on 29 June 2000, implies that more of the environmental related information should be presented in the land information systems. Examples of this are information about areas created within the Nature 2000 initiative and impact from radon in different areas (with information on real property level). The EULIS project will compare how the existing national land information systems handle environmental related information, and determinate the needs, costs and benefits for improved such information on the European level.

## **BIOGRAPHICAL NOTES**

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