Digital Archives and Document Management in the Cadastral Procedure in Sweden

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Key words: Digital Archives, Archives strategy, Document management.

SUMMARY

Lantmäteriet (The National Land Survey of Sweden) holds a huge volume of cadastral dossiers and maps in its archives. The information covers a period stretching from 1630 up to the present day. The archives contain more than 2.7 million documents and plans from cadastral procedures as well as more than 1.5 million maps and other documents. The analogue documents were stored in 24 regional archives throughout Sweden and the total number of document pages is in excess of 70 million. Municipal cadastral authorities also have cadastral archives.

A considerable number of the cadastral documents are used on a daily basis in connection with on-going cadastral activities within Lantmäteriet and other organisations including the municipalities. The material is also of great interest for genealogists and local historians. To increase the efficiency of cadastral procedure as well as to generally improve accessibility Lantmäteriet has, since 1999, been engaged in developing and implementing a digital archiving system, Arken, which will contain all this material. All cadastral materials will be scanned and the original documents, which have suffered from regular use, will be safely archived in depots.

Initially, the development work was organised as a project but since 2003, the work has been managed and co-ordinated by a unit within the Cadastral Services Division of Lantmäteriet. The scanning is carried out by a unit within the National Archives and is planned to be completed during the first quarter of 2009. So far, approximately 90% of the material has been converted to digital format and made accessible for professional users through a special Internet service. Some of the material is also accessible for the general public through an application on Lantmäteriet's web site, www.lantmateriet.se.

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1. INTRODUCTION

Lantmäteriet (National Land Survey of Sweden) holds a very large volume of historical maps and documents in its archives. The information covers the period from 1630 to the present day. In an international perspective the collections are unique. In the archives more than 2.7 million dossiers from cadastral procedures are stored, as well as more than 1.5 million maps. The total number of document pages exceeds 70 million.

1.1 About Lantmäteriet

Lantmäteriet, with it's headquarters in Gävle, is a government agency and the leading producer of geographic databases and maps in Sweden. Lantmäteriet is also responsible for property formation, the maintenance and registration in the Real Property Register and makes available comprehensive amounts of information about the country's 3.2 million real properties. From 1 of June 2008 Lantmäteriet is also responsible for the Land Register.

Lantmäteriet's clients include central and local government authorities as well as private sector companies and the general public. We have a total of approximately 2 300 employees at around 100 offices located throughout Sweden.

1.2 Archives Strategy

In 1998, Lantmäteriet adopted an archive strategy. The strategy entailed:

– The creation of digital versions of the paper-based original material.
– Dissemination of the archived material through Internet-based interfaces complemented by the creation of an organisation well adapted to this purpose.
– Structuring, organising and making an inventory of the contents of all archives both analogue and digital.
– Depot storage of the analgue archives after scanning.

2. ARCHIVES OF LANTMÄTERIET

2.1 History

Lantmäteriet's archives date back to the beginning of organised surveying activities in Sweden. In 1628, the mathematician Andreas Bureus was charged with the task of surveying and mapping all of the provinces of the kingdom with their parishes and villages. The focus was on taxable land owned by peasants.

At that time, the king, Gustaf II Adolf, was engaged in the Thirty Years War, and this, together with his ambition to establish sound Government authorities led to the foundation of the first surveying authority. The maps, called geometriska jordeböcker (geometric land records), were collected in bound atlas volumes and were prepared to complement the existing written land records.

Initially, the material was archived in the royal castle in Stockholm, but was moved to a new building in the beginning of the 1690s. Fortunately this saved the material from being destroyed in the great fire in 1697 when the entire castle was burnt down.

From the middle of the eighteenth century the central archives were expanded by the inclusion of materials, which were the result of cadastral procedures carried out in connection with a major land reform - the Laga Skifte Act of 1827 – which was aimed at modernising agriculture in Sweden. At that time, regional archives (now county cadastral authority archives) were also set up, one in each county, to meet the needs of the regional survey organisation. These archives still exist today and a large volume of material has been added to them through the years. The system that was introduced involved the creation of three separate dossiers containing maps and descriptions: one, containing the original documents from the cadastral procedure, was archived in the regional archive, a second was handed to the involved parties and the third was sent to the central archive (the Land Survey Board archive). Many of the maps have an aesthetically attractive design.

2.2 Volumes

The county cadastral authority archives contain about 2.7 million dossiers. Every year an estimated further 15,000 dossiers are added. The central archive contains more than 250,000 dossiers and maps. More than seventy million documents and maps have to be scanned if all materials are to be converted to digital format. It was, therefore, critical that the right decisions were made when the methods for data capture, the file format for storing, the storage media and technique for presentation were decided on.

2.3 Usage

The original materials have been and, in fact still are, used as the basis for documentation of property sub-division and property formation activities through the years. As the archives contain a complete documentation of the division of Sweden into real property units, they are an important source of information for activities related to planning, ownership rights, financing, statistics and taxation. The Real Property Register is a comprehensive compilation of the textual and map contents of the archives, and is used to investigate the status of a property sub-division. But since the register does not have legal status, retrieval of the source documents from the archives is generally necessary. Because of the frequent use of the original documents some of them are now in a poor state and can, at times, be difficult to read. The county cadastral authorities still receive documents from new property formation activities and other documents concerning the use of land, such as building plans and more.

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As the material kept in the central archive has not been used to the same extent as that in the county cadastral authority, and as the storage facilities have always been more suitable, its quality is, in most cases, better. In total, between 200 and 250 000 dossiers are retrieved from the archives every year. Today the archives are mainly used for property formation activities at Lantmäteriet. Other significant user groups are, in order of volume, the general public, estate agents and different governmental authorities. Interest from the general public is probably the main reason for the recent increase in the use of archive materials. The materials are also of great interest for genealogists and local historians.

3. CONVERSION TO DIGITAL FORMAT

3.1 The Digital Archives project

During the 1990s Lantmäteriet carried out a number of experiments and projects related to the conversion of differing archive materials to digital format. By 1998 this work had resulted in the creation of sufficient material and experience on which to base the archive strategy that is described above. To implement the strategy a project titled "Digital archives" was started and was continued during the period 1999 to 2002. Within the framework of the project technical and administrative solutions for its implementation were formulated and tested in three pilot projects.

The archive system that has been developed is called Arken and contains automated routines for loading large volumes of scanned images, databases for metadata, original files and working copies as well as interfaces that make it possible for users to access the information. A connection between Arken and the job handling system used in cadastral procedures (Trossen) has also been developed.

Since 2003 the management of the conversion of Lantmäteriet's archives is the responsibility of the Cadastral Services Division and is organised as an activity within the line organisation. A special group is responsible for co-coordinating and managing data capture of the county cadastral authority archives. The conversion of 38 municipal cadastral authorities' archives is also co-ordinated by this group.

3.2 Co-operation with the National Archives

From the mid 1980s Lantmäteriet had its own map restoration centre, with a staff of just over 20 persons, where maps from the regional cadastral authorities' archives were repaired and restored. The National Archives had a unit for microfilming mainly of parish registers, and during the 1990s the unit participated in several of Lantmäteriet's data conversion development projects. When Lantmäteriet started the Digital archives project the feasibility of increasing co-operation with the National Archives was considered and during the autumn of 2002 an agreement concerning the future of the restoration centre and the microfilming unit was concluded. The main points in the agreement were that:

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- The National Archives would take over full responsibility for Lantmäteriet's map restoration centre which would be integrated with the microfilming unit.
- Lantmäteriet agreed to utilise the services of the newly formed unit for all data conversion of its archives.
- The county cadastral authorities' archives would be handed over to the National Archives and the regional archives in conjunction with the data conversion.

4. THE PRESENT SITUATION CONCERNING IMPLEMENTATION

4.1 County Cadastral Archives

The conversion of the county cadastral authorities' archives is being carried out according to a plan, the basic version of which was finalised in 2002. The plan has, since then, been evaluated and is reviewed annually. At present, approximately 90% of the total volume of materials in the county cadastral authorities' archives has been converted to digital format and is available in Arken. Our future plans are that all archives will have been converted to digital format by the mid of 2009.

4.2 The Municipal Cadastral Authorities' Archives

Our ambition has been to create a national digital cadastral archive in which all cadastral documents will be accessible, irrespective of whether they are in central or local government archives. The history of the creation and development of cadastral archives in Sweden is a long story of shared responsibility. Since the 1600s, municipal authorities and the State have stored their cadastral information in separate archives and this has resulted in the present situation in which information about a property unit can be found in more than one archive.

There is, therefore, co-operation with the municipal cadastral authorities which makes it possible for them to store their data in Arken. The municipal cadastral authorities pay for the scanning of their archives and have agreements with Lantmäteriet concerning the storage of and access to the digital data in Arken. Most of the municipal cadastral authorities have chosen to convert their archives at the same time as the county cadastral authorities' archives are scanned.

5 CHALLENGES

5.1 Challenges for the Digital Archive project

Lantmäteriet has faced many challenges as a result of the decision to build a digital archive. Some of the most significant has been:

- To reduce the handling and subsequent deterioration of millions of historic and archived documents while at the same time providing greater access to the information.
- To provide an easy to use web based interface which could be used by novices and experts alike to locate, browse, view and download the cadastral information as seamlessly as possible.

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- To find a cost effective and standardised file format which authenticates the original paper based material as accurately as possible.
- To set up a system maintenance plan for constant and continual maintenance. Areas had to cover hardware, software and data, back up procedures, standards and migration plans.
- To agree on content of metadata together with an appropriate method for storage and accessing the information.
- To develop a system robust enough to withstand possible technological failures, changes in computer platforms and media and possible changes in management and funding.
- To meet legal requirements according to Swedish Law.
- To research and implement a technical architecture based on industry standards and best practices in line with the goals and the budget of Lantmäteriet.
- To find a cost effective and potentially long-term method to store large quantities of digital information.

The digital archives project commenced in 1999. Two fullscale pilot projects took place in 2000 and 2001. The experiences from these projects meant that many of the questions relating to technical solutions, quality controls and organisational requirements had to be reconsidered before implementation throughtout the country could be carried out.
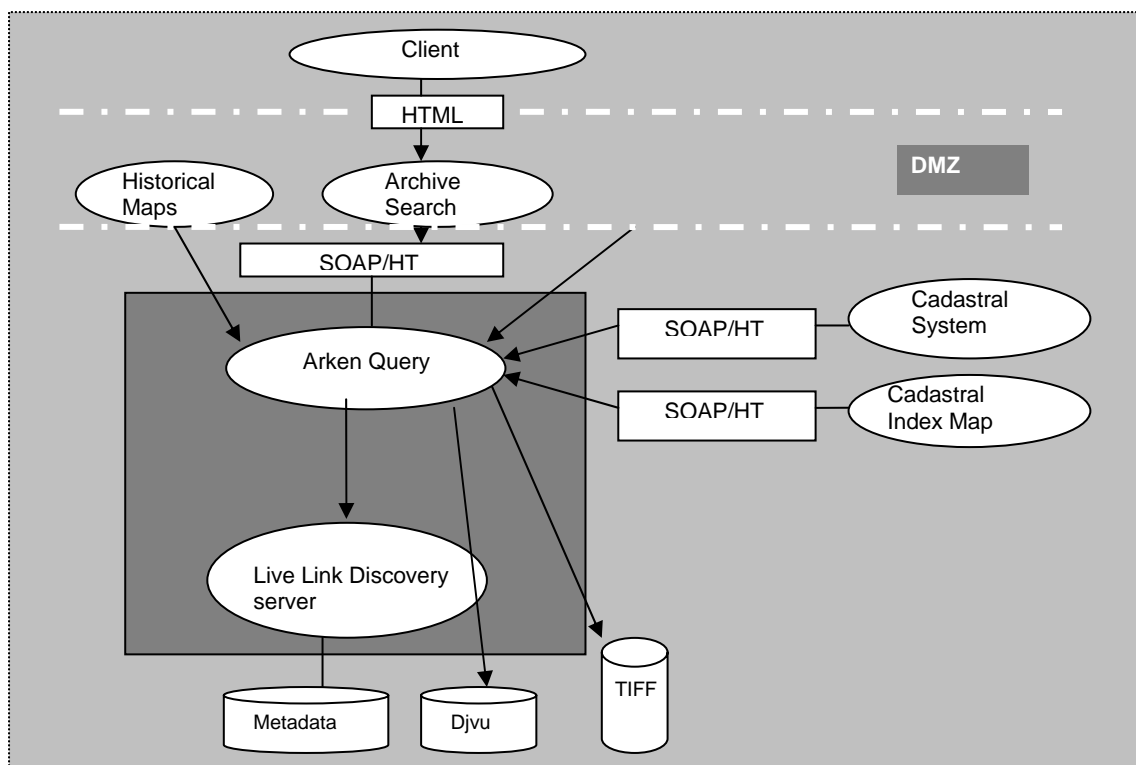
5.2 Challenges Ahead

The technology which supports the digital archive is continuously evolving and changing as time goes by. One of the greatest challenges for the way forward is to ensure the preservation and accessibility of the 70 million documents in the future. Other challenges ahead include the following:

- To develop the system so it becomes as self-sustaining, self-monitoring, and self-repairing as possible.
- To ensure strategies pertaining to technological obsolescence, technical failures, disaster recovery and security are regularly updated and implemented.
- To protect against data loss.
- To effect the transition from traditional paper-based legal documentation to digital documents with electronic signatures.

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6. TECHNICAL OVERVIEW AND HOW TO ACCESS THE DIGITAL ARCHIVE

6.1 Technical Overview

System map for Arken (extract)

The Arken digital archive is based on a series of databases used to store compressed files of the original information. All metadata is stored in the Live Link Discovery Server database which is designed for free text searches. Arken Query is a web service developed in Java used to access information from LLDS.

The Archive System must be accessible from the cadastral client, the Web client for land registration as well as from the Web client for search and querying of cadastral information.

The identifier in the Archive System is the unique transaction identity that is assigned to a procedure when an application for a cadastral or land registration case is registered. Other searchable attributes are parcel numbers and parcel owners.

The original paper based cadastre images are scanned as TIFF images and these are saved on magnetic tape. These can be accessed using a Hierarchical Storage Manager or tape robot. Due to the size of the TIFF files, they are compressed in DjVu format and viewed via one of the web based interfaces using a plug-in and browser.

The Arken system has a number of web based interfaces include 'Archive Search', 'Property Search' and 'Historical Maps'. Archive Search is a service provided to contractual customers whereas Historical Maps is a service offered to the public

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Material from Arken can also be accessed from other programs using a service called Arken Proxy. This service is currently being used by external users who wish to create their own web based interface; and internally to allow access to the digital archive from other programs which incorporate the documents as part of their daily task.

6.2. Access for the General Public

The major change which the digital archive system will lead to is that the materials is generally available via the Internet. Through a web service, called Historical Maps, via Lantmäteriet´s web site www.lantmateriet.se the general public can study old maps and documents and also order analogue and digital copies of them. Public access is limited to material created prior to 1928 in line with Swedish law regarding privacy.

In the beginning of 2008 the number of visitors to the web service has been 20 000 per month. Many persons who earlier have visited our offices to study old maps and documents can now sit at their own computers or at a public library and look at digital copies of the materials. The number of users of the service is expected to continue to increase. Separate copies, both analogue and digital, of the material can be obtained from Lantmäteriet's Customer Services.

6.3 Access for Professional Users

It is possible to obtain direct access to Arken via different interfaces. As some of the information in the cadastral archives may contain personal information to which access is limited by Swedish law this is a service which is only available for professional users and a special agreement is required. ArkivSök (Archive Search) is a web service that can be accessed via Lantmäteriet's web site. The service provides access to all of the material in Arken – cadastral dossiers, plans and provisions as well as historical maps from Lantmäteriet's central research archive. Type the name of a village and you can see all of the cadastral procedures and historic mapping that has been carried out in the village. It is also possible to print out a simple copy.

At Lantmäteriet a direct link to Arken – Cadastral Index Map (mapping system) and Cadastral System is used. Retrieval of data is easy: click on a real property on the map to move to the Real Property Register, then click on the designation of the dossier to which the cadastral procedure belongs or on a plan and the dossier in which you can study maps and documents is opened. The same function, with clickable dossiers, is available for external systems that use real property information via a new service, ArkenProxy. A number of distributors of real property data have begun to use this link to Arken in order to be able to offer their clients complete real property information.

7. THE IMPACT OF THE CONVERSION PROGRAMME ON THE ACTIVITIES OF THE CADASTRAL AUTHORITIES

To evaluate the impact of the conversion programme on the county cadastral authorities, Lantmäteriet carried out a study of the activities of cadastral authorities in those counties

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which have most experience of working with the digital data. Irrespective of the type of office or location it could be seen that experiences of working with digital archive data have been, on the whole, overwhelmingly positive.

7.1 Saving Time

Irrespective of the type of activity or office, in general it can be stated that the time previously required to go to an archive, choose, retrieve, copy and replace documents and then return to the workplace has always been saved. A study that was carried out before the data was available in digital format showed that at Lantmäteriet 200 000 dossiers were retrieved from the archives every year. Time and motion studies also showed that it took, on an average, ten minutes per dossier to retrieve and replace a dossier in an archive. Today, using Arken and Trossen, it takes only a matter of seconds to retrieve a dossier to a computer screen.

7.2 Improved Service – Shorter Handling Times

Irrespective of which office a client visits or contacts by telephone to request information from a dossier, it is generally possible to answer questions or provide a copy of documents immediately. Previously, and almost without exception, there would be waiting times of varying length depending on whether or not the archive was in-house or at another place. With the new system, visitors can, easily and on their own, study documents using the computer terminals that are available at the larger offices.

7.3 A Better Working Environment

One of our staff members commented as follows: Arken has made all aspects of our everyday work much easier to carry out and led to a high level job satisfaction. It can be compared with the introduction of the Land Databank System and other computer-based presentation systems some years ago. When there is a need for access to documents in order to answer a question concerning a specific cadastral procedure it takes only a few seconds to retrieve the information and then continue working. This can be the case with an on-going job or with a visit or telephone call from a client. Finding all of the required information in a particular dossier in the archives can be difficult to do in a single search as other questions often arise during the continued handling of a case. By always having access to dossiers on the computer screen it is possible to go back to a document several times. Previously, several visits to the archives could be necessary, which was always a source of irritation. The challenge today of course is to minimize the risk of repetitive strain injuries!

7.4 Better Quality

Rapid and easy access to documents has meant that more checks can be made in both cadastral procedures and in other activities. This leads to improved quality in both the procedures themselves and in the contents of the Real Property Register.

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7.5 A more Flexible Organisation

The conversion of the cadastral archives to digital format represents the final stage of the transition to a modern system in which all of the basic information that is needed for carrying out cadastral procedures and many other cadastral activities is accessible in digital format, which began with the creation of the Land Databank System and the introduction of digital cadastral index maps. The system makes it possible to carry out many tasks in completely different places from where a cadastral procedure was carried out or was requested. During peak workload periods it is now possible to move work to where capacity is available instead of having to temporarily move staff. Furthermore, for areas of activity in which available competence is under-utilized it is possible for staff to work regionally rather than only locally which, in turn, means that it is possible to concentrate competence at a number of places in Sweden instead of splitting resources between several offices. An example of this type of competence is complex real property investigations.

7.6 Lower Costs for Premises

At the 24 county administrative headquarters where the archives were located the need for office space, rental and running costs for them decreased significantly. These savings are partially neutralized by the fact that depot storage also costs money. The costs for renting and running these offices can be further decreased as there are now increased possibilities to move offices to other premises when there is no longer a need for archive space. So far, since the archives were converted, offices in the county administrative centers of Stockholm, Mariestad, Nyköping and Halmstad have been moved to other premises. Even costs for those offices that do not house original archives can be reduced since there is no need for space for shadow archives or for equipment for reading microfilm.

7.7 Summary of the Impact on Lantmäteriet's Activities

It is clear that the creation of digital archives has significantly contributed to the achievement of the targets that the government set for Lantmäteriet's cadastral activities, namely that:

– Handling times for cadastral procedures should be reduced and adapted to the case type and client requirements.
– Handling of cases should be more efficient so that costs for the involved parties can be reduced.
– Client satisfaction should be maintained concerning treatment and be increased concerning handling times and costs for cadastral procedures.

8. WHO ARE THE USERS OF ARKEN?

The data is used for real property formation by both central and local government bodies. Within Lantmäteriet the data is also used for the expansion and improvement of the quality of the information in the Real Property Register and for building up GSD (Swedish Geographic Data). The local government authorities use the data for their MBK (Surveying, Computing

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and Mapping) activities, for planning of future land use and in the building and environmental sectors as the basis for decision making.

The data is used by other external professional groups for analyses and as the basis for the formulation of policies concerning land and environmental issues as well as for research and studies in the nature and cultural conservancy fields. Amongst the general public the main users are local history and genealogical researchers; in addition, private land owners often retrieve data about their properties.

In 1999, before the decision to convert the county cadastral authorities' archives to digital format was taken, a study to evaluate the extent to which the material in the cadastral archives was used was carried out. The study showed that approximately 100 000 dossiers were used annually internally and around the same number externally, making a total of approximately 200 000 dossiers per year in the whole country. This figure can be compared with statistics for 2007 when more than 1 million dossiers were retrieved via the Arken system. The increased use of the data indicates that the demand for a complete set of real property information is large. When information is easily accessed its use increases, which should lead to improved quality and better legal security in those activities for which the data is used.

9. INCREASED USE OF ARKEN IN THE FUTURE

The use of Arken outside Lantmäteriet by other national and regional organisations and private sector companies is expected to continue to increase during the next few years now that the build-up of the system soon is completed. In addition, there are other areas of activity in which easier access to digital data will offer possibilities, which did not exist with the old system for handling analogue data, but which will require changed routines, working methods and co-operation if the full benefits are to be realised. As the functionality in Arken is further developed and improved we can expect that the investments that have been made in the system will result in continued increases in efficiency and an increased use of the data in many sectors.

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BIOGRAPHICAL NOTES

Christer Berntsson is an Archive Expert. He was responsible for the tecniqal development of Arken. He has also worked as an consultant in archive projects in Egypt and Croatia. He is now working with the continued development of Arken and as an consultant in an archive project in Serbia.

Lennart Sundström is a Land Surveyor. He was educated at the Royal Institute of Technology in Stockholm.He is now head of the unit coordinaiting the conversion activities and implemantaion of the Arken-system.

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