

# **MASTER'S THESIS**

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**MASTER'S THESIS**

**DOCUMENT MANAGEMENT AS A PART OF PRODUCT  
LIFECYCLE MANAGEMENT**

The topic of the thesis has been confirmed by the Departmental Council of the Department of Industrial Engineering and Management on August 27.2003 in Lappeenranta University of Technology.

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## ABSTRACT

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<p>This work concentrates on the document management at a global company Andritz, manufacturer of equipment for pulp and paper industry. The issue is treated mainly from the viewpoint of the company's service business and product lifecycle management. The work concentrates to solve how the document management system that has been earlier used for other purposes can be applied to service business needs. The work is based on the literature, writer's experience and the interview-based outlook about the business in this field.</p> <p>The work introduces basics about document management systems, their structure, basic functionalities and different types of solutions for the document management in the market. The work also describes the present state of the document management at Andritz, products lifecycle main steps, document management meaning in these and present document management system at Andritz. Service business special characteristic and needs for the document management are introduced besides these.</p> <p>The work also includes a practical example of big ongoing projects document management. The project uses document hotel service for project time document management. These documents have to be transferred also to Andritz own system. This transfer is carried out as a part of the work.</p>	

# TIIVISTELMÄ

<b>Tekijä:</b> Janne Yläjääski	
<b>Työn nimi:</b> Document management as a part of product lifecycle management (Dokumenttien hallinta osana tuotteen elinkaaren hallintaa)	
<b>Osasto:</b> Tuotantotalous	
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<b>Hakusanat:</b> Dokumenttien hallinta, tuotteen elinkaari, elinkaari. <b>Keywords:</b> Document management, Product lifecycle management, lifecycle.	
<p>Tässä työssä käsitellään maailmanlaajuisen paperi- ja sellutehtaille laitteita toimittavan yrityksen Andritz'in dokumenttien hallintaa, keskittyen lähinnä yrityksen service-liiketoiminnan ja tuotteen elinkaaren hallinnan tarpeisiin. Tarkoituksena on selvittää kuinka aikaisemmin yritykselle muihin tarkoituksiin valittu dokumenttien hallintajärjestelmä sopii Service-liiketoiminnan tarpeisiin. Työ perustuu kirjallisuutteen sekä tekijän työn ohella sekä haastatteluin keräämään näkemykseen liiketoiminnasta tällä alalla.</p> <p>Työssä käsitellään yleisellä tasolla dokumenttien hallintajärjestelmiä, niiden rakennetta ja perusominaisuuksia, sekä esitellään markkinoilla olevia erityylisiä ratkaisuja. Työssä esitellään myös Andritz'in dokumenttien hallinnan nykytilaa, tuotteen elinkaaren päävaiheet, dokumenttien hallinnan merkitys niissä ja nykyisin käytössä oleva dokumenttien hallintajärjestelmä. Näiden rinnalla pyritään tuomaan esille Service-liiketoiminnan erityispiirteet ja tarpeet dokumenttien hallinnalle niiden kannalta.</p> <p>Työhön on sisällytetty myös käytännön esimerkki dokumenttien hallinnasta suuressa käynnissä olevassa projektissa. Projektissa käytetään dokumenttihotelli palvelua dokumenttien projektin aikaiseen hallintaan. Hotellissa olevat dokumentit tulee siirtää myös Andritzin omaan järjestelmään, tämä siirto on tehty osana työtä.</p>	

## **FOREWORD**

This work is carried out at Andritz Oy's Service office in Savonlinna Finland. The purpose of the work is to develop document management for Andritz Pulp and Paper Mill Services.

I would like to thank my adviser Matti Uusitalo for his valuable advice during the whole work. I'd like to express my gratitude to my supervisor professor Markku Tuominen for his time and advice. Thanks belong also to Documentation Engineer Anna-Maria Tervonen and Development Manager Jyrki Koikkalainen for their time and advice. I'd also like to thank all other parties who have helped me during this work.

## TERMS AND APPREVIATIONS

ActiveX	Outgrowth of two other Microsoft technologies called OLE (Object Linking and Embedding) and COM (Component Object Model).
AIM	<b>A</b> pplications <b>I</b> ntegration <b>M</b> odule
API	<b>A</b> pplication <b>P</b> rogram <b>I</b> nterface
CD-ROM	<b>C</b> ompact <b>D</b> isc- <b>R</b> ead- <b>O</b> nly <b>M</b> emory
COM	<b>C</b> omponent <b>O</b> bject <b>M</b> odel
DLL	<b>D</b> ynamic <b>L</b> ink <b>L</b> ibrary
DM	<b>D</b> ocument <b>M</b> anagement
DMS	<b>D</b> ocument <b>M</b> anagement <b>S</b> ystem
EDMS	<b>E</b> lectronic <b>D</b> ocument <b>M</b> anagement <b>S</b> ystem
ISM	<b>I</b> ntegration <b>S</b> cheme
MS	<b>M</b> icrosoft
NTFS	<b>N</b> T <b>F</b> ile <b>S</b> ystem
ODM	<b>O</b> bject <b>D</b> ata <b>M</b> anagement
ODMA	<b>O</b> pen <b>D</b> ocument <b>M</b> anagement <b>A</b> PI
OLE	<b>O</b> bject <b>L</b> inking and <b>E</b> mbedding
OPE	<b>O</b> verall <b>P</b> roduction <b>E</b> fficiency
PDF	<b>P</b> ortable <b>D</b> ocument <b>F</b> ormat
PDM	<b>P</b> roduct <b>D</b> ata <b>M</b> anagement
PLM	<b>P</b> roduct <b>L</b> ifecycle <b>M</b> anagement
SFS	Finnish Standards Association
SQL	<b>S</b> tructured <b>Q</b> uery <b>L</b> anguage
SSL	<b>S</b> ecure <b>S</b> ockets <b>L</b> ayer
UI	<b>U</b> ser <b>I</b> nterface
XML	<b>E</b> xtensible <b>M</b> ark-up <b>L</b> anguage

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# 1 INTRODUCTION

Nowadays document producing has increased rapidly, still there is a large number of traditional paper documents, but also the electronic form of the documentation has increased. There are a number of different kinds of electronic documentation like e-mails, web pages, memos, worksheets and drawings, which have been stored in workstations and servers. Controllable information has increased rapidly and it has created problems to individuals and companies. Partly this is a consequence of fast information spread provided by e-mail messages and web pages. When the information spreading is easy, also the amount of irrelevant information has increased. The biggest problem seems to be the finding of relevant information from the array of all irrelevant information (Anttila 2001, 1).

For the last 25 years organizations have been fascinated by structured database applications. Yet according to James Martin, a famous information-engineering guru, fewer than 10 to 15 percent of an organization's information assets are being managed as databases. Indeed, 60 to 80 percent of an enterprise's information assets are tied in documents and forms (Sutton 1996, xiv).

Growth of electronic documentation is mainly result from computer-based text edition becoming common in offices. Since the beginning of the last decade there have been many forecasts that traditional paper documents will be compensated with electronic documents and consumption of paper will decrease and finally disappear. Even though the electronic documentation has increased rapidly these forecasts haven't fulfilled. The consumption of paper in the offices hasn't decreased; it has even increased approximately by one quarter from the beginning of the past decade.

This can be partly explained by the fact that people desire to read documents in paper form. In many cases documents have been distributed in electronic form through e-mail or in web pages. Because people want to read the documents in

paper form, they usually print the documents on paper. Documents are usually more easily stored in electronic form and in many cases paper form of document will be disposed after reading and printed again when it is needed next time.

## **1.1 Background and reasons for selected subject**

From the viewpoint of Andritz, main reasons for selected subject are document intensive business, related development projects and needs to enlarge the scope of existing DMS solution.

Process plant deliveries are extensive and include huge amount of internal and external documents. One of the Andritz' strategies to enlarge its business is acquiring companies, which support and enlarge the core business. Therefore the management of business documents is based on many different practices in different business units. Practices differ from file folder systems in servers to complete document management applications.

As a consequence of the acquiring strategy there have been needs to get a complete and uniform solution for document management to cover the whole Andritz Company. The existing document management system is taken to platform for uniting document management practices. This requires also uniform document classifications at Andritz. To unite document classifications in different business units, a development project has been started.

## **1.2 Objectives and defining**

This final work mainly concentrates on document management for Product Life-cycle monitoring process in Andritz Pulp and Paper Mill Services. The main objectives are to define how the document management system that has been earlier selected for other purposes meets the needs of Andritz Pulp and Paper Mill Services. It is important to see that the document management system can

be used as a part of service time product lifecycle information repository from As-Built stage forward. The information sharing with customers, capital business and service have to be studied. Also the transfer of needed data from capital business to customer and service is an important point. This work doesn't try to find new practices for product lifecycle management (PLM) but it concentrates more to integrate present practices with selected document management system (DMS).

### **1.3 Used methods**

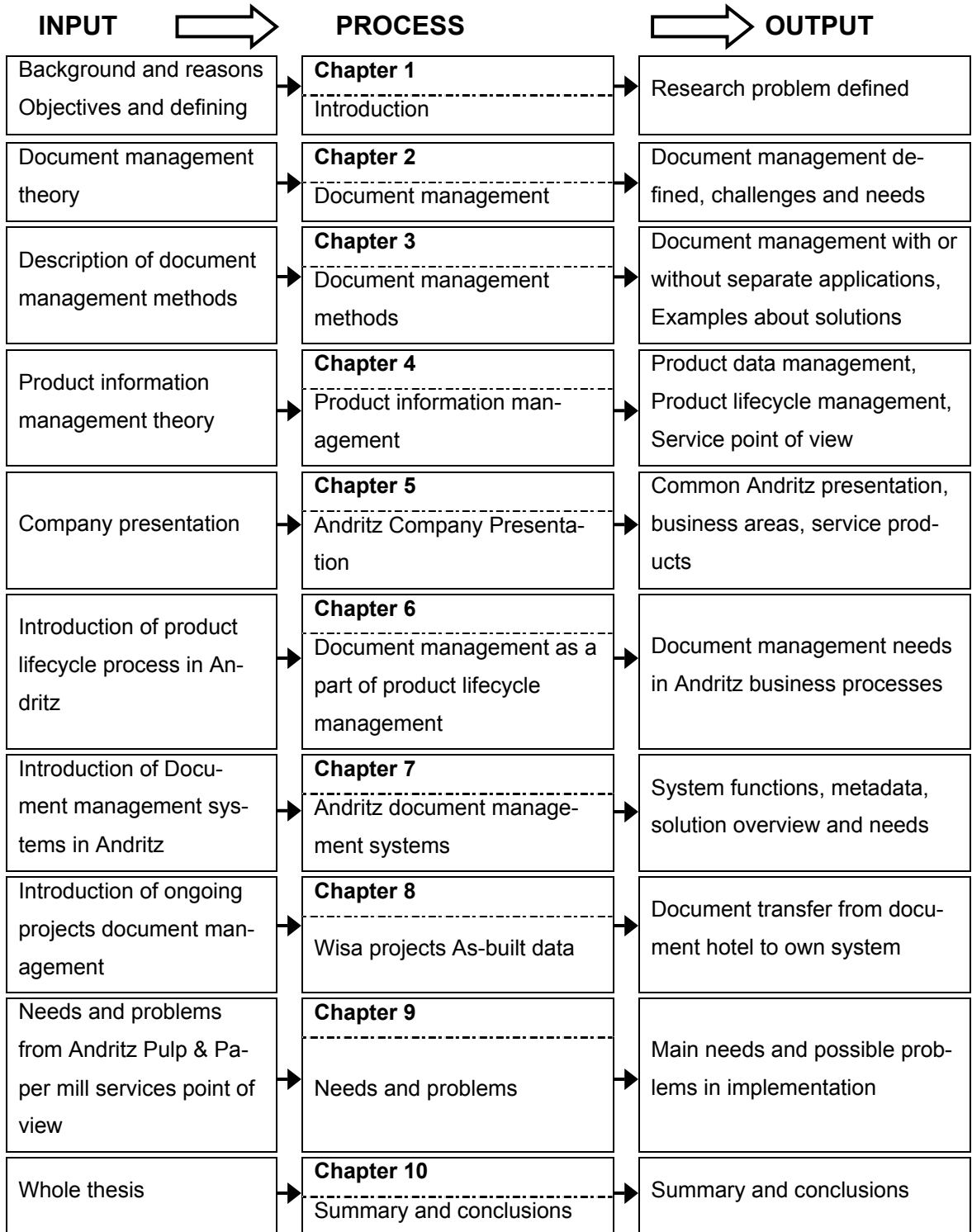
This work is based more on empiric study of presently used system and needs of the user organization. Literature, manuals, articles and standards of this field are used to focus and clarify possibilities, theory and problems in area of selected topic.

The document management system study in this work is mostly based on PowerDOCS 4 system although the system, which has been planned to implement in Andritz Pulp and Paper Mill Services, is Hummingbird Document Manager system newer version from the same supplier. PowerDOCS 4 system is already in use at Andritz, which enables the testing. The differences between PowerDOCS 4 system and coming Hummingbird Document Manager systems main functions are minor so the PowerDOCS 4 system is proper for the test purposes.

### **1.4 Structure of the thesis**

This thesis consists of ten chapters; the inputs and outputs in these chapters are introduced in table 1. Mainly the first chapters examine the topic from the theoretical and common practice point of view; a couple examples of different solutions are also included to clarify the theory. Chapters 5-8 emphasise more Andritz' point of view and unite the theory in the practice. Chapters 9 and 10 summarise the thesis.

Table 1. Outline of the thesis.



## **2 DOCUMENT MANAGEMENT**

Traditional document management at an enterprise was based on paper document management. The documents were grouped into groups or ordered name based and stored in binders. The binders were archived to trays. Documents were copied or borrowed from trays to personal use (Sutton 1996, 8). Distributions of all kinds of documents were handled in a paper form with help of post services and faxes.

In past decades these traditional document management practices have been fallen into poor condition and disrepute because of the volume of transactions generated in the course of business, the lack of definitive document-centred process model and difficulty of storing electronic records in a system designed for paper (Sutton 1996, 8). These factors have created needs to develop more efficient document management methods and systems, which can rise to the challenges of these days.

### **2.1 Present state**

Nowadays it is easy to produce documents, companies have made huge investments in their information systems to make document producing more efficient. The tools, which have been used to create documents, are easy to use. Partly these easily used tools have increased document creation, which is mainly a good thing. It is better that the information is stored in some places in a form of outlined documents, than that there are no documents at all (Anttila 2001, 3).

Certain documents have to be produced regardless of the work amount. For example customer documentation has to be created and even in some cases transferred to the customer's own system in specified format.

Increased amount of documents has anyhow created new problems to document management. An office worker uses approximately 5 to 50 percent of his or her work time to document searching (Anttila 2001, 3). So simply by decreasing document-searching time, huge savings for the company can be found. But always it is not only a question of timesaving, a company's premier capital are employees and information produced by them. If the capital is only in the heads of the employees or in unorganised mass in workstations and servers hard drives, the company's operational preconditions aren't in good shape.

When the amount of documents is increasing it is more probable that accidental mistakes like overwriting and deletion of documents will increase. When the organization grows, the same documents can be created in many times when employees cannot know that the document has been already created or finding of an already created document is more difficult than creation of a new one. In some cases disappearance of a document can be very expensive when the information of document cannot be reproduced or found from anywhere.

Also the quality of products and services will suffer when the organization cannot give the right information to peoples who need it within a reasonable time. Documents are changing all the time, so if the document revisions aren't controlled properly, old information can be used in production and services. These factors can cause huge losses to business operations.

## **2.2 Document managements importance**

In general Document management is only a question of money from the company's viewpoint. Advanced document management can provide cost savings to company and also increase earnings. The cost savings are usually achieved through decreased time used to find documents, better exploitation of old information and elimination of earlier accidental mistakes. New earnings can result for example from better quality and faster work cycle, which are helping companies to compete more efficiently on the market. Also new costs will incur at least

in the implementation stage of the document management system, maintenance of system will also need resources and cause some overhead costs, but in well-organised projects these costs are shortly cut by the cost savings from more advanced document management system (Anttila 2001, 7).

Nowadays it is very common in the business that employees change companies in a short cycle. It is important for the companies that their work practices and systems are such as the documents prepared by employees, remain in use of the company even the employee changes the job. Also new employees should get initiated in company's work practices quickly.

In many cases the e-mail program has been used as personal document repository and amazing amount of information and documents have been collected there. The E-mail program is no good place to storage information from the point of view of the company. When other persons need documents, which have been stored in e-mail programs, searching is not possible, because information is not commonly shared. If the e-mail user changes the employer, information stored in e-mail program can be lost.

Information / document management challenges (Honkanen 2003, 19):

- Information content has been scattered to many systems.
- Management of different levels information: personal, workgroup, company, partner network, and customer.
- Operative systems are repositories, user interfaces are different.
- Competitive situation demands effective information creation and management.
- Real value of information has not recognized.
  - Primary capital of the company- continuity.
- Information content management costs are not recognized.
- Change management- cultural change

Information management needs (Honkanen 2003, 19):

- Support for different way of use.
- Data security.
- Group work capability, information sharing.
- Reusability.
- Extending guidance to whole value chain also outside organization.
- Business transaction traceability.
- Classification of current content and transfer to new system.
- Information filtration and analyzation.
- Needs differ by line of business, duties and situation.
- Powerful search engine.
- Uniform user interface.
- Information lifecycle, archiving.

## **2.3 Definitions**

Standard SFS-EN 82045-1 defines the document as fixed and structured amount of information that can be managed and interchanged as a unit between users and systems (SFS-EN 82045-1: 2002, 15). According to this a document can be almost any structured entity of information, which has been collected into some uniform form. The definition doesn't limit the form of the document (paper or electronic, e-mail, letter, memo, figure, drawing, etc.)

Lifecycle is also related to documents. The document lifecycle can be understood as a time when the document format or content can be changed. The document is information content, which gives the format and structure for the information included in it and makes information approachable (Koulopoulos, Frappaolo 1995, 29-33).

Figure 1 illustrates document lifecycle stages. When a document is planned and wrote, it is normally checked, corrected and after corrections approved. If the

document needs to be changed after approval, it is released and after the changes have been made, checked and approved again.

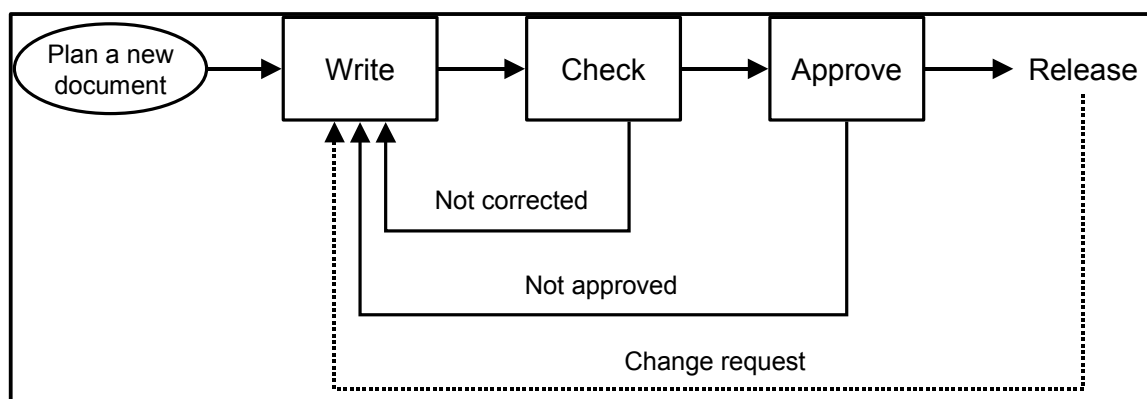


Figure 1. Document lifecycle (Toivonen 2000, 12).

Direct defining of a document is no easy task. Shutton (1996) warns that when organization tries to define a document, grey areas where for example document and database cannot be divided from each other can easily be found.

Management has been commonly defined as design and maintenance of an environment in which recourses, organized in groups can attain common objectives through efficient and effective performance (Sutton 1996, 7).

According to the above definitions document management can be defined for example, as follows: The process of controlling an enterprise's official business transactions, decision-making records and shortage important documents, (like letters, e-mails, etc) which are represented in the format of a document. The medium of these transactions (electronic or paper) is irrelevant (Sutton 1996, 9).

By adapting Spargue, (1995, 32) document management can be defined as: Document management covers document producing, storing, organizing, transferring and distribution, searching and finding, updating and deletion for particular organizational purpose.

## 2.4 Development

Digital knowledge age enables and also forces industrial organizations to find new operational models (Ciborra 1996, 103-118). Global industrial organizations and organization networks need digital information management so that flexible and competitive operation models can be carried out (Galbraith 1994). Documented knowledge is also increasingly commercial product itself or important part of the industrial product from which the customer gains additional value (Sprague 1995, 29-50).

In the 90's, information and document managements planning in organizations has rest, on the other hand, against the core business processes replanning and on the other hand making of broad technology selections and fitting of them first to business processes and after that to the whole organization. Organizations have been trying to standardize their information technology infrastructure. On the other hand, there has already been criticism against the standardization and development of the information technology infrastructure. Standardization and development do not guarantee information managements effectiveness in the organization (Päivärinta, 12). Technology led information managements planning and standardization are not probably even one hundred per cent possible in big industrial organizations, which can include powerfully from each others differing and special needs demanding expertise areas, organization sub cultures and units (Ciborra 1996, 103-118).

So far, information systems planning and research connected to it have mostly ignored people's abilities and tendencies to give different meanings for information wholeness provided by information systems. This should be taken more into account when planning information systems (Ngwenyama & Lee 1997).

Systematic development of document management methods is an essential part of the organizational planning. More increasingly people produce and need knowledge produced by others in their work. Only somewhat more than 10 per cent of employees directly handle physical products in their works (Nadler &

Tushman 1997). Other employees handle information related to products or services or information needed in organizations support functions. When these employees produce or exploit information they operate through documents (Päivärinta, 15).

Document management planning should observe technological concrete document management systems as well as organizations social special features. Fitting these perspectives together helps in creation of practical document management solution.

Simplistically document management developments key sectors can be divided into five sectors. These sectors are very closely connected to each others (Päivärinta, 17).

- Executable work in organization – *processes*
- *Roles* of organization structural parts and employees
- *People*
- *Documents*
- *Document management systems and technologies*

*Processes* includes employees tasks in organization and to same target aimed bigger task wholeness, in which people produce, handle and exploit saved information by the help of documents or otherwise perform tasks related to document management. *Roles* include organizational units, groups etc. structures and in personal level defined task- and responsibility definitions in which document producing, handling and exploitation are related. *People* direct their daily behaviour and work in guidelines defined by roles. *Documents* organize saved information to understandable form for people. *Document management systems and –technologies* include hardware, software and other physical tools with which documents can be produced, handled and exploited (Päivärinta, 17). Figure 2 illustrates document managements developments key sectors.

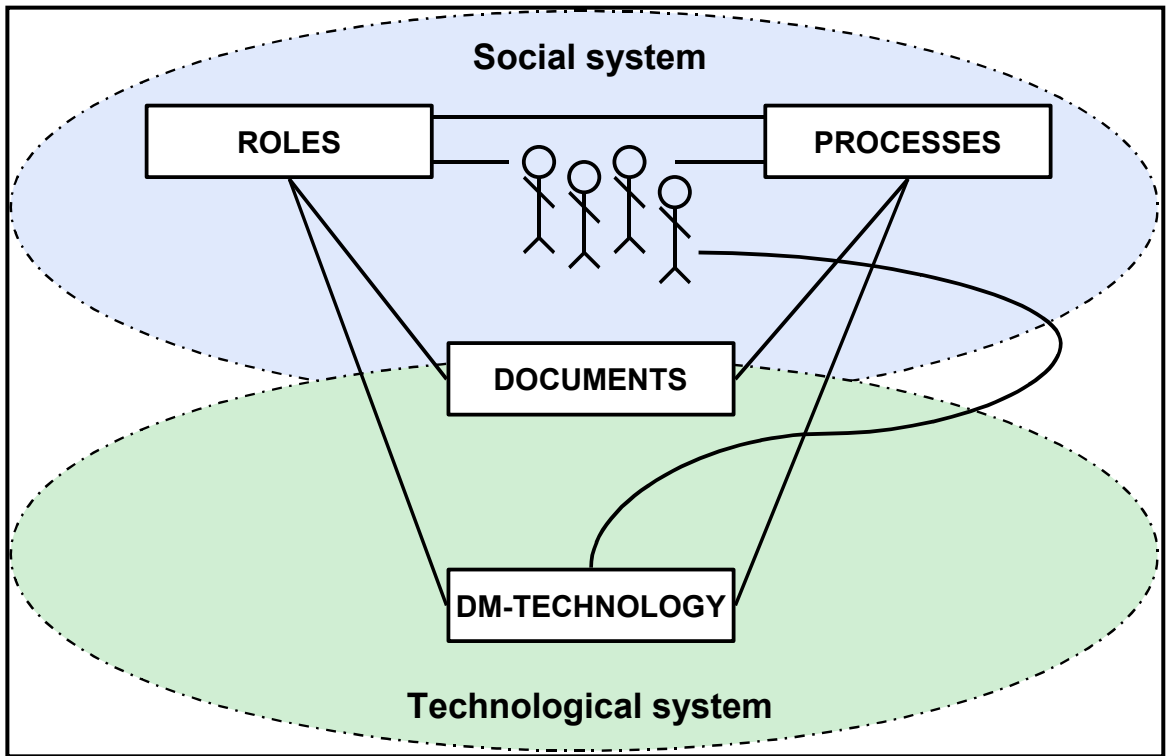


Figure 2. Document managements developments key sectors (Päivärinta, 17).

Document management planning and development can be handled from the point of view of these five key sectors. Each of these sectors provides complementary perspective for each other's from the point of view of organizations document management system development and planning (Päivärinta, 41).

### **3 DOCUMENT MANAGEMENT METHODS**

Documents can be managed by many different methods, for example with or without separate application. Ways to handle document management without any separate applications are for example usage of common document naming practices, documents property information, common folder structures and search methods. Another way is to use some document management application. Nowadays there are a wide variety of document management applications on the market. If the document management has decided to handle with ready-made application, there are many alternatives for finding the best solution for the company.

#### **3.1 Document management without separate applications**

Document management without any separate application solution is usually hard to carry out in a proper way. Problems usually increase if documents are edited and viewed in the same time ordered by many users. Individual user can, however, improve document management with right practices (Anttila 2001, 11).

Common naming practices for documents are one way to improve document management without any software solution. Earlier file names were usually 8+3 marks in Microsoft Dos environment, Unix has allowed longer names but it hasn't been so commonly used. Since Windows 95 operating system, it has been possible to use longer file names. Long file names can usually be 256 marks. This long name can include much information and number codes, but still finding of common naming practice can be difficult. Also if the file name is very long, some part of it can be lost when the document is sent through e-mail or wrote to CD-ROM disc (Anttila 2001, 11).

Documents can be managed also with property information, which has been attached to the document. Windows environment offers two ways to manage

documents by using property information. These are application software's own internal document property information and NT-file systems (NTFS) property information in Windows 2000 environment.

Application specific property information works only with documents, which have been created with Microsoft office tools or a couple of other applications. This property information is related to application software and it isn't dependent on the operating system. (Anttila 2001, 12)

Windows 2000 operating system offers possibility to attach property information to all files. Using this property information requires usage of NT-file system, but on the other hand used application software is not the limiting factor. The problem is that this property information doesn't follow the document if it has been sent via e-mail or saved for example on a CD-ROM disc. Also if the document is transferred to other file system than NTFS, the information will be lost. (Anttila 2001, 12)

The simplest way to manage documents, without document management software, is to use folder structures for documents. The biggest problems with this solution are that one solution has to handle different kinds of needs like categorization of documents, document search, data recording, user right management, etc (Anttila 2001, 14).

The document search in Windows environment has been handled by the help of Search tool. This provides an opportunity to search documents with filename, creation date, edit date, modified date, file type and file size. Besides these, documents can be searched with attached document property information, which has been mentioned earlier. Since Windows 2000 operating system it has been also possible to search documents with NT-file systems property information and also with containing text search. Microsoft office environment contains also its own search tool but compared to Windows 2000 operating systems search tool it doesn't bring any new solutions (Anttila 2001, 16).

Revision control without document management software is difficult. Especially if several users maintain the same documents overlapping changes are possible. Document revision control by using only filenames is also difficult and the problem is how to know which document is the latest approved one. In practice this requires different directory trees for approved documents, old documents and for documents, which have been changed but not approved yet.

### **Coming development**

One of the coming developments to document management methods without separate applications is Windows 2003 operating system. Windows 2003 operating system will provide part of the current Microsoft SharePoint Portals server services as a part of the operating system. Microsoft SharePoint Portals server offers Corporations or departments document management in intranet including version management, search functions and document classification. Windows 2003 environment enables companies to develop their own practices for document management without investments in separate document management tools. Windows 2003 SharePoint service contains big part of the document management systems basic functions, which are described in chapter 3.2.2 (Fujiitsu 2003, 20). These functions are:

- Content creation directly with office tools.
- Better search functions.
- Metadata attaching to documents.
- Versioning.
- Group work support.
- Document accepting process.
- Data security.
- Archiving.
- Search and indexing of many information sources.

Windows 2003 SharePoint service enables also common workspace or network worktable creation and management. This allows sharing of the information content for example between the workgroup. Many different kind functions, ser-

vices and information can be imported to this same web browser based user interface. Instead of disc sharing, e-mails and intranet can be talked as common workspace or network worktable (Fujitsu 2003, 20).

Fujitsu Invanian also provides their Network worktable solution, which is more like ASP service. Fujitsu Invanian Network Worktable solution is introduced in chapter 3.3.2, which concerns ASP services.

## **3.2 Document management applications**

Electronic document management systems (EDMS) as all information systems have developed rapidly with development of computer science. More efficient computers give more possibilities to develop effective electronic solution for companies needs. Lifelines of these days are effective solutions for business transaction handling. Development forces companies to keep their systems on time; lagging behind from development can be fatal.

Nowadays there are a wide variety of different document management applications on the market. Many system providers have published their own document management systems. These systems differ from each other's mostly for their planned main usage; others are more concentrated on the product lifecycle management, the others on engineering information management and others on office document management. Still the main functions and the architecture of the systems are usually very similar.

### ***3.2.1 Common architecture of document management system***

Document management systems have usually certain common architecture, which consist of different layers. These layers handle different tasks and functions of the system and together the layers provide needed functionalities. These layers are Conceptual layer, Logical layer and Physical layer.

## Conceptual layer

The conceptual layer of DMS consists of document repositories for specific document groups. These can be for example Project records. Next levels are specific file rooms (primary categories), which can be for example specific projects. Each file room has Cabinets for secondary groupings of files; these can be for example product lines (Fiberline, Dewatering, Woodyard). Tertiary groupings in structure are drawers, which can be products of a product line. Inside the drawers are folders, which can hold documents, or other folders for more precise categories. Folders can be technical data, layout data, process data flow sheets etc. Under folders are the actual documents. Figure 3 shows the conceptual structure of DMS.

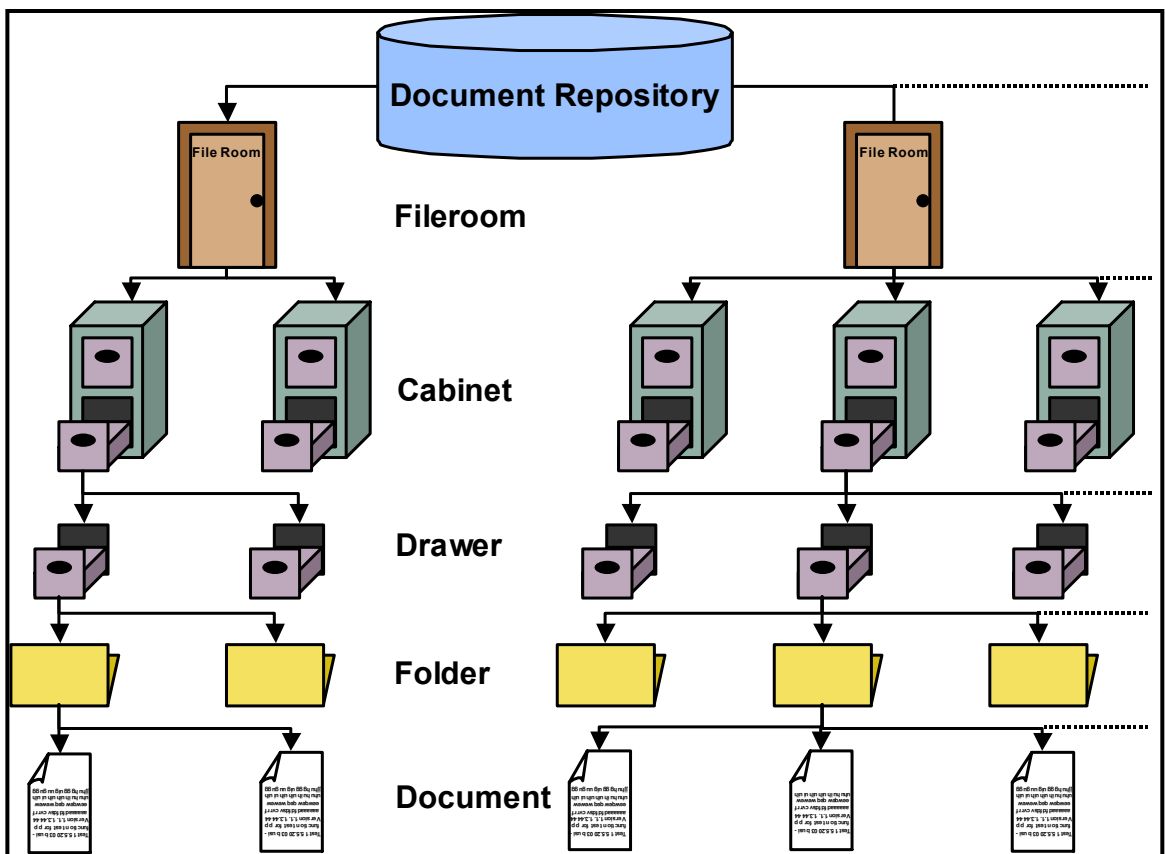


Figure 3. Conceptual hierarchy of the DMS architecture (Sutton 1996, 12).

## Logical Layer

The logical layer of DMS is also based on the model of records but it is process-oriented, not document-oriented. The logical layer is based on the functions that concern the document objects and the users. The logical model, described in figure 4, consists of seven process managers for DMS (Sutton 1996, 14).

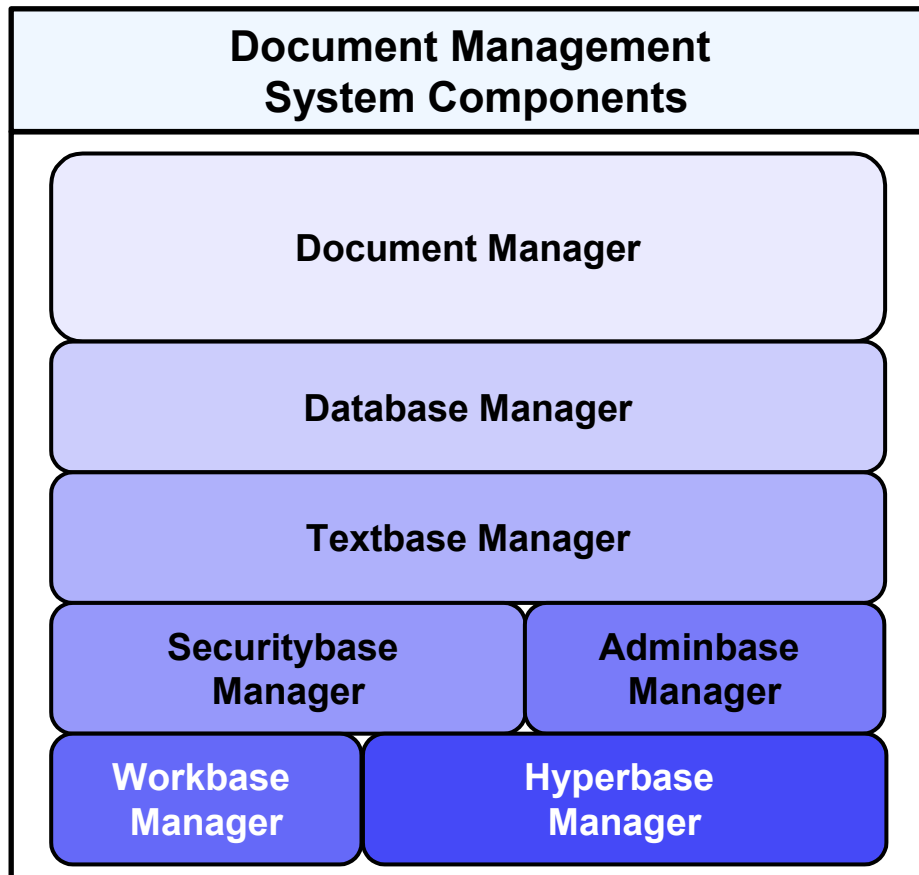


Figure 4. Logical model of the DMS architecture (Sutton 1996, 14).

System components take care of the different functions of the document management system. These components are separate and they handle separately their own functions.

## Physical Layer

The physical approach is based on the implementation configuration of the hardware, software and network in the enterprise. The model can be based on

different solutions, model in figure 5 is based on client/server operating model (Sutton 1996, 16).

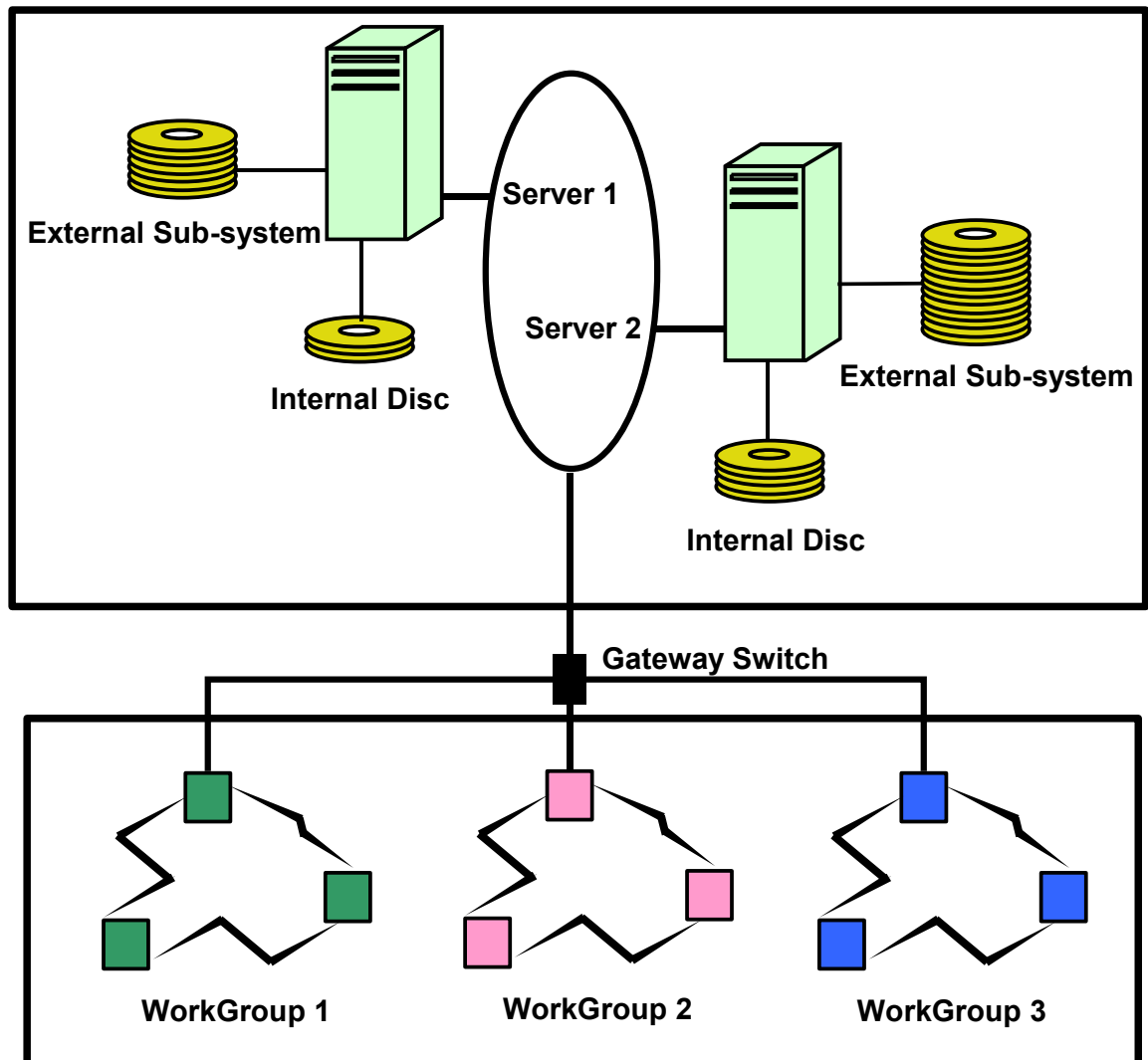


Figure 5. Physical implementation of a DMS architecture (Sutton 1996, 14).

The client server model consists of different servers for documents. For example different production sites can have their own document servers. This makes document handling faster, because documents, which are mostly used in some production sites, are closer to it. Servers are synchronized in defined periods. The user interface can be workstation client or web browser.

### **3.2.2 Common document management system functions**

Document management systems usually include selection of common functions. These functions can be divided into system basic- and support functions. The names of the functions can differ depending on the system provider, but the functionalities are usually almost the same.

#### **Basic Functions**

Document management software usually has almost the same basic functions irrespective of the system provider. These basic functions are needed for all kinds of DMS even these are planned to use for management of different kinds of documents. Common basic functions are listed below.

- Document saving & deleting
- Document archiving
- Information searches
- User rights management
- Virtual folders
- Version management
- Change management

#### ***Document archiving***

Usually DMS automatically handles the document archiving. When a document is fed into the system, it automatically gets the archiving number.

#### ***Information searches***

When a document is saved in the system, also documents property information (documents metadata) is fed into the system. Documents can be searched with this property information. Content searches of the documents can be also allowed.

### ***User rights management***

Different user access rights to documents can be defined with the system. User rights can be usually defined in many different ways, for example to user or user group specific, document or document group specific etc. Also the rights to use different functions of the system can be limited. These rights can be defined also crosswise.

### ***Virtual folders***

With virtual folders physically one classification level can be shown in many folders inside the system. The same documents can be for example in a projects folder and in a folder defined by the document type. When documents can be in different folders depending on the context, the document searching is easier.

### ***Version management***

Documents are changing all the time when corrections and changes in documents are made. When the document or the property information of the document has been changed, the document management system automatically creates a new version of the document. This version can be a sub version or the actual version depending on if it is approved or not.

### ***Change management***

Document changes are hard to manage without any system. If a document is changed at the same time ordered by different users, information can be lost. To avoid this document management systems provide check-out, check-in functions. When document is checked out for editing by the user, other users cannot do changes in it. This lock is released when a new version of the document has been checked into the system.

## **Support functions**

Besides basic functions, Document Management softwares usually contain at least some of the following support functions. Common support functions are for example:

- Viewing
- Printing
- Relations
- Comparison
- Red-lining
- Document numbering
- Application integration
- Language versions in user interfaces
- Work flow management

### ***Viewing***

Document management systems usually provide separate viewing tools for quick viewing of the document. This is usually carried out with a separate viewing program which provides document viewing without application program which has been used for document creation. The user doesn't have to upload the document into the application program for viewing, which accelerates the viewing process and allows the user to view also documents, which are created with the application programs which are not installed in the user's workstation. Viewing program is usually a web based solution, which comprises only the viewing function. Also some other support functions, mentioned later, can be handled via viewing program.

### ***Printing***

Document printing is usually handled with the application program which has been used when creating the document. Also separate printing programs can be used for document printing. In this case the user doesn't need all application programs which has been used for document creation. Printing can be also included in the viewing program.

### ***Relations***

Relations, in document management sense, mean document relations between other documents. The relations are usually carried out with the database relations which facilitate the relation management. This enables, depending on the relation type, for example changes in some documents, can be automatically handled in all linked documents (Anttila 2001, 206).

### ***Comparison***

The comparison function enables to compare two related documents against each others. For example, the changes between the different versions can be tracked with comparison function.

### ***Red-lining***

Red-lining means document inspectors correction markings on the document. These markings are made with a simple drawing program over the document and saved as a separate document. This function can also be one of the document viewing programs functions.

### ***Document numbering***

Document numbering means that documents can be numbered with defined numbering rules, automatically. Numbering can be handled with running number or based on defined numbering system or mixture of these. (Ahola 2003, 14)

### ***Application integration***

Document management systems can also contain application integration modules, which include ready made integration schemes for some common document creation applications. The module can also include libraries, which help building an application integration with other applications.

### ***Work flow management***

When a document is handled in the company, many people can participate in its creation, inspection, approval, publication and distribution processes. This is called a work flow. DMS can provide the work flow management tool which enables that the document proceeds forward in the defined chain after each task automatically. This procedure accelerates the document handling process (Venna 2002).

### ***3.2.3 User Interfaces***

DMS user interface is an important part of the system. The user interface has to be easy to use from the user's point of view; also the administration point of view has to be considered. Installing and updating the user interface must not be too hard and complicated a task. System users have different kinds of workstations with different capacities and with different operating systems. The user interface has to be comparable with different types of workstations.

Most common the user interface for document management applications is workstations client software. Nowadays also web-browser based user interfaces are becoming more common. Other possible user interfaces are; direct interface to application program and windows explorer based use. (Anttila 2001, 106)

### ***Workstation client software***

Workstation client software is the most traditional user interface for Document management software. The client software has to be installed in all workstations, which complicates software updating and installation process. On the other hand, the workstation client software usually offers more comprehensive, stable and faster functions than other solutions. The client enables for example offline usage of the system, which is a desired function nowadays when the employees travel much with their portable computers.

### **Web Browser user interface**

One of the biggest advantages of the web browser user interface is that workstation doesn't need any other software than Internet browser installed. Also software development is easier because there is no need to build different software versions for different operating systems. On the other hand web browser user interfaces functions are generally little more limited and in many cases functions can be little slower and awkward to use than in client software solutions.

### **Application Software interface**

For document producing persons, the most desired user interface is usually the direct link from application software to document management system. This solution enables that the work with document management system differs as little as possible from the work without system. Documents should be saved directly in the document management system and usage of it is a part of daily work. The limiting factor is that this kind of interfaces is heavy to maintain, the ready-made links to all application programs cannot be found and updates of the application program require also updating of the interface.

### **Windows Explorer user interface**

Linking Document Management System with Windows Explorer tool is a good solution in many cases. Even this requires the installation of separate software in every workstation; the solution seems to be the same windows explorer in the user's point of view. The user doesn't need to learn the usage of new software. When DMS is visible all the time in the resource management tool, it is easy to get documents from there and at the same time it guides document savings in the right place.

## **3.3 Document management software and service providers**

Nowadays there are many document management software and service providers in business. Variety of different document management products and

services is wide and companies have alternatives to choose the solution, which fits best for their needs.

### **3.3.1 Commercial document management software solutions**

Commercial document management software applications are nowadays becoming more common all the time. Next there is shortly introduced couple common document management software. Systems differ from each other and partly they have also different target groups. Some of the programs are very universal; some of them emphasize more office documentation, some technical documents and some more product data management (PDM).

#### **Aton**

Aton has been developed by Modultek Oy in Finland. The sales agent of the program in Finland is Modultek Oy. Software prime range of use is customer specific solutions or products lifecycle management in manufacturing industry, software companies and service providing companies. Software is compatible with Windows NT 4.0, Windows 2000, Sun Solaris, HP-Ux and IBM AIX server operating systems and Windows 98, Windows NT 4.0, Windows 2000, Sun Solaris, HP-Ux and IBM AIX workstation operating systems. Available user interfaces are Web browser, java UI, SolidWorks UI, AutoCad UI (Anttila 2001, Appendix 1).

#### **Automanager Meridian**

Automanager Meridian Software has been developed by Cyco Software in the Netherlands. The sales agents of the program in Finland are CAD-Quality Finland Oy and Future CAD Oy. Software's prime range of use is technical document management. Software is compatible with Windows NT 4.0 and Windows 2000 server operating systems and Windows 95, Windows 98, Windows NT 4.0, Windows 2000 workstation operating systems. Available user interfaces are client software, application interface, Windows explorer and Web browser. (Anttila 2001, Appendix 1)

### **CyberDOCS Obsidian**

Software has been developed by Hummingbird Ltd in Canada. The sales agent of the program in Finland is Affecto Oy. CyberDOCS system is based on the PowerDOCS document management system, also developed by Hummingbird Ltd. Software's prime range of use is affair and document management. Software is compatible with Windows NT, Windows 2000 and Unix server operating systems and Windows 95, Windows 2000 and Unix workstation operating systems. Available user interfaces are Web browser and Windows environment (Anttila 2001, Appendix 1).

### **DMS Document Manager**

Software has been developed by RAVALIK OY in Finland. The sales agent of the program in Finland is also RAVALIK OY. Software's prime range of use is electronic document management (CAD-, Microsoft Office-, Text-, Tiff-, Jpeg-, etc formats). Software is compatible with Windows NT, Unix and Linux server operating systems and Windows 98, NTV4, Windows 2000, Linux and AIX workstation operating systems. Available user interfaces are Web browser and Windows client (Anttila 2001, Appendix 1).

### **Microsoft SharePoint Portal Server**

Software has been developed by Microsoft. The sales agent of the program in Finland is Microsoft Oy. Software's prime range of use is Corporations or departments document management in intranet including version management, search functions and document classification. Software is compatible with Windows 2000 server + service pack 1 server operating systems and Windows 98, Windows 2000, Windows ME and Windows NT 4.0 workstation operating systems. Available user interfaces are Web browser (Internet explorer 4.0 or newer, Nav 4 and Windows explorer (Anttila 2001, Appendix 1).

As mentioned earlier in chapter 3.1, Windows 2003 operating system provides part of Microsoft SharePoint Servers functions as part of the operating system. This enables document management without separate software.

## **ERP Systems**

Also some Enterprise Resource Planning (ERP) systems provide tools for document management. For example, SAP ERP software includes some document management functions; software also provides the solution for building the project portal. The project defined product structures and timetables can be managed in Project portal. SAP has also developed its ERP system more suitable for product lifecycle management (Nikulainen 2001).

Baan ERP system includes Object Data Management (ODM) module, which is partly indented for document management purposes. With this module different types of documents can be attached to different products via different document libraries. Revision control and versioning are also possible.

Advantages of using ERP systems in document management can be found from many different perspectives. These can be for example:

- One system includes much information about business, so almost all information can be found in the same place.
- No linking between the parallel systems is needed.
- Exploitation of different kind of information together is easier.

However, document management functions provided by the ERP system are usually more limited and more complicated to use than those of the software, which are directly designed for document management. An ERP system doesn't necessarily include all the needed functions for effective document management and the functions, which are included in ERP's, are probably too complicated to use by most of the users.

Also, if document management is planned to handle widely with the ERP system, this will need huge amount of licenses for the ERP system, because the document management system should be accessible to almost all employees. This may create new problems for example for the user right management. The ERP system includes information from almost all of the company's business

transactions, pricing, salaries, orders, quotations, etc. so its usage is planned to be more limited than that of document management systems.

### **Other suppliers**

Document Management software suppliers are also Documentum Inc (USA), Lotus Development Corporation (USA), NSD Oy (Finland), Novell Inc. (USA), Single Source Oy (Finland), Structural Dynamics Research Corporation (USA), SAP AG (Germany) and PTC (USA).

### **3.3.2 Application Service Providers (DMS Services)**

The application service provider is a service provider who provides, hosts and administers access to applications, which are in centralized controlled machines and system. Several parties can use the same applications (TIEKE 2001, 4).

ASP is an applicable tool for outsourcing some of the organizations functions. Advantages of these kinds of services are clear for particular organizations. Solutions can be used device independently from almost any place (Elisa 2003). Also external business partners can use service with desired limitations, for example, some document folders can be defined accessible to some suppliers. For distributed organizations ASP services are a good solution to get common tools easily and without own administration organization. On the other hand, APS users are dependent on service providers; also a stable and fast Internet connection is essential for these organizations.

Application services can be classified by the planned main use of the service. Some Application Service Providers concentrate more on document hotel / project bank services for projects, some provide the concept, which is more like traditional document management software for companies and some provide network worktable solutions for companies internal use or for the project portal in internet. The line between these services is not clear, because all of these

can be used partly for the same purposes and all can contain modules for the same usage.

ASP basic model, described in figure 6, consists of three different parties. *Software and technology suppliers*, who offer technology and software for ASP services, *application service providers* who offer content, management and support for the service and the *end user organizations*, which use applications. Next chapters will introduce a couple of ASP services.

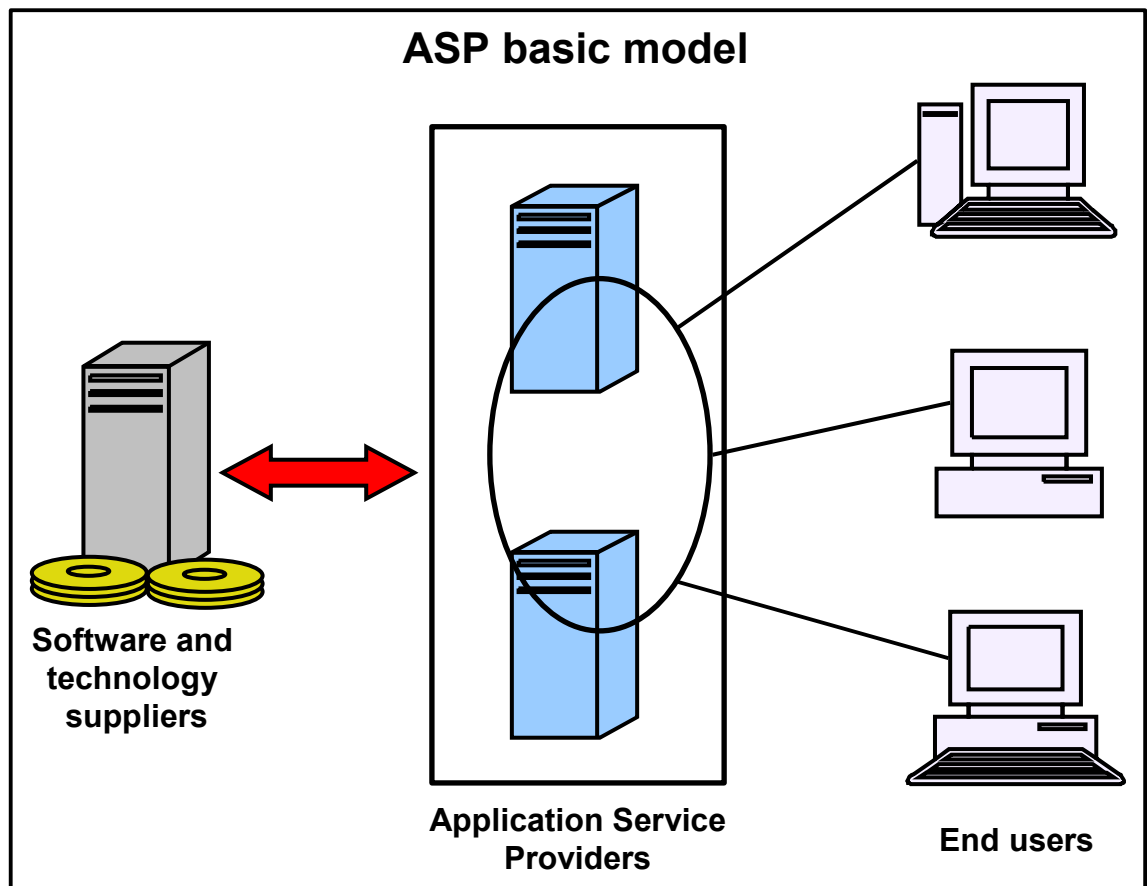


Figure 6. ASP basic model (Jansson et al. 2001, 15).

### **ASP Document management Software, Kronodoc**

One Application Service Provider, who provides document management software services over Internet, is Elisa. The name of the Elisa's DM software solution is Kronodoc, which is based on Kronodoc -product. Kronodoc has been developed for distributed organizations document and project management.

Kronodoc enables the centralization of the whole organizations document management. It is based on a hierarchical tree structure, which is shown to users. It also enables usage of parallel structures. All systems definitions, actions and functions can be managed by means of Internet user interface (Elisa 2003).

Kronodoc's basic functionalities are among others; document lifecycle, document stage, and document type management. The basic functions of Kronodoc are similar to common basic functions of document management systems. All documents have their own identification data form, which can be enlarged if necessary, so the user can attach attributes to documents, which vary depending on the document type. These attributes can be for example timetables. The documents can be also revised, copied and linked (Elisa 2003). Search functions and systems user right management are similar to those in other common DMS'. The users can also order information about the changes in some documents. The system development and customisation of the basic version can be done with ready-made support functions.

### **Service**

Elisa Internet takes care of service updates, technique of service and servers Internet connections. Help desk services are available for the customers in Internet. Service is placed to Elisa Internet server and the data communications are protected with Secure Sockets Layer (SSL) secure format. The customer is responsible for the content of the service, usage, user management and costs of all parties managed by customer (Elisa 2003).

Kronodoc can be used also for project management needs. So the line between the document hotel services, introduced in the next chapter, and the ASP document management software services is vacillating.

### **Document hotel / Project bank service providers**

Another example of ASP services is document hotel services, these document hotels are planned to use mainly for big projects document management needs.

Documentation of project can be stored in servers over Internet. Projects can contain tens of thousands documents delivered by different suppliers and sub-contractors. Document hotel service allows different suppliers to store documents in given format in the same structured document hotel system. All documentation of the project can be found in one place and management of documents is easier than in case where different suppliers send these documents in different formats separately to the customer. When the project has finished, all documentation of the project can be found in the same place and documentation can be uploaded directly to the customer's own system. Figure 7 shows the document hotel principle.

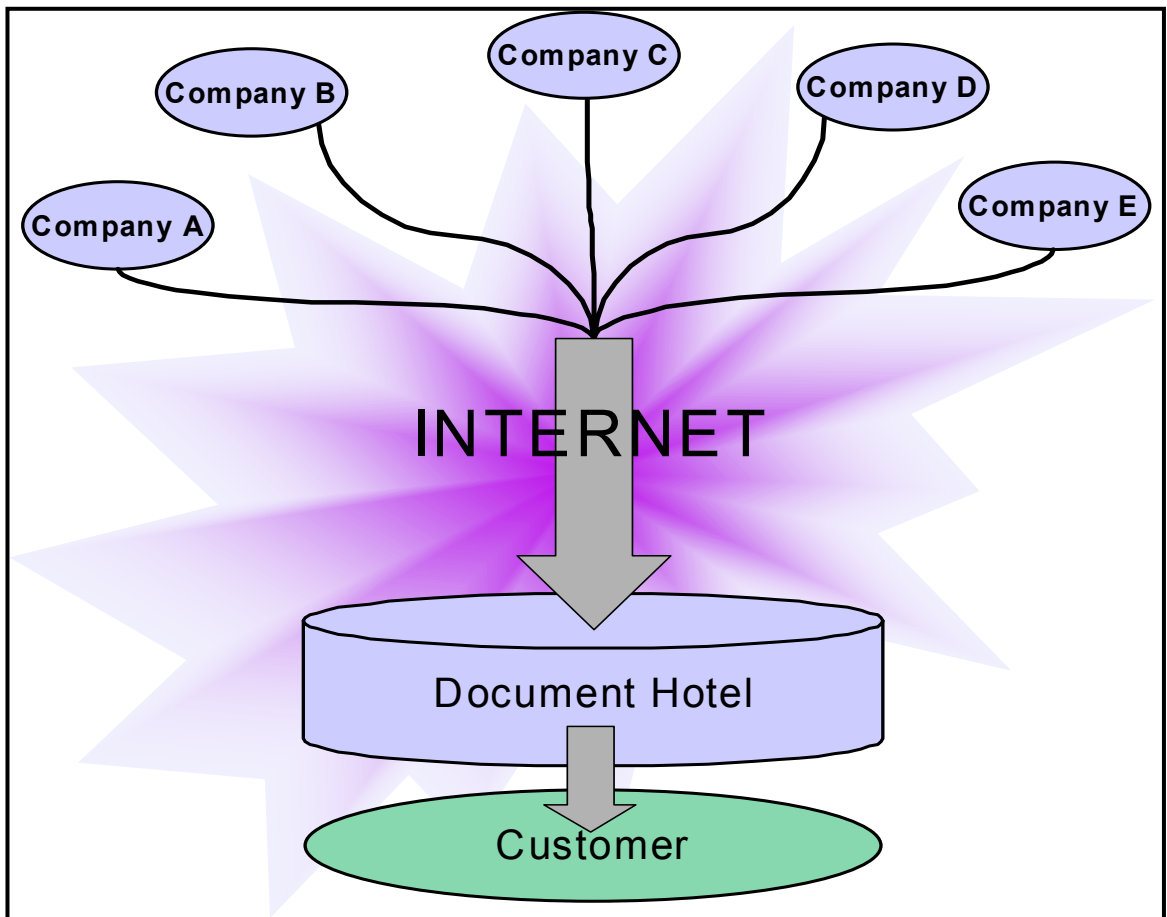


Figure 7. Document Hotel principle.

## **Pöyry's DocHotel™**

For example in Wisa 800 REC project, in which also Andritz participates, the customer Wisa Forrest Oy uses document hotel service provided by the major Finnish consulting company Jaakko Pöyry Group. The system has been developed by Pöyry's subsidiary Inforbis Oy. Pöyry's document hotel service has been developed for multilateral document management. The concept includes methodology, routines and related tools for document management of major projects.

The system is based on the IBM Lotus Domino.Doc application but it has also features developed to serve especially project management. Domino.Doc is a well-known supplier of document management systems worldwide. It is a member of the family of Lotus collaboration tools (Inforbis 2003, 3).

Pöyry's document hotel service solution consists of four major service layers, which are; service for the planning of multilateral document management, coordination of the multilateral document management, user support service and system hosting service.

Service for the planning of multilateral document management includes for example:

- Definition of needs and goals for multilateral document management.
- Definition of roles and access rights of different participant types (consultants, suppliers, authorities, project owner, etc.).
- Definition of the working routines.
- Planning of the appraisal of motivation among participants and binding them to the working method.
- Definition of the monitoring methods (Inforbis 2003, 2).

Coordination of the multilateral document management includes among others:

- Compilation of instructions for different user groups.
- Appraisal of motivation and training.

- Start-up actions.
- Monitoring and reporting (Inforbis 2003, 2).

User support service including:

- Training of individual users.
- Technical help-desk function for users (Inforbis 2003, 2).

System hosting service including:

- Configuration of the system in accordance with the plan made in service item A.
- System services (hardware capacity on a shared server, broadband connection from the server to the Internet plus DocHotel software user rights during the project period).
- Administration of users and user rights according to project coordinator's advice.
- All normal system hosting services (Inforbis 2003, 2).

Advantages of these kinds of services can be found from many perspectives. Major projects are usually realized very infrequently, so one big advantage is that the user organizations do not have to invest in hardware or software or acquire any special skills for these infrequent projects. The systems are usually easy to build-up because the concept has been already developed and user defined customisations are in many cases made easy to build or even developed for ready made modules, so the system will be up and running within a relatively short time. Service can be also ended whenever there is no need anymore.

### **Network worktable solution, Projectia**

Fujitsu Invian has provided network worktable solution Projectia. Projectia is a network worktable solution developed by Fujitsu Invian and ABB. Projectia has developed to unite project documentation, operating instructions and company information systems. This solution is based on Windows 2000 and Office

2000/XP environments. Projectia network worktable is a web browser based system, which is based on Microsoft SharePoint Portal.

Projectia is meant to be a source for the common project information, help for uniting business processes, document management tool, project library, search engine and help for business partner and customer operations. Projectia worktable can be shared for example between project participants. The main functions of Projectia are named in table 2.

*Table 2.* Projectia network worktable, important functions (Fujitsu 2003, 20).

Intranet portal features	Document management features
<ul style="list-style-type: none"> <li>• News</li> <li>• List of events</li> <li>• Gallup</li> <li>• Discussions</li> <li>• Flea market</li> <li>• Person gallery</li> <li>• Phone directory</li> <li>• Page management tools</li> <li>• Content creation</li> </ul>	<ul style="list-style-type: none"> <li>• Document versioning</li> <li>• Change management (check-in/check-out functions)</li> <li>• Profile attachment to documents</li> <li>• Document key data synchronization with profile data</li> <li>• Document classification with subject</li> <li>• Document releasing</li> <li>• Announcements about new and changed documents</li> <li>• Document approval process</li> </ul>
Indexing and search engine	
<ul style="list-style-type: none"> <li>• Document management</li> <li>• Intranet</li> <li>• Disc sharing</li> <li>• Exchange, notes</li> <li>• Internet</li> </ul>	

The network worktable enables that employees see right in the morning the latest news, events, documents which are in their own use, documents which have been changed since last reading, etc. The main page can contain links to

common intranet services, sub-pages, the common office tools and applications.

These kinds of network worktable solutions are interesting opportunities for companies. Windows 2003 operating system enables network worktables as a part of the operating system. If Windows 2003 became the common operating system in companies, these solutions will probably come commonly used in many companies.

### **Other ASP suppliers and providers**

Other ASP service providers are for example; Accenture Oy, Active ISP (Finland) Oy, Analyste Oyj, Cisco Systems Finland Oy, Compaq Computer Oy Ab, Crescom Oy, EMC Computer-Systems Oy, Elisa Solutions Oy, Enfo Oy, Eterra Systems Oy, Fivetec Solutions Oy, Fujitsu Invia Oy, Hewlett-Packard Oy, IBM International Business Systems IBS Oy Ab, KPMG Consulting Oy Ab, Melba-Group Oy, Microsoft Oy, Novo Group Oyj, Oracle Finland Oy, Profiz Business Solution Oyj, Siemens Business Services, Sonera Juxto Oy, TietoE-nator Oyj (TIEKE 2001, 28).

## **3.4 Document metadata**

Regardless of the system with which the document management has been decided to handle, one common factor for document management can be named. All systems, which have been developed for document management purposes, include metadata for documents, at least in some form. Finnish Standard Association SFS defines metadata for documents as data for the description of documents and their management (SFS-EN 82045-1: 2002, 15). So from the viewpoint of the document management the metadata is data about data, which is used for classifying and describing different types of documents and to help their management.

Metadata is usually defined internally by user companies to fit system users needs, so metadata definitions in different document management system can differ much from each others, even the systems are used for the same purposes. For example, naming of the same metadata fields can differ in different companies and even in different business units within one company. This complicates the information sharing between the systems.

Standards for metadata for document management purposes have been developed, for example European Standards IEC 82045-1 “Document management – Part 1: Principles and methods” and IEC 82045-2 “Document management – Part 2: Metadata elements and reference model” include also metadata definitions. Finnish Standards Association SFS has approved these standards also as Finnish national standards.

### **3.4.1 Standard for metadata definitions in electronic data transfer**

PSK Standards association has defined the standard for drawings metadata and XML definitions needed in electronic data transfer. Definitions are based on IEC standards 82045-1 and 82045-2. The basic concept of documentation has been described in standard 82045-1 and metadata definition in standard 82045-2. IEC has defined different domains for document according to the documents handling stage. This definition uses the following stages table 3.

*Table 3.* Document handling stages according to IEC (psk5822-e5: 2003, 2).

Customer	Project’s owner, customer. Party, for who the documents are created, defines usually classifications, etc.
Supplier	Delivers documents to customer. Usually document publisher. Supplier can be for example Design Company or the equipment supplier.
Creator	Documents original creator

The same party can act in different areas at the same time. For example when the mill prepares drawings, the mill is at the same time Customer, Supplier and the Creator. (psk5822-e5: 2003, 2)

## Metadata definitions by PSk

The PSK Standards association's standard includes also XML (Extensible Mark-up Language) tags for all these definitions. These can be used for example in electronic data transfer. Definitions are described in table 4.

Table 4. Document metadata definitions by PSK standardisation (PSk5822-e5: 2003, 3-14).

<b>Projects identification data</b>	
<b>Name</b>	<b>Description</b>
Project Id	Identifier of a project within an organization acting in the role of the customer
Project Name	Clear text name of a project shared by all involved organizations within a project
Supplier Project Id	Identifier of a project within an organization acting in the role of the supplier
Contract	Identifier of a contract between customer and supplier
Customer	Name of the organization acting in the role of the customer
Supplier	Name of the organization acting in the role of the supplier
Creator	Name of the organization acting in the role of the customer
<b>Documents identification data</b>	
<b>Name</b>	<b>Description</b>
Customer Document Id	Unique identifier within a specified organization in the role of the customer
Customer Revision Id	Identifier of approved document version in customer domain. Applicable in addition to Document Id.
Supplier Document Id	Unique identifier within a specified organization in the role of the supplier
Supplier Revision Id	Identifier of approved document version in supplier domain. Applicable in addition to Document Id.
Creator Document Id	Unique identifier within a specified organization in the role of the creator
Creator Revision Id	Identifier of approved document version in original creator domain. Applicable in addition to Document Id.
Page	Page or part identifier
<b>Document description</b>	
<b>Name</b>	<b>Description</b>
Title	Short clear text description of the content of the document, first row
Additional Title	Additional short clear text description of the content of the document, second row
Additional Title2	Additional short clear text description of the content of the document, third row
Revision Text	Short description of the effected changes

Table 4 cont. Document metadata definitions by PSK standardisation (PSk5822-e5: 2003, 3-14).

<b>Document classification</b>	
<b>Name</b>	<b>Description</b>
Customer Document Class Code	Document classification according to a customer classification schema
Customer Document Class Name	Document classification name according to a customer classification schema
Supplier Document Class Code	Document classification according to a supplier classification schema
Supplier Document Class Name	Document classification name according to a supplier classification schema
Creator Document Class Code	Document classification according to an original creator classification schema
Creator Document Class Name	Document classification name according to an original creator classification schema
Function Class Code	Function classification identifier describing document target.
<b>Document references</b>	
<b>Name</b>	<b>Description</b>
Document Area Code	Identification of a document area.
Document Area Name	Name of a document area
Supplier Document Area Code	Supplier's identification of a document area.
Location Area Code	Identification of a location area described in document.
Location Area Name	Name of a location area described in document.
Process and Mechanical Reference designation	Identification of a process or mechanical object described in the document.
Electrical Assembly Reference designation	Identification of an electrical assembly described in the document.
Electrical Application Reference designation	Identification of an electrical application described in the document.
Instrumentation Application Reference designation	Identification of an interment application described in the document.
Superseded By	Document identity of a document which supersedes the actual document
Superseding	Document identity of a document which is superseded by the actual document
Refers To	Reference to defined document(s) associated with actual document version.
Bill Of Material	Identifier of bill of material associated with actual document version.
<b>Document creation, review and approval</b>	
<b>Name</b>	<b>Description</b>
Creator Name	Name of the person who created the document.
Creation date	Date when document is created.
Reviewer Name	Name of the person who reviewed the document.

Table 4 cont. Document metadata definitions by PSK standardisation (PSk5822-e5: 2003, 3-14).

Review date	Date when document is approved.
Approver Name	Name of the person who approved the document.
Approval date	Date when document is approved.
<b>Document status</b>	
<b>Name</b>	<b>Description</b>
Status	Status with regard to the result of an activity associated with the document.
Release date	Date when the document is released.
<b>Document format</b>	
<b>Name</b>	<b>Description</b>
Document size	Code of the physical paper sheet size of a document based on a defined size coding system
Document scale	Document scale based on a defined size coding system
Number of pages	Total number of pages based on the specified document size

### 3.4.2 Advantages and problems

Advantages of the standards can be found from many perspectives. Usage of standards accelerates development of own metadata definitions because standards give ready-made platform for definitions. Also when standards are used, transfer of documents between the different systems is easier because definitions are fitting together.

However, nowadays the problem is that usage of these standards is not very common. If standards aren't used commonly, the benefit of them to the user is minor. In the situation where the company needs metadata definitions and there are not any old definitions, these standards are a good platform. If the company tries to unite metadata definitions and has proper old definitions, usage of the standard could be too complicated and it is discarded because of the minor benefits.

## 4 PRODUCT INFORMATION MANAGEMENT

The speed and quality of actions are emphasised in the operational environment of industrial organizations. Management of all information related to products is important in this environment. The systems, which facilitate product information handling and exploitation, are more and more important in this environment.

### 4.1 Product data

Product data means a broad bunch of information related to products, which can be divided to three groups (Halttunen et al 1995, 10-11).

1. Product *specification data* defines unambiguously products physical and operational characteristics and describe product characteristics from certain perspective, for example from engineering and production perspective.
2. Products *lifecycle data* always relates products one expression and describes events related to products engineering, production, delivery, usage, maintenance and discard.
3. *Metadata* related to product is data about data. Metadata describes for example; in which form data is saved, in which information repository data is stored, who was the original data creator, when data is saved and edited by whom, etc.

Product Data Management (PDM) includes all actions and systems used to arrange and manage the product, data such as data is real time and not in conflict, data is protected against the inappropriate usage, destruction and disappearance and is smoothly usable (Halttunen et al 1995, 11). Product data is managed during the whole lifecycle of product.

The line between the product data management and document management (DM) is getting dimmer. The product data management relates management of all information and processes related to products, during the product lifecycle (Halttunen et al 1995). Data related to products is saved in databases and it includes for example direct measures, materials and producers of certain components. Document management and especially electronic document management (EDM) relates to management of documents and processes which are used to create, publish and maintain documents (Spargue 1995). Major difference between the PDM and DM has been that documents aren't attached to any specific component or assembly of the product structure. This difference is disappearing when document management systems are developing more advanced functions for product structures or DM systems are linked with systems, which handle specific product data and structures for example like ERP systems.

## **4.2 Product lifecycle**

Product lifecycle can be understood at least in two ways. It can mean the lifecycle of the whole new product from innovation to end of the product manufacturing or it can mean the lifecycle of a single product from engineering to demolition. These two different approaches are shortly introduced in the next chapter.

### ***4.2.1 Product lifecycle approaches***

The product lifecycle can mean complete products or product groups' lifecycle, as an example of this approach we can take the typewriter. Typewriters are one example of the products, which are disappearing from the market. Typewriters product idea was created somewhere in the mid of the 19th century, and the first typewriters were invented in 1870's. The typewriters have been developed during the lifecycle; electric typewriter is one good example of this development. These kinds of development steps can extend the lifecycle of a product. Nowadays typewriters are replaced with computers and manufacturing of typewriters

in a large scale is not profitable anymore. In this sense the typewriters are at the end of their lifecycle.

This kind of a product lifecycle model, introduced in figure 8, includes five major lifecycle stages. These stages are product development, market introduction, market growth, market maturity and sales decline. Product lifecycle data accumulation starts from product development and continues during products lifecycle. Product lifecycle profits cumulate during the lifecycle from development forward. The development stage usually includes only costs why the profits are nil. The sales start when the product has been developed and introduced into the market. If the product suits the market, the profits will rise during the following lifecycle stages. After product introduction competitors may imitate the product concept and develop their own substitute on the market. This decreases the profits and finally, when the product moves closer to the end of its lifecycle, sales and profits will fall.

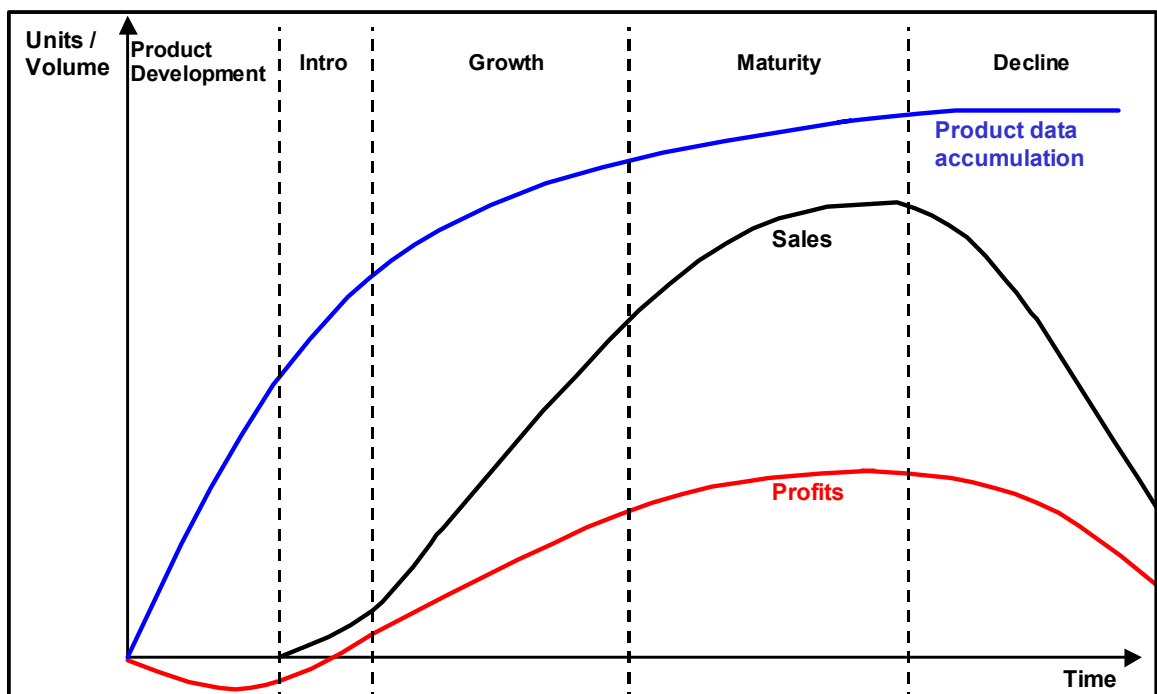


Figure 8. Product lifecycle profits, sales and accumulated product data.

Product lifecycle monitoring in this level is not sufficient for business, which produces major and long lifecycle equipment. In this area more precise monitoring of single equipment's lifecycle is needed. Another way to think products lifecycle is to concentrate on a single product's lifecycle. The lifecycle of big products like paper machines, washers and other products in pulp and paper mills, has to be monitored product by product. For example, the washer's lifecycle starts from engineering of the washer. Engineering starts from recommended basic model of the washer, which is modified to the customer needs. This customer version of the washer gets unique product ID and the product lifecycle data is collected during its lifecycle from engineering to demolition. Single product's lifecycle ends when the product is demolished, even the same kinds of products are still in production. This chapter concentrates on the product lifecycle approach like this.

Figure 9 represents single products or projects lifecycle approach and collected information exploitation in new products or projects. When a project starts there is already some amount of information about projects or products, for example engineering data or data from earlier projects. In projects, which include new technology or equipment, this information can be minor, but in projects, which are based on familiar equipment and concept, this information amount can be very comprehensive. Information accumulation starts from preliminary planning and continues during the delivery. When the project is delivered to the customer, the customer takes new equipment into use. In this stage information can be lost. For example, in project or product information transfer to the customer some data can be lost if all the needed data is not documented or saved in a proper place from where it can be transferred to the customer. Information accumulation continues during the equipment usage and ends when the equipment is discarded. Information, which is collected during the equipment usage in the end users system, is not always saved in the suppliers system. Accumulated information can be used in future projects.

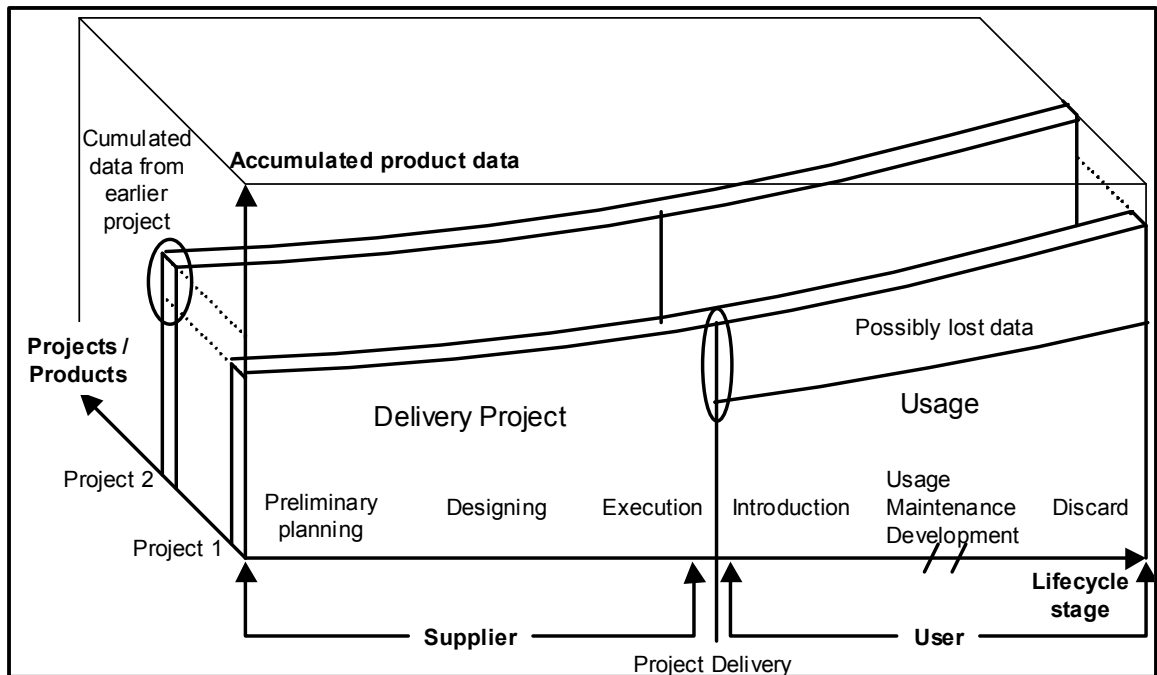


Figure 9. Information accumulation during the product lifecycle and information exploitation in new projects (Jansson et al. 2000).

The product's lifecycle usually starts from a product idea and ends to demolition and recycling. Steps between these stages are for example engineering, production, build-up, installation, usage, repairs, upgrades and rebuilds. During the product's lifecycle information amount concerning the product is increasing.

#### 4.2.2 Lifecycle in Service business

In service business information management, experience collection and accumulation of the product's lifecycle is important. Understanding the lifecycle steps, knowledge about the product engineering, production, installation and usage gives outstanding advantage for service business; it also gives experience based competitive advantage for coming quotations and deliveries.

The product lifecycle management extends over organization borders. Producer / Manufacturer company handles the engineering, production and in many cases installation of the product in the end users system. After installation, end users usually maintain and manage product according to their own practices.

This makes information management and collection about product lifecycle more difficult.

Many circumstances influence on information sharing between the organizations, for example (Jansson et al. 2001, 39):

- **Relationship between the companies.** Companies can be unfamiliar for each other or they can know each other's well and have been worked together for a long time.
- **Level of information technology in companies.** The most undeveloped information systems are usually the determinant factor in this area.
- **Indented functional level in information management.** For example indented level can be, real time access to information or periodic information sending.

In addition, questions about information ownership and information usage as a competitive factor have to be solved when information is shared over the organization borders. These questions are usually partly related to relationships between the companies but aren't merely solvable by developing the relationship between the companies (Jansson et al. 2001, 39).

Due to above mentioned factors, good relationships with customers are especially important for service business. Information system development is not always the solution to product lifecycle management, especially if customer relationships are not open or customers information systems are undeveloped, building of new advanced product lifecycle management system can be useless. Also if the wanted functional level of information management system is defined too comprehensive, system development can fall to excessive work and too long timetables. In many cases it is best to start with basic solution, which covers the essential functions, not all details. A later system can be developed during its usage.

## **5 ANDRITZ COMPANY PRESENTATION**

Andritz is listed Technology Group based in Graz, Austria. Andritz develops and manufactures customized production systems for pulp and paper, steel and other specialized industries (sewage sludge dewatering and drying, feed industry). Each of the Business Areas also offers special services – for instance sale of original spare parts or technologically advanced engineered wear parts.

### **5.1 Andritz Group**

The Andritz Group has a global staff of over 4,500 employees. The Group has 16 production facilities, located in Europe, in the Nordic countries and the US, and has over 60 affiliates and distribution firms around the world. The sales of Andritz were over 1,100 MEUR in 2002.

Andritz acts in many business areas, these are:

- Pulp and Paper mill business.
- Rolling Mills and Strip Processing Lines.
- Environment and Process Technologies.
- Feed Technology.
- Hydraulic Machines.

The biggest business area of Andritz is Pulp and Paper mill business, which covers about 60% of the whole Group's sales. Major geographic markets are Europe and America, which account for approximately 46% and 38% of total sales respectively. Asia contributes 14%, and the other continents 2%.

### **5.2 Pulp & Paper Mill Services**

Andritz Pulp and Paper Mill Services is part of Pulp and Paper mill business of Andritz Group. Andritz Pulp and Paper Mill Services have 520 personnel world-

wide excluding manufacturing. Pulp & Paper Mill Services offer mill wide knowledge for customer processes and equipment. The mission of Pulp & Paper Mill Services is;

*“Our mission is to help customers to maximize reliability and to improve production efficiency of their mills without major capital expenditures.”* (Andritz Pulp and Paper Mill Services 2002).

### **5.2.1 Business Partners**

Besides its own manufacturing and maintenance, important part of the service business is strictly selected partner network, which handles locally part of the service operations. Partners are selected especially when the customer is located far from Andritz' own service centres. Partners are appointed to handle agreed part of the operations on behalf of Andritz.

### **5.2.2 Service Products**

Pulp & Paper Mill Services offer different solutions for the customer depending on their needs. Main products / services of Pulp & Paper Mill Services are:

- Service Contracts
- Equipment Upgrades
- Rebuilds and Retrofits
- Shutdown Services
- Field Services
- Spare Parts

### **Service Contracts**

Service contracts are contracts in which Andritz takes responsibility for maintenance of selected scope of equipment in some mill. These contracts have been made with some specific mills. Contracts can be made for equipment, systems, departments or even for mills, so they can contain a wide scope of maintained equipment.

## **Equipment Upgrades**

Equipment upgrades are services, which concentrate to upgrade equipment with better solutions. An upgrade can be for example changing of equipment to use lesser electricity when the price of electricity is high or increasing the maximum capacity of the equipment.

## **Rebuilds and Retrofits**

Rebuilds and retrofits are services, which concentrate to rebuild broken and faulty equipment. The equipment is rebuilt according to the same technology as it was manufactured. The purpose is to get the equipment into the same condition as a new one. Service can be carried out, by Andritz or authorized partners, in workshops or on site depending on the customer's needs.

## **Shutdown Services**

Shutdown services concentrate on planning of shutdowns, shutdown work and contracts. Common tasks are shutdown inspections and repairs of the equipment.

## **Field Services**

Field services concentrate on trouble shooting in case of disturbances, process studies, optimisation of equipment and process capacity, preventive maintenance, training of equipment maintenance and usage and emergency services in 7 days a week, 24 hours a day.

## **Spare Parts**

Spare parts service sells different kinds of spare parts like first time spares, start-up spares, consumable and wearing parts, project spares, spare part packages and spare inventories. Spare parts service also delivers recommended spare parts lists for projects.

## **6 DOCUMENT MANAGEMENT AS A PART OF PRODUCT LIFECYCLE MANAGEMENT**

Product Lifecycle Management (PLM) is a management system that bridges the gap between engineering, manufacturing, procurement, and the back office financial and human resource systems. It is managing the product lifecycle from product creation to its obsolescence (Gould 2002).

Document management is an important part of the product lifecycle management. The documents, which report the product condition in some moment of its lifecycle, are essential for the whole lifecycle management. If the history about product lifecycle is documented and the documents are well managed, the producer company can develop the products lifecycle into desired direction. For example longer, more profitable and easier to manage and maintain. From the customer's point of view this can mean clear benefits like growing products lifecycle profits, better equipment usability, raised equipment productivity and better quality of the products.

### **6.1 Main stages of Andritz product lifecycle process**

The product lifecycle, from Andritz' point of view, contains three major steps i.e. Sales, Delivery and Service. This chapter will concentrate more on Service point of view of document management as a part of the product lifecycle management, but a short introduction of other steps, Sales and Delivery, has to be included to clarify the whole product lifecycle in Andritz Group.

#### **6.1.1 Sales**

In the Sales phase, Andritz usually sells a project, not a single product. The project can contain a wide scope of delivered products for example a complete production line to a pulp or paper mill. The bidding process of these kinds of big

projects means a huge amount of work and it can contain a truckload of documents. When a quotation has been sent, the approval process contains many negotiations and changes to original quotation documents.

The quotation documentation has been handled with many individual systems and stored in different databases, workstations and servers depending on the unit, which has prepared the quotation. At the moment there is an ongoing development and implementation process of the Customer Relations Management (CRM) system, which has been developed for Andritz needs. The system has been planned to unite the CRM system to the whole Andritz group and it has been already implemented in several units. Also Pulp and Paper Mill Services has decided to implement the CRM system, which will handle customer information, quotations and quotation documents in the future. The CRM system is linked with Andritz existing document management system, so the quotation documentation will be available in the DMS when the CRM is implemented.

The end of the Sales Phase is an “As-Sold” version of the project. This means from the document management’s point of view that all material is in the phase as it has been sold to the customer. After that, the sold project will be transferred to Delivery. The As-Sold version of the documentation includes generic product and engineering data, which will be sharpened during the delivery.

### **6.1.2 Delivery**

The As-Sold documentation is a platform for the delivery phase but there will be many changes to the As-Sold version of the project when the delivery proceeds. For example, more detailed equipment specifications and layout plans are created. Also some practical changes to the equipment have to be done on the site, or some equipment has to be replaced by comparable one.

When all parts of the project have been delivered, erected, inspected and the warranty time has expired, the delivery transfers the project and project material to service. The delivery phase ends to the “As-Built” phase, which has been

comprised during the delivery. “As-Built” means the state of a delivered project, as it has been build-up for the customer. From the document management’s point of view “As-Built” state means detailed product documentation, which includes also customer documentation.

### **6.1.3 Service**

When the project has been transferred to service, service starts to handle maintenance and service of the delivered equipment. It is important for service business that the condition of maintained equipment is clear and documented well. This helps service to serve their customers better, more efficiently and faster. Also when service have all history well documented, it is much more easier to plan and organize coming maintenance, maybe even prevent coming needs for maintenance. “As Build” material from the delivery phase is a platform for service. Engineering also uses the product lifecycle history to develop better and long lasting equipment. When service makes changes to equipment “As-Built” material expires and a new “As-Is” version is created. Figure 10 describes the main tasks in Sales, Delivery and Service business processes and the project material versions during the lifecycle.

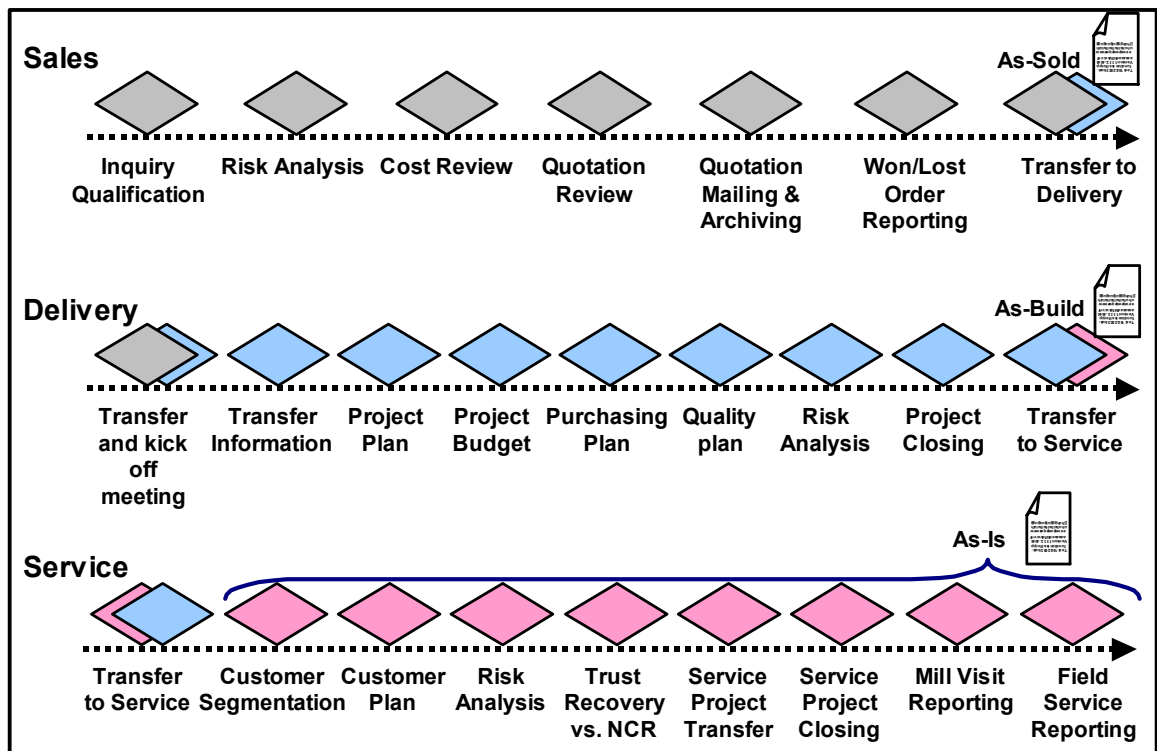


Figure 10. Andritz business processes and documentation versions (modified from Andritz 2003).

### Andritz Oy's OPE<sup>®</sup>-Concept

Andritz Oy has developed their own maintenance strategy called OPE<sup>®</sup> (Overall Production Efficiency). According to OPE<sup>®</sup>, the equipment's overall efficiency will be made better during the equipment's lifecycle.

The OPE<sup>®</sup> concept is based on preventive and improving service. Compared to normal aging, the OPE<sup>®</sup> tries to get production capacity better during the equipment's lifecycle by developing and maintaining the equipment continuously. Figure 11 illustrates OPE<sup>®</sup> concepts mindset.

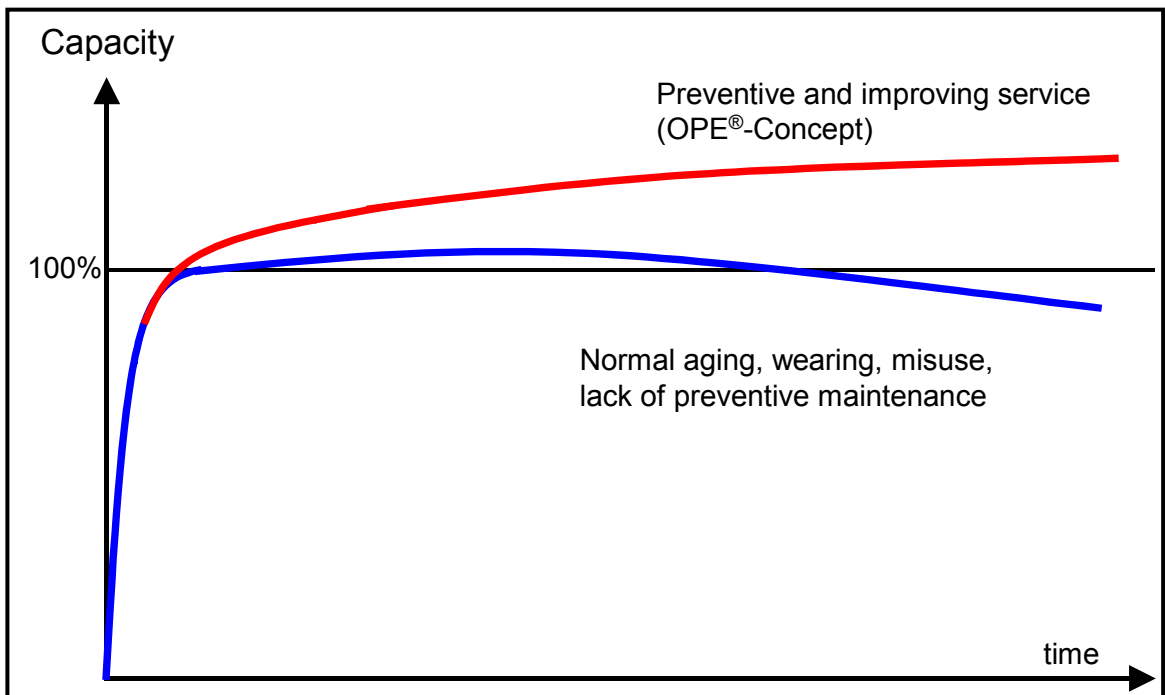


Figure 11. OPE® -concepts mindset (Andritz Pulp and Paper Mill Services 2002).

Normally the defined capacity for the equipment is reached fast after the start-up. The capacity of the equipment starts to decrease with time. This model doesn't meet the customer's needs after the warranty time. The customer will assume the responsibility for the equipment after the warranty.

The OPE® curve shows that by using the OPE® -concept, the equipment's capacity will improve during its lifecycle. This capacity improvement is reached by maximizing the capacity first, besides this OPE® -concept pays attention to the productivity development possibilities of the equipment and processes after the start-up. This is done by minimizing the bottlenecks in the equipment and processes, by developing the equipment by means of a new technology and by optimising the process. The OPE® -concept mindset meets the customer needs better and improves the cooperation with the customer.

Processes and equipment operating time control, analysing and inspections during planned shutdowns belong closely to the OPE® -concept. Information

about the equipment and processes are collected with these actions. With help of collected information, right actions to improve the capacity can be taken.

Mr Aulis Katajamäki, Director of Global OPE<sup>®</sup> Product Group says; *“Previously the basic principle was that a supplier designed and built a plant for a customer, and then the customer was solely responsible for the operation of the plant, as well as any and all problems that arose. Our new concept is different from the old model, now we offer Andritz expertise for the customer on a continuous basis.”* (Katajamäki 2003, 18).

Compared to normal product lifecycle in service, mentioned in chapter 4.2.2, the OPE<sup>®</sup> -concept offers customers better service after the warranty time. From Andritz point of view OPE<sup>®</sup> -concept helps to get closer relations with customers. These factors improve the information sharing between the parties, making product lifecycle information collection easier.

## **6.2 Document Transfer From Project to Service**

As mentioned earlier, the “As-Built” material about delivered projects is essential for service business. Nowadays the transfer from the delivery phase has been handled in many different ways and there are no uniform practices for the transfer. The uniform document management system allows easier transfer of the “As-Built” material from Delivery phase to Service as well from Sales phase to Delivery. When the documents are in the same common place, the documentation is also easier to transfer to the customer. When the documents are already in the unite document management system, the transfer can be done fast and relatively easily. The ways to handle the transfer can be for example changing the place of material from delivery project files to service structure. Also document status will be updated from “As-Built” to “As-Is”.

Transferred documentation contains a wide variety of different kinds of documents. These are for example operation and maintenance instructions, different

types of drawings, memos, meeting documents, etc. From the service point of view the most important part of documentation are the drawings and installed component lists.

Figure 12 shows service focus in different lifecycles and document data collection during the product lifecycle. In the start-up phase service starts to plan and implement the maintenance strategy. At document management point of view this phase contains As-Built data transfer from project to service. This phase starts the continuous data collection to service systems during the products life-cycle.

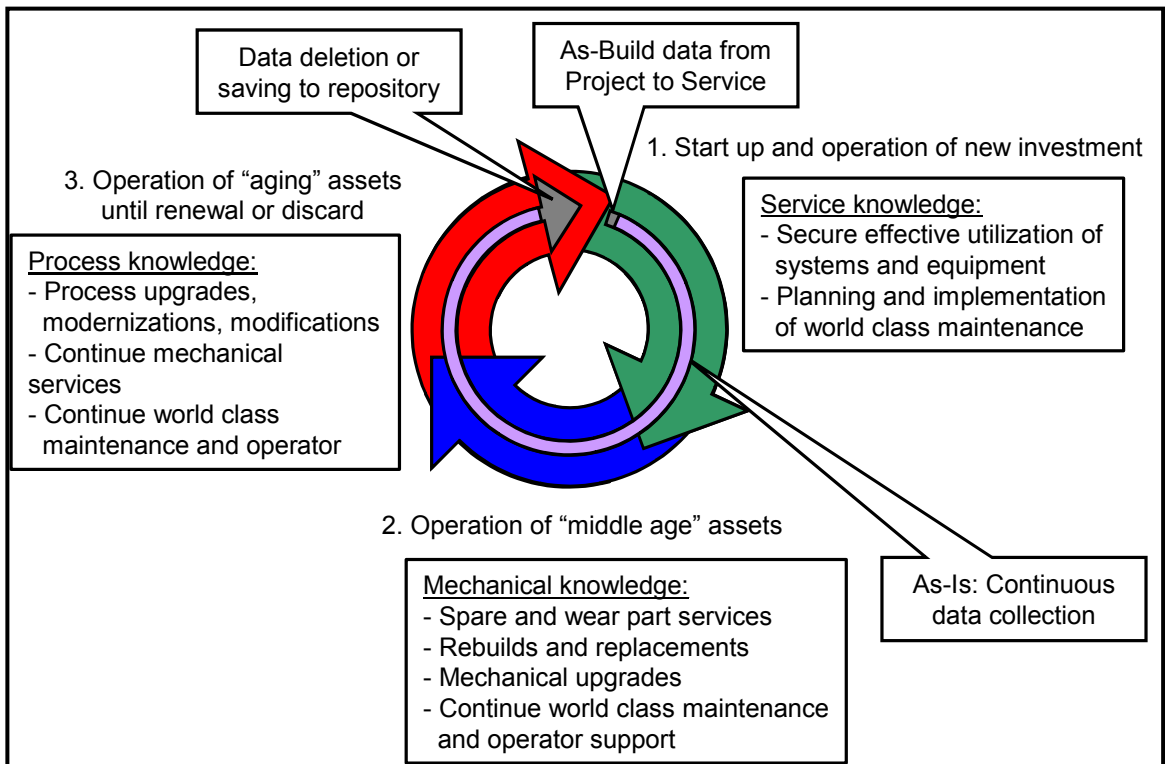


Figure 12. Service focus in different lifecycles (adapted from: Andritz Pulp and Paper Mill Services 2002).

### 6.3 Product lifecycle management in service

As mentioned earlier, service needs detailed and real time information about products in mills. So knowledge about the mills with installed equipment base is

important for service business. When service makes some changes to the equipment, As-Built data expires. It is important that these changes will be documented and the documents are saved in one common place where they can be easily found and used again when service engineers visit the same mill again. The entire service history of one mill should in a place where it can be managed and accessed easily. The system should be relatively fast and easy to use. If a document addition to the system is too complicated, the operators do not necessarily use the system.

When “As-Built” data has changed, the status changes to “As-Is”, which means from the equipment point of view the best knowledge about the equipment’s condition as it is currently in the customer’s system. These changes can be managed in the DMS by changing the document status from “As-Built” to “As-Is”. Figure 13 clarifies the content of data in different stages, “As-Sold”, “As-Built” and As-Is.

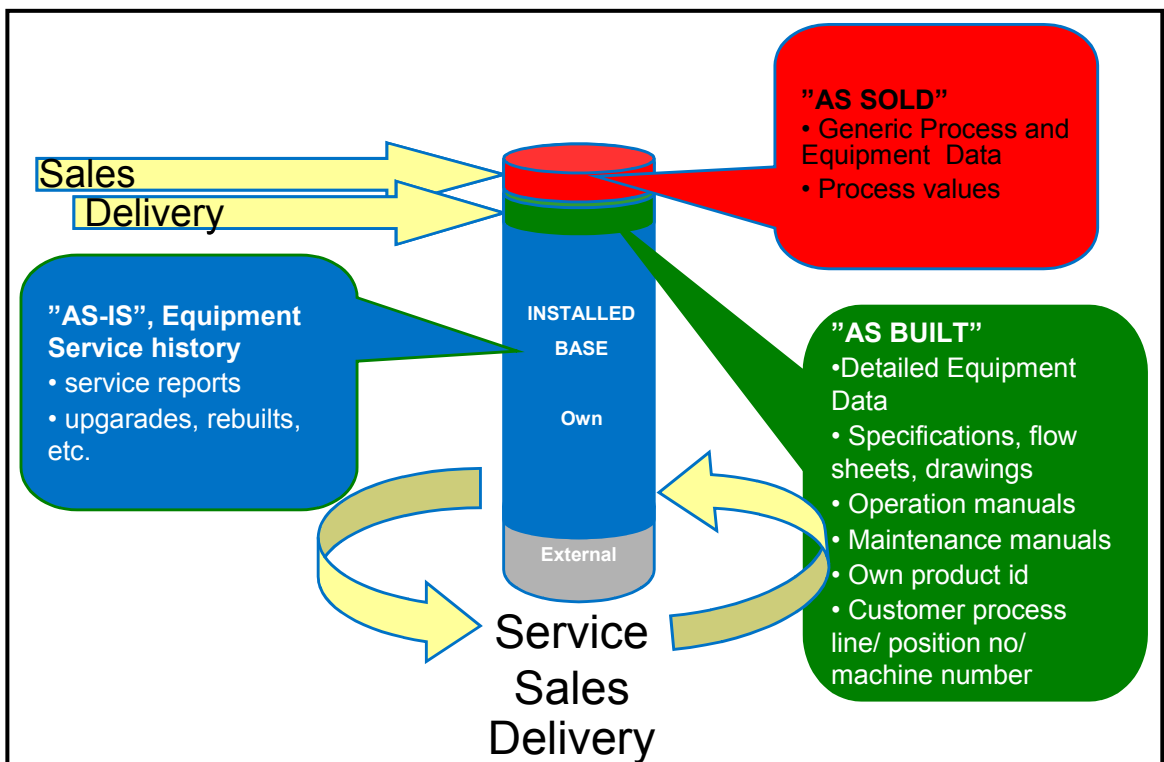


Figure 13. Usage of Installed Base in Andritz Business Processes (Uusitalo 2002).

In service business the transaction with customers is important. Even though Service has proper systems to manage product lifecycle data in mills, one has to remember that information about the mill “As-Is” installation doesn’t necessarily describe the current conditions. If the customer has replaced equipment and used some other suppliers, information about these changes aren’t necessarily in Andritz’ records. Also customers can order maintenance for Andritz products from other suppliers, for example in cases where they make a service contract for a wider scope of mill equipment with another supplier.

Andritz has also concluded service contracts, which contain wide scope of maintained equipment. In these cases the contracts contain also equipment from other suppliers. When this kind of a contract has been made, it is important to get proper information about the technology and current condition of the equipment, which is not manufactured by Andritz. Also this equipment must be added to the systems to enable maintenance history collecting.

## **6.4 Installed Base Machine Chart system**

Andritz Pulp and Paper Mill Services use Installed Base Machine Chart system for collecting information about the lifecycle conditions of mills and mill installations. The installed Base Machine Chart system collects information about mills installed equipment bases, which has been delivered by Andritz. Also the equipment that is maintained but not delivered by Andritz can be added to the system. Mill visits and quotations for mills are stored to the system, too.

Andritz Pulp and Paper Mill Services, Savonlinna office, in cooperation with users, have developed the installed Base Machine Chart system. An external software company has carried out the system programming. The system user interface is web browser based and the system information is stored in Microsoft SQL Server (Structured Query Language) database.

Figure 14 illustrates the structure of the Installed Base Machine Chart system. The equipment is identified by the manufacturing number, which is unique for every equipment. Besides this customers' own numbering system can be also added to the system. Mills are identified with the mill numbers. These mill numbers are taken from Jaakko Pöyry group's mill number definitions. quotations, mill reports, mill data, process data, installed base structure and machine charts are stored in the database under a specific mill. This information can be added and viewed via web browser user interface. Also online diagnostics about mill conditions are planned to store in the system in the future.

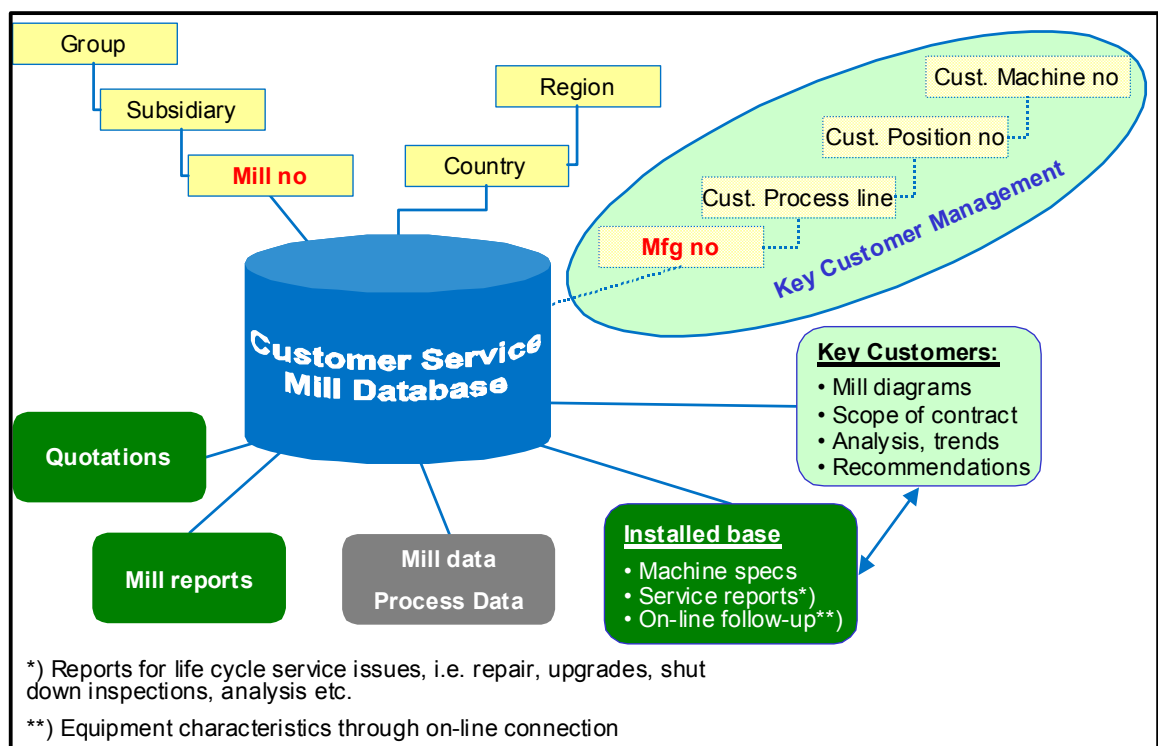


Figure 14. Installed Base Machine Chart system structure (Uusitalo 2002).

The Installed Base Machine Chart system collects equipment specific logs about the mill equipment under the mill hierarchy. A machine chart includes basic information about the equipment, main components from the service point of view, service reports on the equipment and maintenance history of the equipment. Changes, repairs and failures of equipment components can be directly stored under the component. The system also collects a history about these

changes, so the earlier condition of the equipment and components can be tracked from the machine chart. When service makes bigger changes, inspections and maintenance visits, these are documented and saved in the system under specific equipment or mill.

## **6.5 Fisher Pulp and Paper Industry Database**

The Installed Base Machine Chart system has similarities to commercial installed base applications like Fisher Pulp and Paper Database. Fisher Pulp and Paper Database collects information about pulp and paper mills, which are making finished products more than 50 tons per day. The database includes information for example about (Fisher 2003):

- Paper and pulp production capacities of mills
- Contact information about key personnel
- Mill ownership
- Waste and water treatment
- Links to company website, driving directions and weather at the mill
- Mill equipments
- Mill process control systems

Compared to the Installed Base Machine Chart system, Fishers equipment data is more like a reference list of customers' mill installations, because it doesn't include so detailed data about equipments as the Installed Base Machine Chart system. Also some of Andritz' equipment is missing from the database. From the service point of view Fisher Pulp and Paper Database is no sufficient tool for the product lifecycle management. However, parallel usage of the Installed Base Machine Chart system and Fishers database gives Andritz important knowledge about mills. Especially equipment that has not been delivered by Andritz is not usually included in the Installed Base Machine Chart system. In this area Fisher database gives important information for Andritz.

## **6.6 Andritz Group CRM Installed Base**

Also Andritz Group CRM includes installed base functionality. This installed base also includes data, which is not so detailed than in the Installed Base Machine Chart system. Andritz Group CRM installed base includes a link to Fisher Pulp and Paper Database, why the equipment can be easily viewed from both the sources.

The Installed Base Machine Chart system has been decided to link with Andritz Group CRM installed base. Thus Andritz Group CRM and Installed Base Machine Chart systems installed bases will be united in a way that the equipment base data is in Andritz Group CRM installed base and more detailed equipment data, service history, main components for the equipment etc. can be viewed with a link to the Installed Base Machine Chart system. After uniting the systems, the data from each system can be easily compared with Fishers Database data.

## **7 ANDRITZ DOCUMENT MANAGEMENT SYSTEMS**

Some Andritz groups business units currently use the document management system. Earlier the selected system was Hummingbird's document management system, the first version of which was DocsOpen system at Andritz. Nowadays newer versions of the DocsOpen system, PowerDOCS 3.9 and 4.0 systems are in use. In winter 2003 document management practices are planned to unite and to transfer to a newer document management system Hummingbird Document Manager.

### **Nowadays**

The present document management system includes 3 different libraries. The libraries are in use of Hollola Finland, Munchy USA, and Graz Austria. DMS set up has been handled as a distributed application; local Fusion servers are in Atlanta USA, Montreal Canada and Örnköldsvik Sweden. The central database is in Hollola Finland. Currently the system includes over 1 000 000 documents in oracle database and over 600 user licenses in use.

### **Future development**

Andritz AG, Graz, Austria is testing a newer version of the system, Hummingbird Document Manager. Hummingbird Document Manager (also called DM 5) system has been planned to implement at Andritz. Also Pulp and Paper Mill Services have planned to implement the system in winter 2003. Figure 15 shows the document management system development steps in Andritz.

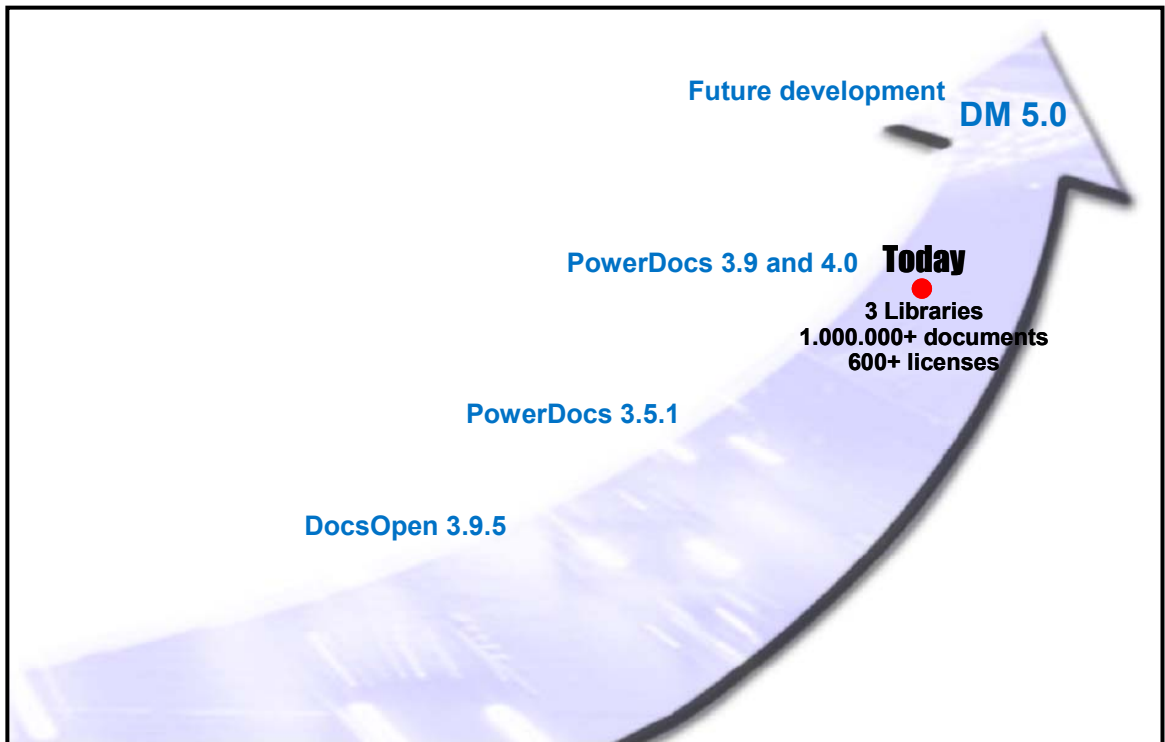


Figure 15. DMS development in Andritz (Andritz DMS presentation 2002).

The objectives of the development processes are to get the DMS into use by all business units, a closer integration to other IT systems (ERP, etc), design global user groups and to define the global user management concept. The global DMS team has been established to unite different libraries. The team has defined uniform Andritz metadata definitions and the different libraries are planned to unite in autumn 2003.

The main goals in the DMS development process are to translate document-based electronic information into knowledge assets, to provide a strong foundation for collaborative and content management solutions and access to these assets from the desktop, browser, email system, and web portal.

## 7.1 PowerDocs 4, document management system

PowerDocs 4 is a document management system developed by Hummingbird Ltd. The PowerDOCS 4 system has been developed mainly for the office

document and affair management. Andritz has customized some parts of the system to fit better to their own needs; so all the functionalities mentioned in this chapter aren't included in the basic PowerDOCS 4 system. The system works in Microsoft Windows NT, 98 and 2000 environment.

### **7.1.1 Parts of the system**

PowerDOCS system comprises three separate parts; PowerDOCS client program, Fusion net server and database, which includes the document data.

The PowerDOCS 4 client program is installed in the user's personal computer. The client handles the user interface to the PowerDOCS system and all the relevant functions for the user can be handled with the client. The client program also enables the offline usage of the system (Makkonen 2001, 2).

The documents are saved in the net file servers. The system itself takes care of the directory construction and archiving of the documents. Documents metadata is stored in the database. Metadata can be used for searches, creating system internal structures, etc (Makkonen 2001, 2).

### **7.1.2 Programs compatible with PowerDOCS**

Basically, a document or a file created with any application program can be archived in the system. However, by using applications, which are integrated into PowerDOCS, more comprehensive functions are available. Document quick view, direct printing and launching the application program from PowerDOCS to update the document are working with applications, which are integrated to PowerDOCS. This kind of integration exists for the following programs (Makkonen 2001, 2):

- Microsoft Word
- Microsoft Excel
- Microsoft Powerpoint
- Microsoft Outlook

- Microsoft Photo Editor
- Adobe Acrobat

All the above programs, except Outlook, can also be launched directly from PowerDOCS (Makkonen 2001, 2). The future Hummingbird Document Manager system, introduced in chapter 7.2, will provide also AutoCad extensions in addition to this list.

### 7.1.3 Basic functions

As mentioned earlier in chapter Common document management system functions, document management software usually includes certain basic and support functions. These are listed again in table 5.

Table 5. Document management systems common functions.

Basic functions	Support functions
Document saving & deleting	Work flow management
Document archiving	Viewing
Information searches	Printing
User rights management	Relations
Virtual folders	Comparison
Version management	Red-lining
Change management	Document numbering
	Application integration
	Language versions in user interfaces

PowerDOCS 4 system includes almost all the common DMS functions. Besides these, the system includes many other functions. All system functions aren't introduced in this work. The common basic and support functions compared to PowerDOCS 4 systems functions are introduced in table 6.

Table 6. PowerDOCS 4 functions compared to common DMS functions.

<b>Basic Functions</b>	
<b>Name</b>	<b>Description</b>
Document saving & deleting	Documents with integrated application can be created directly from the system to the selected document template. Also ready-made documents can be imported to the system. Deletion of documents can be limited with user rights.
Document archiving	Handled automatically when a document has been created or transferred to the system.
Search	Searches against the metadata definitions, recently used searches can be stored as favourites.
User right management	Different user rights for example user- / document group based, user / document based, etc. can be defined.
Virtual folders	Internal system groupings with metadata definitions can be defined.
Version management	Document version history can be seen.
Change management	Document can be checked out for editing and checked in after the editing.
<b>Support functions</b>	
<b>Name</b>	<b>Description</b>
Work flow management	Not in PowerDOCS 4, but will be in Hummingbird Document Manager system.
Viewing	Documents can be viewed with a viewing program in a separate viewing window.
Printing	Document can be printed via viewing program or via application program, which was used to document creation.
Relations	Relations between different documents can be created. More advanced functionality is available in Hummingbird Document Manager system.
Comparison	With CompareRite function two versions of a document, or two documents prepared by the same or different applications can be compared, and mark all deletions, insertions, moved text, and replaced text. The differences are reported in a composite file.

Table 6 cont. PowerDOCS 4 functions compared to common DMS functions.

Red-lining	Not in PowerDOCS 4, but will be in Hummingbird Document Manager system.
Document numbering	Not in PowerDOCS 4, document numbers are generated automatically by system; numbers cannot be changed or affected.
Application integration	PowerDOCS includes Application integration module, which includes application integration via standard methods.
Language versions in user interfaces	If different language versions are needed, translations can be made, but because company's official language is English, there are no other language versions available nowadays.
<b>Other important functions</b>	
<b>Name</b>	<b>Description</b>
Favourites:	User can add the selected objects (documents, folders or searches) to the Favourites toolbar where they can be easily found.
Recent:	This function opens a view, which shows the latest documents created or edited by the user in question.
Profile:	Opens the Metadata data window of a document. The data of an archived document can be changed here.
History:	Shows all actions taken with this document, including viewing.
Copy:	Copying of the selected document.
Attaché	'Traveller's bag' The owner of a portable PC can save needed documents for offline use to attaché. When the net connection exists again, the system updates the documents if needed.
Mail:	Mailing of the document with Microsoft Outlook, options are: <ul style="list-style-type: none"> <li>• Send Copy: sends a copy of the document.</li> <li>• Send Copy and Check out: sends a copy for revision.</li> <li>• Send Reference: sends only a link to the PowerDOCS document.</li> </ul>

#### **7.1.4 Usage**

The PowerDOCS 4 system has been developed more for office document management than for technical drawing management. Technical drawings can be stored in the system but all the functions aren't in use with them. If drawings are wanted to store in the system and used with full functionality, the system has to be customized. Hummingbirds Document Manager system will have AutoCad extension, which facilitates technical document handling.

#### **7.1.5 User interfaces**

The PowerDOCS 4 system enables usage of all common user interfaces. Different PowerDOCS 4 user interfaces are:

- Workstation client software
- Windows Explorer user interface
- Web browser user interface
- Application software interface

#### **PowerDOCS workstation client software**

The PowerDOCS 4 DMS main user interface is a workstation client interface. This interface offers the most comprehensive functionalities and allows also off-line usage of the system.

#### **Windows Explorer user interface**

The PowerDOCS 4 system also enables the Windows explorer user interface when the workstation client is installed. PowerDOCS functions, libraries, folders, etc. can be used via standard windows explorer tool.

#### **CyberDOCS, web browser user interface**

The CyberDocs program is a web browser based user interface to the PowerDOCS document management system. The CyberDocs is separate software with own licence, it is mainly intended to use for document viewing via Internet.

It contains also some other basic functions of PowerDOCS, but it does not offer so comprehensive functionality than the PowerDOCS workstation client software.

### **Application software interfaces**

The Andritz PowerDOCS 4 system includes also an auxiliary program called Smiley. Smiley is an application interface to Microsoft Word program. When a word document is saved, Smiley starts and opens PowerDOCS metadata form for document saving. Smiley also helps to minimize filling-in of metadata data in PowerDOCS and to automate the handling of templates.

The PowerDOCS 4 system also contains a link to Microsoft Outlook e-mail program. With the link e-mails can be saved in PowerDOCS directly from Microsoft Outlook. E-mails can be saved as documents or as document attachments to meeting invitations.

### **7.1.6 PowerDOCS architecture**

PowerDOCS is a tightly integrated Windows client for the DOCSFusion server. Together with the DOCSFusion server and the DOCS Open database, it constitutes a three-tier document management system (Hummingbird 2001, 11).

PowerDOCS is based on Component Object Model (COM) objects. The Microsoft Component Object Model (COM) is a platform-independent, distributed, object-oriented system for creating binary software components that can interact. Component Object Model based solution allows third party developers to have access to different product features and customize and extend almost any part of the product. The same object libraries and services as PowerDOCS developers used are in their use (Microsoft 2003).

PowerDOCS is not a single monolithic product. It consists of many modules, where each one provides some logical piece of the products functionality. All

these modules interact via COM interfaces. This allows the developers to replace any entire module with their own module if a need arises (Hummingbird 2001, 11). Figure 16 gives the high level overview of the product architecture.

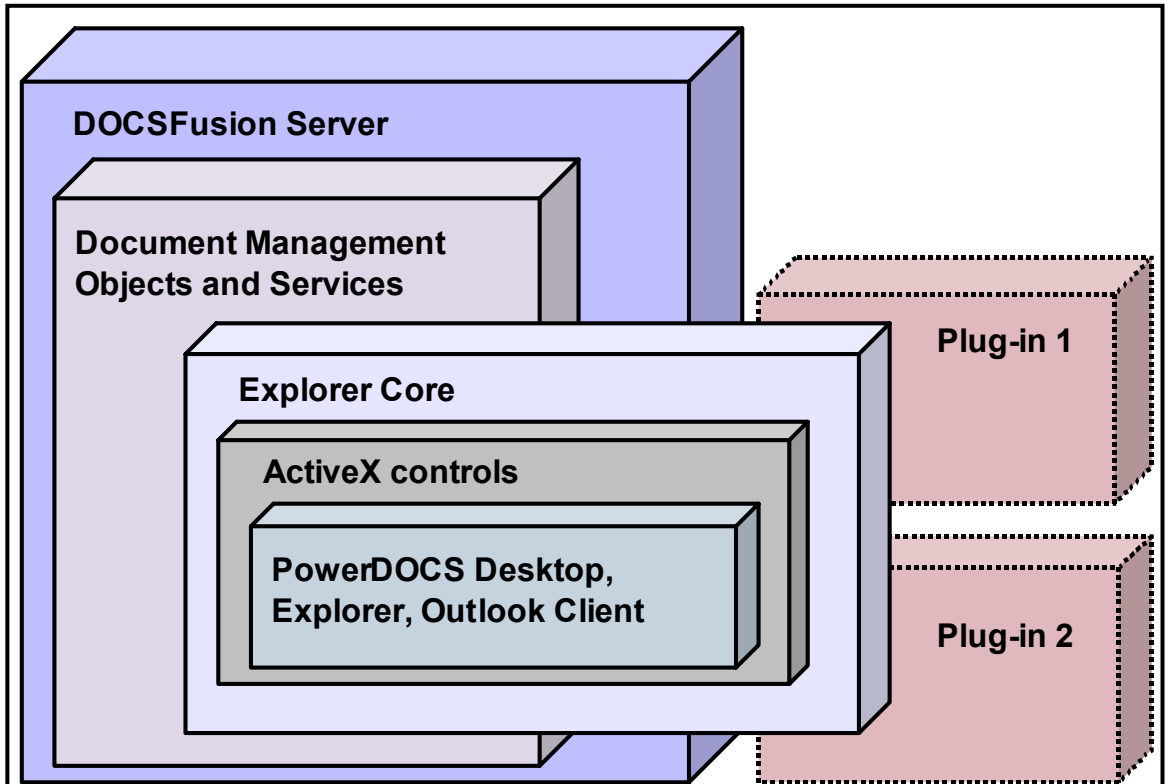


Figure 16. PowerDOCS architecture.

The DOCSFusion server is the platform of the PowerDOCS document management capabilities. The Document Management Objects and Services layer provides high-level document management oriented COM objects. Those objects can be used from any modern programming environment. ActiveX controls can be used to display and visually manipulate data in the DOCS Open libraries. The developer can combine them how he likes. Explorer Core technology makes possible to create the user interface independently of the business logic of underlying objects. Explorer Core guarantees that if the developer follows some simple rules while writing his application, he will benefit from the extensibility features made possible by the Explorer Core. For example, all new func-

tionality provided by the plug-ins will be immediately available in his application (Hummingbird 2001, 12).

### 7.1.7 Application Integration

Application integration with a document management system and other systems is in many cases a desired function when the document management system implementation is considered. Also in case of Andritz, application integrations have been built up. For example, the Andritz Customer Relation Management system CRM has been partly integrated with PowerDOCS 4. Also the Services Installed Base Machine Chart system has been planned to integrate with the Hummingbird Document Manager system, when it is implemented to service. Service reports, mill visits and other documents, which are fed via Machine chart system, are planned to save in the Hummingbird Document Manager system. Links to documents in Hummingbird Document Manager are placed to the Installed Base Machine Chart system. Next there are shortly introduced PowerDOCS systems application integration functionalities, these functionalities are mainly the same as in Hummingbird Document Manager system.

The PowerDOCS Application Integration module can be used for building of this integration. The module consists of the application integration module (AIM) and different integration schemes (ISM). All these modules interact with the document management plug-in to provide needed functionality. Figure 17 shows the structure of Application Integration.

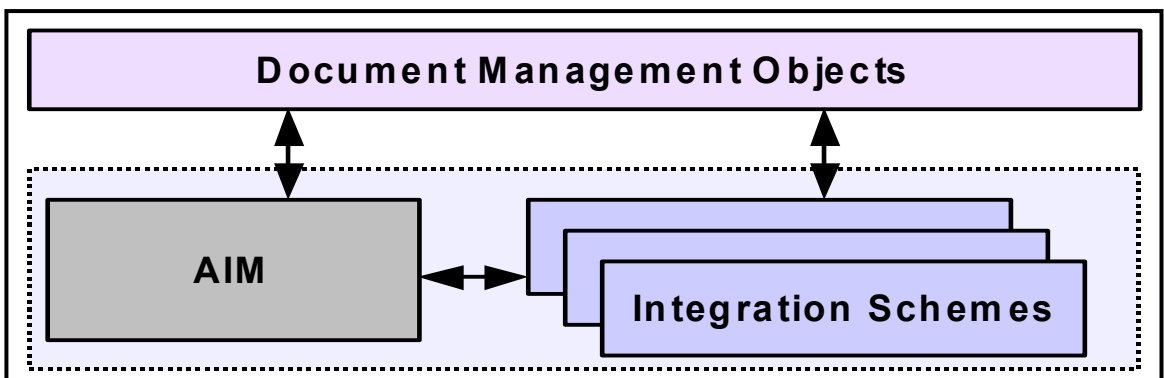


Figure 17. Structure of Application Integration (Hummingbird 2001, 18).

PowerDOCS delegates all application-related requests such as Open, View, and Print to an application associated with the document using the Applications Integration Module (AIM). The AIM, attempts to commit such calls to its registered integration schemes. The AIM supports some application integration functionality by itself, so it can provide integration via standard methods. But if there is an application that requires special integration methods, the developer needs to be able to provide a custom integration scheme (Hummingbird 2001, 18).

PowerDOCS offers several built-in Integration Scheme interfaces (ISMs). These built-in schemes cover the most common methods of integration:

- **Open Document Management Application Program Interface (ODMA)** is an open industry standard that enables desktop applications to interface with a document management system. ODMA allows multiple applications to access the same DMS without the need for a hard-coded link between the application and the DMS (Webopedia 2003). The ODMA is the most preferable way to communicate with document management systems.
- **Passive integration with Microsoft Word and Excel.** This integration method uses the application's built-in macro languages.
- **PowerDOCS Interceptor.** The Interceptor is used for full integration of applications with PowerDOCS via the settings of launch methods and not on the basis of the respective macro modules (Hummingbird 2001, 19).

In most cases, these ISMs save the developer from writing a custom scheme. However, if there is an application that requires special integration methods the developer needs to be able to provide a custom ISM (Hummingbird 2001, 19).

## 7.2 Hummingbird Document Manager

Hummingbird Document Manager document management system is the newest version of Hummingbird's document management systems. Mainly the system functions are similar to those of the PowerDOCS 4 systems. One of the biggest

changes from the user's point of view is probably the more advanced Internet browser user interface, which covers more comprehensive functions. This also facilitates the IT organizations work, compared to PowerDOCS 4 system, because clients don't have to install anymore.

### ***7.2.1 Differences between the PowerDOCS 4 and the Hummingbird DM system***

Hummingbird DM offers some new / advanced features compared to PowerDOCS 4 system. These new features are:

- Profilable folders, folder inheritance Where-Used, related documents
- Webtop user interface
- Personalization
- Library maintenance
- Microsoft Outlook and Explorer Extension enhancements
- Active Directory Support (Authentication)

#### **Profilable folders, folder inheritance**

Folders provide navigable content structures for compound documents with descriptive profiles and activity history. This facilitates document searching from the folder structure.

#### **Where-Used, related documents**

Where used function displays where documents are also being referred. This helps the user to determine the influences of the changes. Hummingbird DM offers possibility to create better links between the documents and related documents tab where these relations can be seen. With this function documents, which contain similar content or process, can be linked. "Related Items" enable users to create virtual or topical associations from folder to folder, or file to file.

## **Webtop, Web Browser User interface**

The Hummingbird DM Webtop delivers functionalities, which are usually found only in Windows interfaces, providing hierarchical content views that support drag and drop operations.

## **Personalization**

Hummingbird DM offers also better personal workspace personalization possibilities. With these the user can personalize his or her user interface for personal needs.

## **Library maintenance**

Web- and Windows-based Library Maintenance utilities facilitate centralized repository configuration and upkeep. Hummingbird DM also includes tools for metadata mass imports.

## **Microsoft Outlook and Explorer Extension enhancements**

Hummingbird DM also includes more advanced Microsoft Outlook and Explorer interfaces. Working with these programs is more transparent than it was in PowerDOCS 4.

## **Active Directory Support**

Hummingbird DM enables authentication via Windows active directory. This enables that Windows active directory users can use single sign on. When the user has signed on to her or his own computer, the password need not be written anymore when starting DM software.

Hummingbird Document Manager unites some of the PowerDOCS 4 system modules. For example, DOCSFusion server, CyberDocs user interface and PowerDOCS client are united to one module. Hummingbird Document Manager modules compared to PowerDOCS 4 modules are introduced in table 7.

Table 7. Comparison of PowerDOCS 4 and Hummingbird DM modules.

Old Name	New Name
DOCSFusion, CyberDOCS, PowerDOCS	Hummingbird DM
DOCSFusion Routing, PowerDOCS and CyberDCOS routing	Hummingbird DM Workflow
PowerDOCS and CyberDOCS Imaging	Hummingbird Imaging
	AutoCAD DM Extension

An AutoCAD extension provides application integration between AutoCAD and Hummingbird DM. This functionality allows organizations to work more effectively with engineering documents and extends the system usability from office document management also to engineering document managements side.

### 7.2.2 Document metadata

For defining unite metadata definitions for Andritz, a development project has been started. The PowerDOCS 4 system has its own metadata definitions, which have been developed internally in different business units. These different definitions are taken to the platform and created new unite metadata definitions which will be taken into use in the Hummingbird DM system.

Metadata for Hummingbird DM system will be archived into a document profile form. Document profile forms can vary depending on the document type, because all documents do not need the same metadata definitions. In Andritz case, the first step is that there is a couple of different metadata forms for office documents and for document searches, later more forms can be developed and the metadata definitions can be focused if needed. Figure 18 shows detailed office document form and in table 8 are defined the descriptions for each field in metadata form. The standard office document form is almost of the same kind with fewer fields.

**Detailed Office-Profile-Form**

SourceCompany  ...  Doc #

Issued by  ...

Document Title

Business Phase  ... Language(s)  ...  ...

Document Type  ... Doc. Status  ...

Doc.Sub Type  ...

Application  ... Enable Content Searching

Mill Area  ... Product Code  ...

Project Number  ... Equipment Nr

Project Name  ...

Client Name  ...

Sender/Receiver  <>

Comments  <>

Access Control  
Secure Document  Edit  V

Retention Schedule  
Type  Keep ...

Document History  
Created  31.12.2002 by  MMMMMMMN

Edited  01.01.2003 by  YZZZZZX

OK  
Cancel  
Details <<

Figure 18. Detailed office document form.

- User default: mandatory entry field
- Mandatory entry field
- System fills in the data; mandatory entry field
- System fills

Table 8. Metadata forms field descriptions.

Field	Description
Source Company	Document Location, data server (file server). The library where the document is located.
Issued by	Document's Author, network alias.
Doc #	Document number; given by the system when a document is saved for the first time; a running number.
Document Title	Document name, up to 240 characters; default is the file name, but it can be modified.

Table 8 cont. Metadata forms field descriptions.

Business Phase	Previous "Business Process Phase" or "Work Area"; incl. a list of several options to choose at a time.
Document Type	Main type of the document.
Doc.Sub Type	Sub type of the document; is related to the selected Doc-Type.
Application	Program application; e.g. MS Word, MS Excel, ...
Language(s)	Document language.
Doc. Status	The readiness of the document.
Enable Content Searching	Makes possible to search by document's content.
Mill Area	Different mill areas. e.g. Fiberline, Recovery Island, Wood Processing, ...
Product Code	Product type, according to Mill Area.
Equipment No.	Equipment manufacture number or its main drawing number; used by Service e.g. E11530151000; (in the future a link to an ERP database).
Project Number	Number of the project, later can be a link to CRM/ERP database or synchronised with the above database.
Project Name	Name of the project, later can be a link to CRM/ERP database or synchronised with the above database.
Client Name	Name of the client, later can be a link to CRM/ERP database or synchronised with the above database.
Sender/Receiver	Name of sender or receiver; comes automatically from email or some Smiley templates etc.
Comments	Info related to the document or other documents etc.
Access Control/Secure Document	Who has right to do what with the document.
Retention Schedule/Type	Info for the database.
Document History/Created/Edited	System fills in the history data.
Details	A selection/s in All Folders list.

## **Digital photos**

Digital photos are also planned to store in the system. In the Graz library the picture metadata form is used, but this form doesn't contain all details needed for picture management in Finland. For example, according to Finnish legislation photographers' name is needed if the photo is used in public. So this identification data is needed for the Finnish system. Digital photos usually contain some identification data like date, time, place, name of the photographer, etc. Hummingbird DM doesn't contain tools for reading this data directly from the photo file, why it has to be filled manually into the saving form. For reading metadata directly from digital photos, some picture/photo editor is needed to integrate with the system but at the first this is not included in the system.

The functionality needed from the service point of view is that digital photos of the equipment can be stored in the system. This enables that service can collect a photo archive for example of the failures of the equipment, these photos are planned to store also in the Installed Base Machine Chart system. So service will need their own picture metadata form, which contains identification data of the equipment, photo and photographer. Photo savings can be handled first by using the detailed office document form for photos, later a separate picture form can be created. The procedure for photo savings could be that service photos of equipment failures are saved in the document management system via Installed Base Machine Chart system. In this case metadata can be taken directly from the installed base structure. The photos/pictures, which do not belong to the Installed Base Machine Chart system, could be stored in the DMS directly with the picture metadata form.

### **7.2.3 Document servers**

DMS set up has been handled as a distributed application; local Fusion servers are in Atlanta USA, Montreal Canada and Örnsköldsvik Sweden. The central database is in Hollola Finland.

DMS implementation for Pulp and Paper Mill Services is planned to handle with Hollola servers. The servers are physically located in Hollola and used over an intranet connection. The first plan was that document servers would be distributed in many places according to the main usage of documents. The metadata of documents is only in one main server in Hollola Finland. According to this solution document handling via DMS would be faster, because the documents need not be downloaded via intranet because the servers would be located in office locations. However, because of the financial matters the first solution was chosen in order to build Hollola server.

### **7.3 DMS as part of the system chart**

The document management system is one part of the company's system chart. Documents created by some application programs are saved in DMS. To make this task as easy as possible, the positioning of DMS in the system chart has to be clarified and considered carefully.

The document management system can be directly attached to document creating systems with integration methods mentioned in chapter 7.1.7. This kind of usage of DMS is the easiest because the user doesn't have to save documents separately in DMS after they have been created with some application software. From the user's point of view DMS is almost invisible, because when DMS is directly linked to application software, created documents are saved directly in DMS with the application program's own standard save function.

#### **7.3.1 Example DMS FAST link**

Andritz Kraft Mill Division uses internally developed sales application FAST for preparation of quotations. In big projects the quotation phase contains a lot of work and documentation so FAST application has been planned to integrate with DMS. A short description of the planned implementation in FAST case clarifies needed procedures of integration and the same procedure can be used

also with other systems. Affecto Oy has prepared a short description about PowerDOCS FAST link.

FAST sales application automatically creates quotation documents. This documentation is based on the project, which has been created with the application. When the needed scope of the project has been defined to the system, the system automatically creates Word and/or Excel files of technical data, prices, etc. for the equipment as attachment to the quotation.

After creation the documents are saved with Word and Excel functionality in DMS. This functionality will be carried out with an extension to the existing document forming macro. Macro will be attached for example to Word saving functionality and it guides quotation attachment savings to DMS. Information about links to DMS documents is returned to FAST interface and the documents can be viewed afterwards directly from FAST (Affecto 2003).

Saving with forming macro will be carried out with DLL-component (Dynamic Link Library) which carries out the actual document saving, macro only starts the DLL-component. The DLL-component will return the saved document ID- and revision information to forming macro. After that the original quotation attachment will be maintained in DMS (Affecto 2003).

### ***7.3.2 Installed Base Machine Chart link***

The same kind of linking like in FAST case can be also done between the Hummingbird DM and Installed Base Machine Chart systems. Needed documents from the Installed Base Machine Chart system to Hummingbird DM are in the first step service reports on specific equipment, mill visit reports on mills, quotations for mills and digital pictures of equipment failures and damages. Actual documents will be archived in DMS and a link to documents is placed to certain equipment machine chart view or to certain mill view.

## **Metadata feed automation**

When linking of DMS and Installed Base Machine Chart system is considered, linking can be handled in a way that the document metadata feed can be at least partly automated. The metadata feed automation between the DMS and Installed Base Machine Chart system can be handled by utilizing the information, which has been included in the Installed Base structure and Machine Chart system. Needed metadata for document saving is described in chapter 7.2.2.

Service reports are stored under machine charts and machine charts are under mill in installed base hierarchy. Mill visit reports are stored under specific mill. So Customer information can be taken from the mill name for a specific mill visit and service report. Also creator information has been stored in mill visit reports and service reports and it can be taken from the system. With some additions to Installed Base Machine Chart systems document-adding form all the needed metadata for the DMS system can be taken automatically from the machine chart system.

## **8 WISA PROJECTS AS-BUILT DATA**

As mentioned earlier in chapter Document hotel / Project bank service providers, in Wisa 800 REC project, the customer Wisa Forest uses document hotel services for document management of the project. Inforbis Oy, a subsidiary company of Jaakko Pöyry group, has developed Document Hotel solution. All suppliers of the project store documentation of their products in the document hotel. When all documents have been transferred to the document hotel and the project has been closed, the As-Built version of the documentation has been generated. This version of the project documentation is needed for service business, as well as in the customer's own maintenance system, and the transfer of it to Andritz' own DMS is important.

### **8.1 Wisa 800 REC Project introduction**

Wisa 800 REC project is UPM-Kymmene Wisaförrest Oy's project to build a new chemical recovery line to Pietarsaari Finland. The project includes a new recovery boiler, turbine, evaporator plant and cooking chemicals preparation plant. Also some connections to other mill departments will be modified, because the mill capacity increases. The new recovery plant is planned to start up in spring 2004. Jaakko Pöyry Group acts as the project consultant.

Andritz' scope of Wisa 800 REC project is to deliver a pulp mill chemical recovery line. The line is the biggest pulp mill chemical recovery line in the world. Building of the chemical recovery line is at the moment the second biggest construction project in Finland. The delivery includes all processes and equipment for recovery plant like evaporation plant, recovery boiler, causticizing plant and lime sludge reburning kiln.

The project documentation has been decided to store in the Document hotel document management system provided by Jaakko Pöyry Group. Also commu-

nications of published documents are handled by means of the Document hotel. The purpose of document hotels in the project is to collect project documents with metadata during the project for the project use and after the project to transfer them to the customer's mill systems. Project document handling methods, document formats, document distribution instructions, metadata definitions, project standards etc. are defined by the customer for suppliers' use.

## **8.2 Document mass transfer tool**

For document mass imports and exports to and from the document hotel a tool named Masi has been developed. Inforbis Oy, a subsidiary of Jaakko Pöyry Group, has developed Masi. Masi is a Microsoft Excell based application, which handles metadata and document mass imports to document hotel and mass exports from document hotel. Documents can be also imported to hotel separately via Internet but if there are several documents to process, the fastest way is to use mass import tool like Masi. Also changes to metadata and documents can be handled via Masi.

Masi has been developed to Microsoft Excell platform and programming has been done with Microsoft Visual Basic for Applications tools. Masi has been built to Excel worksheets, which include columns for each piece of information, to be given on the metadata input form of the document hotel. The columns contain the same menus as the metadata input form of the document hotel.

### **Masi Functions**

Masi contains functions for document handling between the Document Hotel and user workstation via Internet. Main functionalities are:

- Document metadata feed to document hotel.
- Document feed to document hotel.
- Document and metadata updates to document hotel.
- Document metadata transfer from the document hotel.
- Document transfer from the document hotel.

### ***Document upload to DocHotel***

Document metadata is fed to Masi Excel worksheets; all Microsoft Excel functionalities are in use to help this operation. When all needed metadata and the paths, from where the documents are uploaded, are fed to Excel sheets, the document upload to the document hotel can be started. Masi gets a copy of the document from its current location and transfers it to the document hotel via Internet. The document is placed in binders and cabinets defined in metadata.

### ***Document download from Document Hotel***

When documents are transferred from the document hotel, first the metadata of documents must be downloaded. When metadata download has started Masi asks the cabinet and the binder from where metadata will be downloaded. After that Masi downloads all metadata from defined cabinets and binders to the same Excel sheets, which were used also for document upload. When metadata is downloaded the user must define the path where he or she wants the documents to be downloaded. After that actual documents can be downloaded to a specified location via Internet. Document metadata is stored in Masi Excel sheets for future use.

### ***Document and metadata updates to Document Hotel***

Masi can be used also for document and metadata updates to the document hotel. If the document or the metadata is changed and the changes are wanted to upload to the document hotel, the changes to the metadata and path of documents' new version are placed to Excel sheets. After that the document upload is handled as described earlier.

Figure 19 illustrates the use of Masi for document handling. Documents can be uploaded directly from the user's workstation or from the Intranet server via user's workstation to the document hotel. Download from document hotel can be done also directly or via workstation.

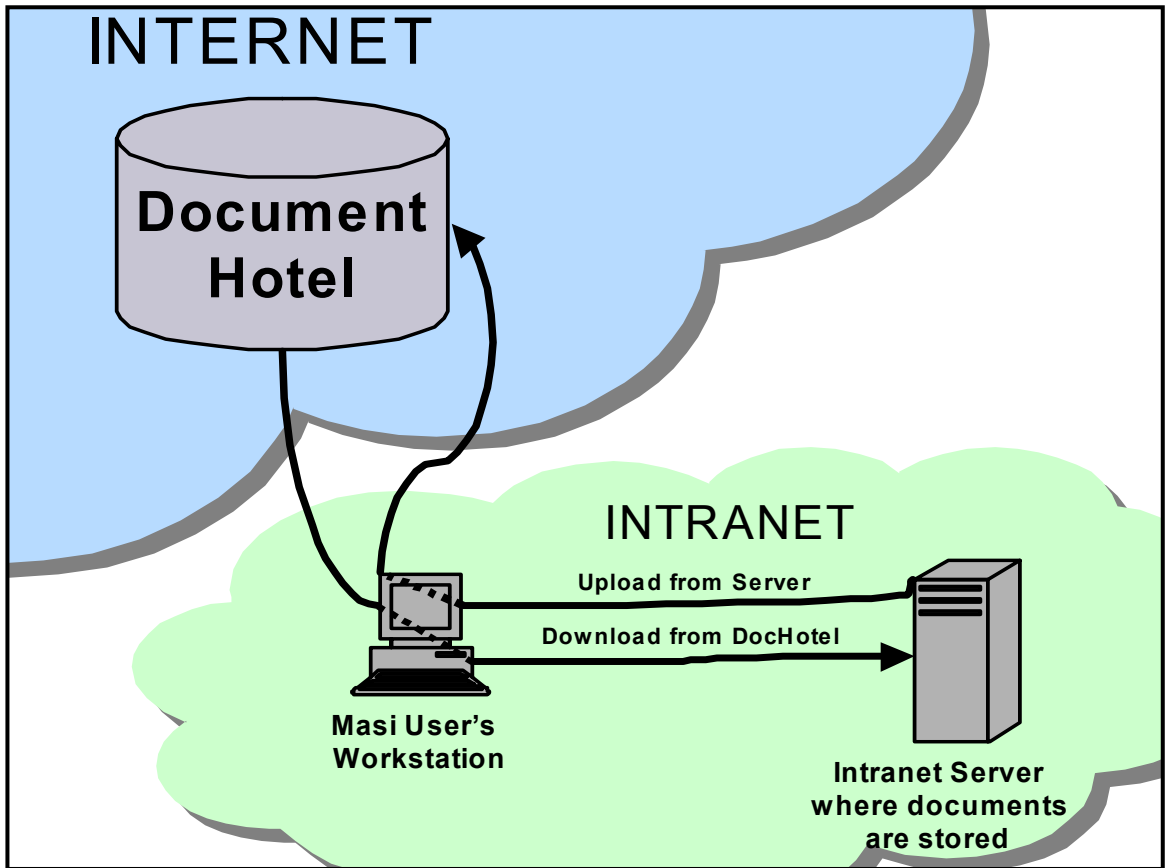


Figure 19. Use of Masi for document handling.

### 8.3 As-Built data transfer from the document hotel

Wisa projects As-Built data is planned to transfer from the document hotel to Andritz' own DMS system. Because Andritz DMS system is under construction and it will be in full use not earlier than in winter 2003, the documents have to be transferred to a temporary document repository by means of Masi tool. The temporary repository is placed in Andritz Intranet server.

#### 8.3.1 Structure of temporary document repository

The temporary document repository has been built to file the folder structure. The structure is the same as it is in the Document Hotel. First the structure was created for the server and after that the documents were transferred to the right folders. Document metadata was saved in Masi Excel sheets from where it can

be transferred to the Hummingbird DM system when it is ready. The structure of the temporary document repository can be seen from appendix 1.

Wisa project Document Hotel conceptual structure has been built from different groupings; these groupings are introduced in figure 20. The first level of the grouping is the library in this project Wisaforest. The second level is a cabinet category, in this project Yhteiset (common), Yritykset (companies) and Koulutus (training). The third level is a cabinet level; in this project for example JPH asiakirjat (JPH Documents), Andritz asiakirjat (Andritz Documents), etc. The fourth level is a binder category; in this project for example Yhteinen Dokumentaatio (Common Documentation), Talteenotto (Recovery), Sellutehdas (Pulp mill), Kuivauskoneet (Drying machines), Paperitehdas (Paper mill), etc. The fifth level is binders, in this project for example Projektin hoito (Project management), Talteenotto 3 (Recovery 3), Yhteiset (Common), Paineilmakeskus 3 (Compressed air centre), etc.

After these levels the hotel contains Virtual folders for more precise definitions. Virtual folders are defined in metadata classification. The sixth level is formed of metadata field Asiakirjan laji (documents class), in this project for example Asiakirjat (Documents), Konetekniikan piirustuslajit (Mechanical engineering drawing classes), Sähkötekniikan piirustuslajit (Electrical engineering drawing classes), etc. The seventh level is formed of metadata fields Asiakirjalaji (Document class) or Piirustuslaji (Drawing class) depending on the type of the document. In this project these are for example, T Tekn selvitykset ja muistiot (Technical analysis and memos), T Projektiaikataulut (Project schedules), etc.

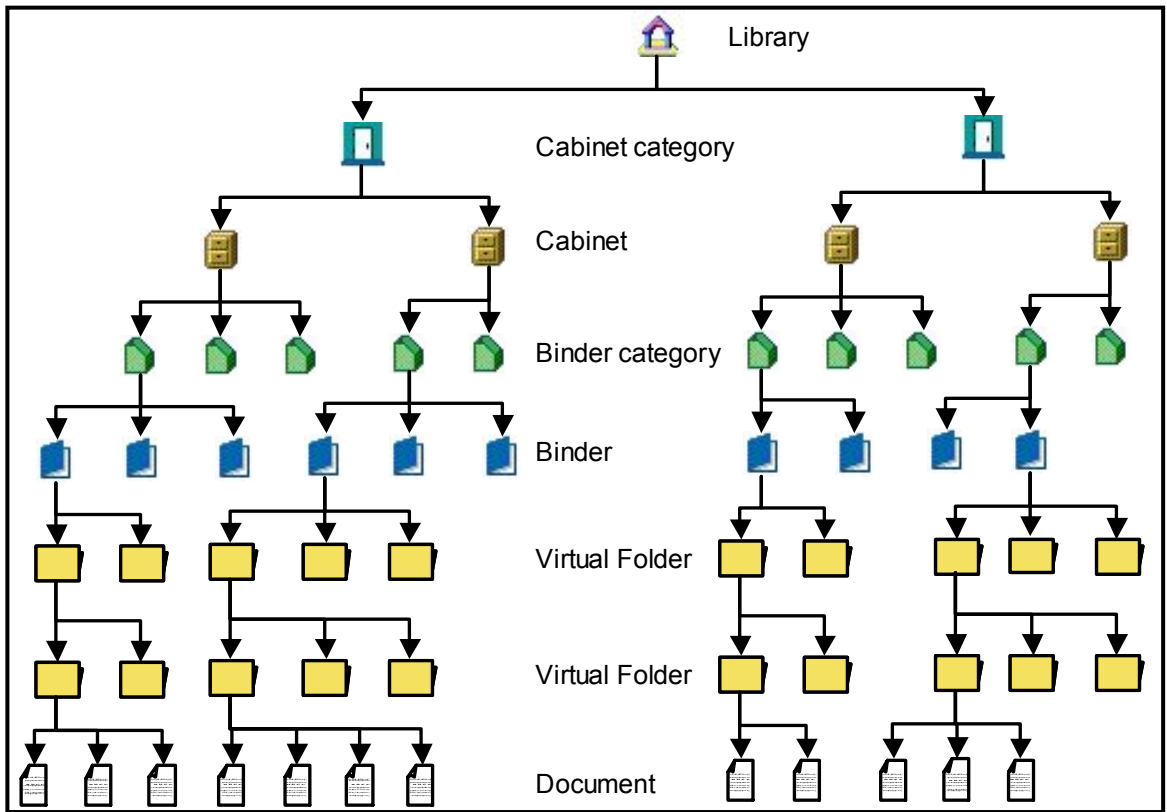










Figure 20. A conceptual structure of Wisa Forest document hotel.

The following icons represent different levels of the document hotel.

1.  Library, (Wisaforest)
2.  Cabinet category, (0 Yhteiset, 1 Yritykset...)
3.  Cabinet, (01 JPH asiakirjat, 02 Andritz asiakirjat...)
4.  Binder category, (0 Yhteinen dokumentaatio, 1 Talteenotto 3)
5.  Binder, (01 Projektin hoito, 400 Talteenotto 3 yhteiset...)
6.  Virtual Folder (Asiakirjat, Konetekniikan piirustuslajit...)
7.  Virtual Folder (T Tekn selvitykset ja muistiot, T Projektiakataulut...)
8.  Document

This structure was built to the server, excluding virtual folders. These aren't included in the structure because this level can be built afterwards if needed, by

help of the metadata file. Then the documents have been transferred over the Internet to right folders in the server.

The actual transfer stage was relatively slow because the documents come from the document server over the Internet. Some problems appeared during the transfer due to changing speed and breaks in Internet connection to the document hotel server. Fortunately Masi tool informs about errors in transfer and the transfer could be started again when the connection was stabilized. Altogether there were over 5700 documents transferred from the document hotel to the temporary file folder structure.

### ***8.3.2 Document usage in temporary repository***

When documents are in the temporary structure, before the transfer to the DMS, they must be in use of the Andritz' employees to guarantee that the documents, which are transferred to DMS, are the latest ones. In order to avoid the problems, there must be rules for document usage in the temporary repository. First all persons who will update the documents after As-Built state, must be informed of the repository. Also clear rules for document revisioning have to be developed because file folder structure doesn't include DM system revision management and updating rules.

To avoid the problems in document updating and revisioning in this transition state, one and maybe the best way to handle document updating is to appoint persons who will transfer updated documents centralized to the structure, when the needed changes are made by responsible engineers. When Andritz DMS has been implemented, this stage is not needed because DMS will handle the revisioning and updating.

### ***8.3.3 Transfer from temporary structure to DMS***

When the service DMS definition has been approved and the DMS has been implemented, documents can be transferred to DMS from the temporary docu-

ment repository. For this transfer all needed metadata fields has to be linked between the document hotel and Andritz DMS. The document hotel metadata is stored on Masi applications sheets and when the linking has been done, metadata and the documents can be transferred to DMS.

Metadata linking between the document hotel and own definitions is a complicated task and it must be done with certain generalizations. Some of the Document Hotel metadata fields aren't relevant for Andritz DMS and some can be defined as a different structure. One definition in the Document Hotel can be a set of different definitions in Andritz' system.

Metadata transfer to the coming DMS has to be handled in some reasonable way. Manual transfer of metadata and documents is too big and a time-consuming task. Hummingbird DM has document mass transfer functionality. When metadata linking between the Andritz and the document hotel definitions has been done, the transfer can be carried out by using this mass transfer functionality.

#### ***8.3.4 Documents from own DMS to customer system***

Transferring documents from the document hotel to own DMS is still the “wrong way” to handle documentation of projects. The optional way is that documents are fed to Andritz own system and then uploaded directly to the customer's system or document hotel. Problems in this solution are that the customers have their own specific metadata definitions; also different mills within the same end customer group can have their own definitions. Metadata definitions for some specific customer can be changed since the latest project. Building of the upload tool, which can be used by several customers, is difficult and the tool will need continuous development. The use of common metadata standards will help in this task in the future.

One solution to handle this problem is the complete linking of the customer's specific metadata and own metadata definitions. Linking between the manufac-

turing company and the product end user company is difficult and there are many definitions, which are missing from the other system. Also there must be a rule-based program/tool, which could translate fitting definitions into the customer's format. All definitions cannot be linked directly, so to handle definitions, which do not fit with each other, manual work is needed in most cases.

The usage of metadata standards, mentioned earlier, could be one solution. If standards are used in the supplier and customer's systems, there is no need for metadata linking. However, nowadays standards aren't commonly used and even Andritz' would use these standard definitions, benefits are minor if the customers do not use these. Also a direct appliance of metadata standards is not even possible for all companies, so even if the standards were more commonly used, metadata linking in certain degree will be needed.

One solution could be that customer specific metadata definitions are saved in their own system. A requirement for this solution is that documents can have several metadata definitions depending on the customer. This kind of solution is not possible in PowerDOCS 4 system because the system doesn't allow several metadata records for one document. However, this could be handled by creating physically different documents for all customers and creating links between these. When one of these linked documents is changed, the change will be handed down to all linked documents. The content of all these physically different documents will remain the same due to linking. Problems in this kind of linking are that the number of documents in the system will increase because the same document needs different versions for different customers. Also maintaining of metadata will become complicate because of several definitions for the same document.

One way to handle the transfer from Andritz' own DMS to the customer's system or the document hotel is to link the metadata case by case with customers' definitions and to use a tool like Masi in Wisa project to handle the transfer. When linking of definitions has been done once, this linking can be used in

coming projects with the same customer and even if the definitions have changed somewhat, the old linking offers a good platform and accelerates the linking process. Also a tool like Masi can be relatively easily customised for different needs.

Andritz uses also an internally developed ELDOC application for handling “As-Built” data about the projects. This application has been developed by Andritz Graz Austria. The application uses a Portable Document Format (PDF), the file format developed by Adobe Systems for document savings. Documents are saved under the project hierarchy. These documents and the hierarchy can be saved directly on a CD-ROM disc and sent to the customer. The ELDOC application is linked with PowerDOCS 4 system. Also this kind of solution can be used as intermediary for document transfers to customers.

## **9 NEEDS AND PROBLEMS**

In the planning and implementation phase of the information system, some needs from the user's organization will most probably arise. These needs have to be studied and clarified carefully to create a reasonable solution, which serves the interest of the user's organization.

### **9.1 Needs**

During this work I have studied the basic needs of the user's organization in a large scale, so more specific development needs for the system could arise during the system usage when the users become acquainted with the system. Next there are shortly summarised the main needs which have been noticed during the work. I have also recommended some options to handle different needs with the system. During the system implementation, these needs have to be observed and reasonable solutions or procedures to handle these cases with the system have to be terminated.

#### **Documents from Andritz' system to the customer's system**

Document transfer from Andritz' own document management system to the customer's system should be studied and transfer methods should be united. Different possibilities to handle the transfer are considered in chapter 8.3.4.

#### **Document access rights**

Nowadays document access rights for a specific document are managed by the document creator, which is on the other hand a good thing because the document creator knows best the content of the document. At the same time document creator doesn't necessarily know if some other users for example in different business unit need the document. The document can be stored in the archive without usage or can be created again when the other users don't know that document has been already created. Also when the document creator has

to take care of the access rights there is one more task to perform. If the creator doesn't know who will need the document, he or she must clarify it. These "extra" tasks can cause resistance to the system usage.

The quality of the documents, which are created into the system, will automatically improve because the system guides to use document templates and when the system is commonly used and the users don't want to put unfinished documents to it. If the access rights are defined as fixed default to users, this could become a threshold for the user. Users consider the system as "monitoring device" which is used to monitor the quality of their documents.

A solution to this can be default access rights, which can be changed. Users are usually working with the same workgroup and the documents are usually created for this group. So the access rights can be set as a default for this group and can be changed by the user if needed. In this situation the user doesn't have to define access rights separately for all documents because they are a default. These access right groups have to be defined exactly, in cooperation with the users.

### **DMS linking to other systems**

Linking of important service systems to DMS, for example Installed Base Machine Chart system is needed to link with DMS in a defined scope, chapter 7.3.2. This facilitates lifecycle information collection from the equipment.

### **Rules for document transfer**

Common rules and practices for transfer of different document versions from sales to delivery (As-Sold) and delivery to customer and service (As-Built) has to be developed. Also the direct transfer of "As-Built" material from Andritz' own DMS to the customer's system is important to study.

### **Picture form for service business**

Service needs a place where digital photos, which are taken from equipment failures and damages can be saved with a link to the equipment. The photos could be stored in the DMS via Installed Base Machine Chart system. This requires its own metadata form for digital pictures. The form can be created by modifying a picture form, which is already used in Graz Austria. Before this is done, the detailed office document form can be used as digital photo metadata form. More about this in chapter Digital photos in page 83.

### **Updates to document metadata definitions**

For the service business some additions to document metadata definitions are needed. For example document statuses "As-Sold", "As-Built" and "As-Is" are needed. These have to be inserted into metadata document statuses. Other needs may arise during the implementation.

### **Documents from subsuppliers**

One coming development need will be the transfer of subsuppliers documents to Andritz' system. Andritz uses several different subsuppliers for manufacturing, engineering and service operations. These suppliers document their products and transfer these documents to Andritz. These documents are also needed in Andritz DMS so in the future practices for this transfer are needed to develop.

### **Clear rules how to use DMS**

Clear rules for DMS usage are needed. If rules are missing, employees easily keep old traditions. For example, when the DMS is implemented, document savings in old local servers, which have been used as document repositories, could be prevented.

## 9.2 Possible problems in implementation

Some problems can arise in implementation stage. In this project these can be for example:

- System servers are in Hollola, which will decelerate the connection to DMS.
- The system can be too complicated to use by some users.
- There is no other language versions available than English.
- The system is considered a monitoring device.
- Does the usage bring documents available for right users or are the documents saved usually with too limited access rights?
- System benefits cannot be seen or reached. Users don't understand the benefits of the system to other users, or the documents are saved with too limited access rights and distributed like earlier. This makes the system almost useless.

To avoid problems in DMS usage, all system users must be well trained to use the system; also the benefits of the system must be clarified to users. A clear statement about system implementation from business managers is also needed to clarify the situation.

## 10 SUMMARY AND CONCLUSIONS

Document management without separate software is nowadays too complicated a task to handle because of huge amount and fast cycle of business transactions. ASP services like document hotels are becoming more common nowadays when companies are outsourcing most of the functions, which aren't directly relying on the core business. Information sharing with suppliers, subcontractors and customer is essential in these days. In service business this transaction with other parties is emphasized in a higher degree.

In Andritz group the document management is handled with many different practices because the company has partly grown by acquiring companies, which expand its core business. Common business processes for Andritz have been developed and will be implemented in the short run. Information and operational system unification is closely related to the common business process development. Also document management practices for Andritz are decided to unite. The platform for this uniting process has been taken by the Hummingbird's document management system PowerDOCS, which has been already used in some of Andritz business units. The newest version of the system Hummingbird Document Manager is planned to implement also in Andritz Pulp and Paper Mill Services in winter 2003.

This work was concentrated to clarify if the earlier selected document management system is proper for Andritz Pulp and Paper Mill Services needs. The work was mostly based on the PowerDOCS 4 system study, because it was already in use, which makes testing possible. The differences between PowerDOCS 4 system and Hummingbird Document Manager system main functions are minor so the PowerDOCS 4 system was proper for the test purposes.

The system was studied mainly from the product lifecycle management's point of view. The product lifecycle in Andritz contains three major steps i.e. Sales, Delivery and Service. The product lifecycle management in Andritz Pulp and

Paper Mill Services concentrates on lifecycle monitoring of individual products in production conditions in mills. Collection of the product lifecycle history is especially important for service business. History has to be collected properly in a common place where it can be easily found.

With earlier mentioned customisations Hummingbird Document Manager system covers the basic needs of Andritz Pulp and Paper Mill Services. With these changes the system will be a great development of document management practices if it is properly taken into use and all employees are committed to using the system.

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# Appendix 1

## Structure of temporary document repository

