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**CLOSER LOOK INTO CONTENT MANAGEMENT: WHY INVEST
RESOURCES IN DOCUMENT MANAGEMENT?**

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ABSTRACT

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The digital content companies have to handle is increasingly large. Any company and their workers now face a problem where documents accumulate in unstructured ways. This causes relatively large waste of workers' time and ultimately companies economic losses. A solution to this problem was required by the Detection Technology company and this thesis aims to present the problem at hand a possible solution.

This thesis defines the problem of increasing amount of digital content to manage in a company. It also presents a solution in Enterprise Content Management and more specifically in Document Management Systems (DMS). Both concepts are defined, and their activities explained in the theoretical frame. More detailed descriptions of the components of a DMS are highlighted in order for the reader to be able to grasp the most important parts of a DMS.

The choice and implementation of a DMS in a company can be beneficial in many ways. However careful attention has to be paid to the research for the most suitable DMS for one particular company. This is discussed in the section on Return On Investments and limitations of a DMS.

To help the reader understand in a practical way what the research for the best DMS entails, a practical example was performed in this thesis, for the specific needs of the DT company. Their needs are described. A selection process for suitable DMS is demonstrated along with their testing. Finally, the tested DMSs were weighted.

This thesis is encompassed in the following research question: How can the right choice of content management and especially of DMS significantly enhance the efficiency of a small and medium size enterprises?

Keywords: content management, document management, document management system, digital content management

PREFACE

The purpose of this thesis topic came from a need expressed by Detection Technology, Inc. (DT) established in 1991. This company provides services and products globally related to X-ray imaging. Their area of applications spreads over medical, security and industrial fields. While the headquarters of DT are in Oulu, and they have another small Finnish office in Espoo. Their international offices are established in the US and in China, and they provide products and services in 40 different countries. They employ all over the world approximately 280 employees and the company has been steadily growing over the past several years (Detection Technology, 2015).

DT has expressed the need to organise their digital content and to find a suited DMS option. Their network drive-based shares have become a burden to use with their limited revision control and user rights management, especially now with the increased amount of new employees. The lack of predefined process for document management might also cause unnecessary duplicate versions and this often leads to disorder and waste of time. This thesis was requested in order to address this issue.

This thesis work was carried out in the fall of 2015 and the spring of 2016. Matti Tuomikoski from the DT company played a key support role in the elaboration of this thesis. I would like to thank Matti and Ilkka from DT for their help and support. Additionally, M-Files and Canon companies were met face to face and they generously offered their product for trial as well as some support. Those meetings were organised in collaboration with the DT team. I would like to thank Sampo Torikka from M-Files, and Tomi Lias and Jan Lindeman from Canon for their generous support during the testing. My supervisor for this thesis is Terhi Holappa. She supported my work during the last year, and collaborated with DT. I would like to thank her for her support throughout the process.

In Oulu, 12.04.2016

Jaakko Suorsa

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VOCABULARY

CMS	Content Management System
DITA	Darwin Information Typing Architecture
DMS	Document Management System
DT	Detection Technology, Inc.
ECM	Enterprise Content Management
IS	Information System
IT	Information Technology
LAN	Local Area Network
OCR	Optical Character Recognition
ROI	Return on investment
SaaS	Software as a service
SME	Small and medium sized enterprises
UI	User interface
VPN	Virtual Private Network
WLAN	Wireless Local Area Network
XML	Extensible Markup Language

1 INTRODUCTION

Content management has gained importance in the majority of modern day enterprises over the past two decades. The amount of electronic or digital content being produced and handled on a daily basis is steadily rising. Managing all this without proper tools can be troublesome and time consuming. This thesis investigates two concepts: Enterprise Content Management (ECM) and Document Management Systems (DMS). While the difference between the two may be clear to some, here is a very brief explanation of the differences that will be tackled all along the elaboration of this thesis. ECM can be conceived an umbrella concept to describe all the digital content an enterprise has to manage, such as images, emails, videos etc... An ECM can be pictured as an office assistant that will recognise the *content* within a document and will automatically know who, where and when to send it. A DMS on the other hand, is a more specific tool and has less functionality than an ECM. A DMS could not be pictured as an office assistant, but more as a filing cabinet. It is a simplified version of an ECM that focuses on *documents as wholes* and not on the specific content of each document. While the functions of an ECM are more extensive and are often targeted to customers with more security concerns (lawyers, doctors), they also come with a heftier price. This is why DMSs are often considered more specifically for smaller enterprises, as they enhance the document management of a company while keeping the prices relatively low (Zybert, 2014).

The importance of enterprise content management (ECM) and especially document management systems (DMS) are often overlooked by small and medium size enterprises (SMEs). Many tend to rely on their old network-drive based or similar systems. Possible reasons explaining this could be the relatively high ECM or DMS implementation costs, which might look terrifying on paper but pays itself back in matter of months from the implementation, in best case scenarios. To illustrate this, the DMS Company M-Files had done Return On Investment (ROI) calculations for the Detection Technology Inc (DT), in 2012. It was estimated that the initial implementation and training costs would be covered

in two months in form of saved work hours spent on handling and managing documents.

DT's current Document Management System solution is no longer sufficient with the ongoing growth of the company. Consequently, this thesis focuses on the importance and the understanding of content management and especially document management systems. This will highlight the positive outcomes coming from the right choice of a specific ECM/DMS best suited for a specific company. Therefore, the research question is: **How can the right choice of content management and especially of DMS significantly enhance the efficiency of small and medium size enterprises?** To further this research question, testing of DMSs were operated in order to choose an appropriate DMS solution for a specific company, which is DT in this case.

The main purpose of this thesis is to display the positive sides of the implementation of an ECM/DMS. However it is important to also display the risks of such implementation, as plenty of work and resources are involved. This thesis examines concepts related to content management, such as enterprise content management and its benefits. Then it goes to the specifics of document management system and its components. The following part will go through the financial benefits gained by use of a DMS by illustrating Return on Investment approximates. Goals and methods will be explained followed by the testing of DMSs and test results. Finally the results of the thesis and conclusion will be discussed.

2 CONTENT MANAGEMENT

This chapter discusses enterprise content management (ECM), talking about the components and logics behind it. It then highlights the benefits of the use of an ECM in modern day enterprises. This chapter also gives basis for the understanding of the following chapter about DMS.

2.1 Enterprise Content Management

Enterprise content management (ECM) is now crucial to all organizations that create, organizes and archive data, documents or information. ECM can be seen as a strategy, a tool or methodology. It is used to manage, preserve, deliver and archive information in all its forms. ECM allows for that information to be easily accessible throughout its lifecycle, across the organisation (Alalwan & Weistroffer, 2012; Cameron, 2011; Caressi, 2009; Vom Brocke, Simons & Cleven, 2011). According to these authors, there are many ways to categorize the area of functionality of ECM. Therefore, for the purpose of this research: create, manage, deliver and archive/discard will be the main areas used and explained, as can be seen in Figure 1.

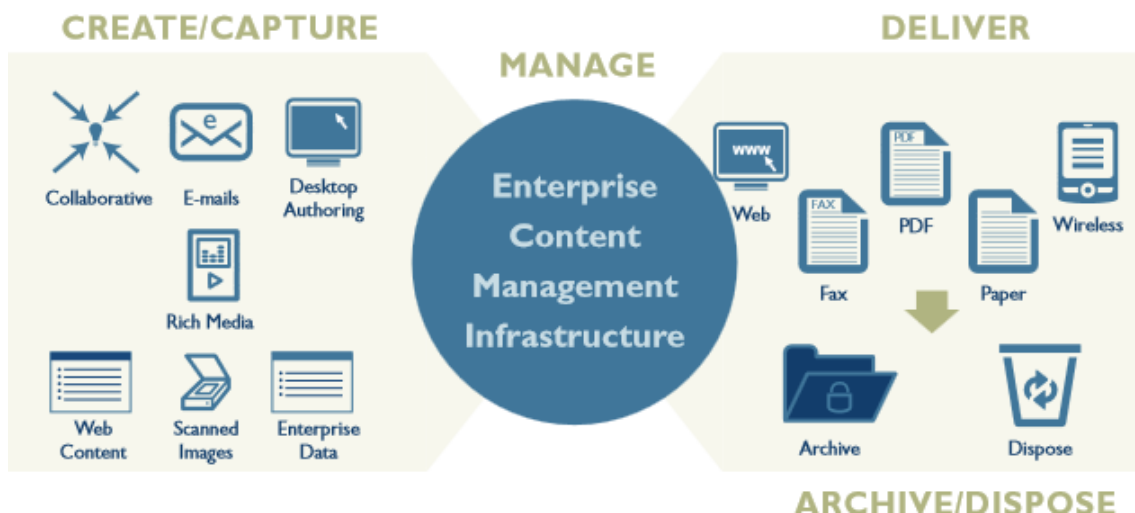


FIGURE 1. Content areas of an ECM (Caressi, 2009)

People in enterprises *create* the content, from a vast array of sources and document types, to be turned into electronic forms – digital content. The creation of those documents also allows for data identification, extraction, validation and indexation (Caressi, 2009). The digital content can then be centrally *managed* in order to enhance collaboration, processes, interactions and exchanges. The digital content created can be searched, secured, and controlled, with all the different stakeholders (Cameron, 2011; Caressi, 2009). The most useful area of functionality for ECM is in the *delivery* process, as this is the one that enhances or impedes the availability of information in a smooth and efficient way. This will ensure that the information is available and/or delivered in the correct format, to the right person in a timely manner.

2.2 Benefits and use of ECM

The efficiency and accuracy of this digital content delivery is a central concept in this thesis. An overwhelming amount of data is created to be managed and delivered. A large portion of it is traditional paper documents being digitalised. With this increase in the amount of digital content in companies, comes along an increased unstructured organisation of the new digital content. For example, it has been shown already some years ago that the unstructured digital content to be stored and delivered increase at a rate of 800MB per person per year (Alalwan & Weistroffer, 2012). Moreover “Over the last 25 years, enterprises have spent a substantial portion of their information resources budgets on data-centered and system-centered applications that represent less than 15 percent of the average enterprise’s information assets” (Sutton, 1996, preface). The authors explain that 75-80% of the digital content companies hold is unstructured, ill formatted and sometimes hard to find when needed. They add that this unstructured digital content is increasing from 65 to 200% per year in the industry sector. This alone calls for a fundamental shift from the traditional ways the digital content is managed and available to the member of companies. It crucially calls for the use of ECM, especially for large companies. When digital content is no longer needed, it is often not apparent that it should be discarded in order to free up space from the storage systems. Only for these reasons, it is clear that there is an urgent need for ECM in modern day enterprises, resulting from the exponential

growing need of management, delivering, archiving and disposing of currently unorganised digital content.

Precious time can be saved while making efficient use of ECM. Time and money is saved while people are being delivered the right information in the right format at the right time. Time (and money) is also saved in the workflow, the solving of document management problems and in the employees sticking to their task description instead of dealing with such time wasting tasks, caused by a disorganised mass of digital content to look through (Alalwan & Weistroffer, 2012; Sutton 1996). It was shown that traditional approaches to document management have failed (Sutton, 1996). The exponential increase in unstructured digital content along with the failure of traditional ways to manage documents “caused the emergence of different content management platforms that support various applications (...) many organizations have implemented enterprise content management (ECM) systems” (Alalwan & Weistroffer, 2012, p.441). Some companies are still hesitant to invest in enterprise content management systems, as they are not aware of the extent of time being wasted, efficiency and productivity not being maximized. The argument debated here is for the implementation of ECM, to increase the employees’ efficiency and productivity, resulting in massive returns at the end of the year. A relatively small investment in ECM could in time generate substantial returns even for smaller companies.

Large or growing companies such as Cisco, IBM, Nokia or Oracle had to take those issues in consideration and acquire tools that would enhance more extensively structuring, developing, managing and publishing of their digital content (Benz, 2010). Even smaller company who would want to work with a variety of concepts and products, and make it available for the construction of other concepts would greatly benefit from a more specific organization of digital content. For instance a Darwin Information Typing Architecture (DITA) could be tremendously helpful. While it is worth mentioning that this system is interesting and promising, it is not a core part of this thesis. Therefore, some additional information about DITA is provided in this thesis, in the Appendix 1.

Following the section on Enterprise Content Management, it is logical to focus now on document management. While ECM is broader in the management of raw data in all forms, document management, regards the management of documents, rendering the handling of the documents themselves easier. A document management system is basically a software that manages (store, track, retrieve, archive) the digital content throughout their life cycle.

3 DOCUMENT MANAGEMENT

Now that the idea of the 'office assistant' managing the *content* has been explained in the previous chapter, the idea of the 'filing cabinet' in document management systems follows. In this chapter, the definition of document management system is developed. The components are displayed.

“Harnessing information technology to manage documents is one of the most important challenge facing IS managers in this decade (...) Electronic Document Management (EDM) promises major productivity and performance increases by applying new technology to documents and documents processing” (Sprague, 1995, p.29). Even though this quote was written some 20 years ago, it is still very relevant today and speaks about the preoccupations of people working with Information Systems (IS), then and now.

3.1 Definition and understanding of Document Management System

In order to understand the concept of *document management*, it is important to understand what document means, and what management means in this context. Michael Sutton (1996) has described these two really well in sub-chapters of his book. He defines a document as a package of data, and examples of documents can be notes, emails, purchase orders, invoices, spreadsheets or studies. When looking at the meaning of management in the context where it applies to documents, a manager designs and maintains a domain, for groups of organized resources to efficiently reach an objective. When putting the two concepts together defining document management, it can be conceptualized as a virtual organizer that stores packages of data (documents) in electronic formats (digital content), on a server that can store, index and retrieve when needed – just like an electronic filing cabinet.

Many of the DMSs, including both of the tested products, change the usual way of thinking when it comes to managing information. 'Where' something is stored changes to 'what' is stored. This classification can be achieved by carefully filling in the metadata during document creation, and following company-wide rules

regarding mandatory metadata fields. More information about metadata and other DMS features are discussed in next subsections.

The figure below illustrates the different functions of DMSs in general. The italicized words will be described further in this chapter. The whole situation described in the figure below rests on the *underlying infrastructure* of a DMS that contains all the computers and devices linked through a network, which allows for all the operations described below to take place. The figure shows that any document types can be handled. Creating any documents or capturing them into a DMS will be related to *authoring* features (tool to capture documents in the DMS). While authoring, a user wants to make good use of *metadata* which makes the documents understandable by both humans and computers. Once the documents are captured, they can be stored (in a cloud or on premises) and managed in the DMS, as shown on the figure below.

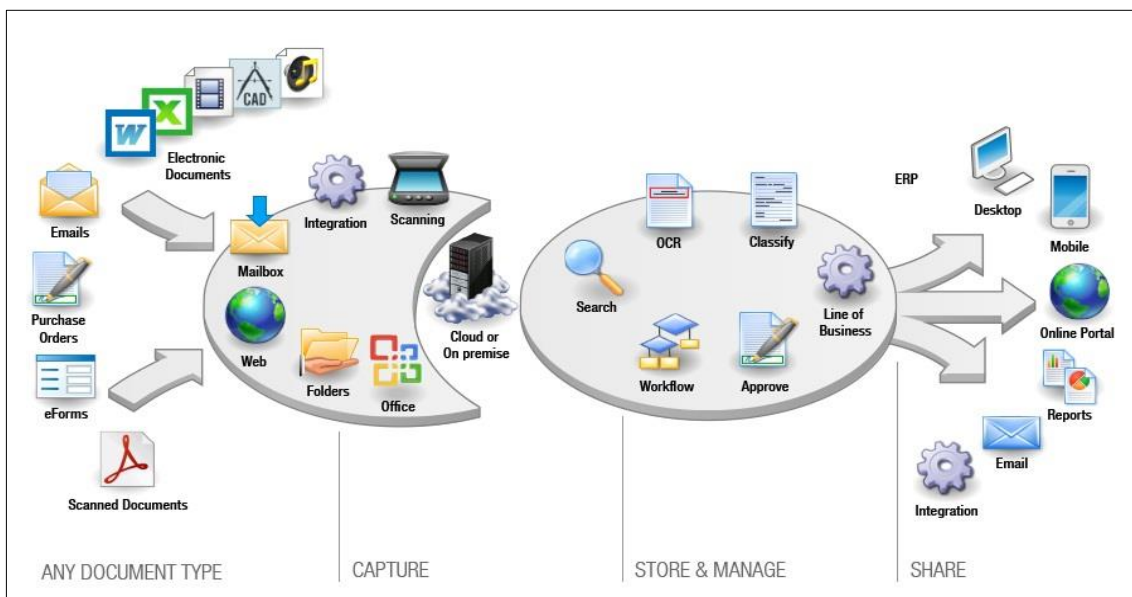


FIGURE 2. An illustration of the functions of DMS (Kazz, 2015)

The *storage* feature is fundamental and allows for users to store, search and retrieve documents. As shown on the figure above, the managing aspects of a DMS rests on the *workflow* (approval) and *library services* (*check-in and check-out*). The management of documents in a DMS include also *document recovery and backups* which are crucial to avoid data loss and *security* plays an important role in the management also.

In the next sections, the basic features of a DMS explained above with the Figure 2 is described, in order to give the best and clearest picture possible of the most important features to pay attention to in the choice of a DMS.

3.2 Features of a document management system

There has been traditionally two types of document management; management of editable documents and management of fixed documents. This distinction has vanished due to the DMS producers that tend to integrate or merge the two into one. In this section, there is therefore no clear distinctions as to which feature belong to which type of document management. It is only worth noticing here that fixed document management usually involves access, indexing and retrieval while editable documents use processes in relation to authoring, workflow and revision (Cleveland, 1995). Both types of document management mentioned above can generally be found in all of the modern day DMSs.

A good and flexible DMS allows the document creator to define the user rights (read, edit, delete/write) during the document creation process via the document profile. In many enterprises, this type of document protection and user rights management is handled by the network access rules and in order to make changes, help desk has to be contacted for assistance (Campbell, 2007).

In order to provide a more extensive understanding of a typical DMS, here are the basic features one can recognize from most DMS solutions currently available on the market. This hopefully enhances the use and benefits of a DMS.

3.2.1 Storage / Document repository

The central part of the DMS is where all the digital content is stored. As shown on Figure 2, storage usually consists of database and search engines, where the latter helps users to retrieve the documents. This is supported by features such as browsing functions or search and retrieval functions. (Cleveland, 1995; Components of an Electronic Document Management System, 2008)

3.2.2 Underlying infrastructure

While this is not exactly a component of the DMS application, it is still crucial and required part to operate a DMS. The infrastructure usually rests on hardware one can generally find from an office, such as desktop computers or servers for example. The interconnection of the computers through a LAN or WAN is also counted as part of the infrastructure (Cleveland, 1995).

3.2.3 Metadata

Simply put, “Metadata is information about the content that provides structure, context and meaning” (Lovinger, 2012, My Definition). It is a summary that describes the data, which is a central aspect in DMS as it enables faster searching and working with the digital content. Typical details included in metadata can be for example: author, creation date, date modified, file size and so on. Metadata can be used to classify and index documents for faster search and retrieval (Components of an Electronic Document Management System, 2008). Example of typical metadata, and its’ three types, can be seen from Figure 3 below.

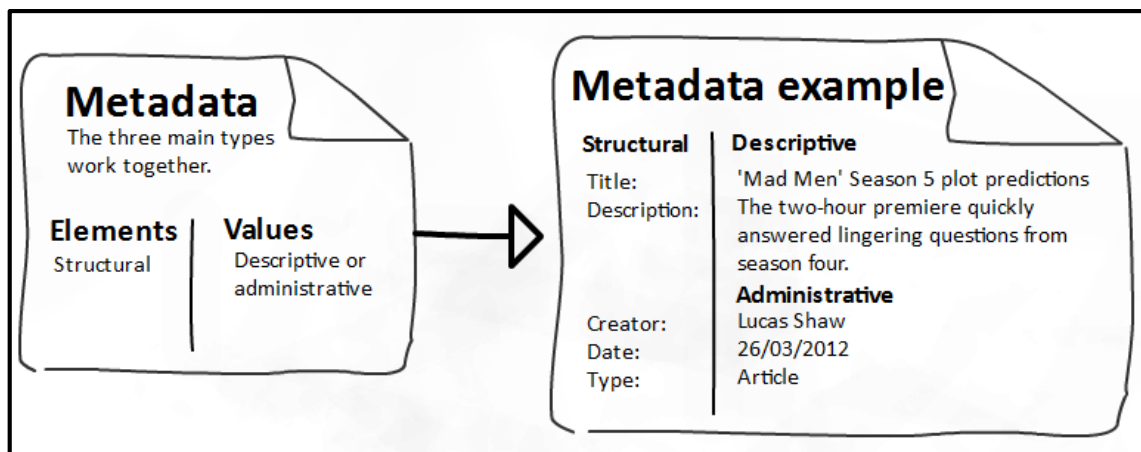


FIGURE 3. The three main types of metadata (Benson, 2012)

3.2.4 Authoring

In order to create documents, authoring tools can be used for support. As explained by Cleveland (1995):

“Some more sophisticated tools support structured or guided authoring, where authors are constrained by the system to enter data in specified ways. Typically, they are interfaced with DMSs in order to capture document metadata at the time of creation and revision“ (p. 2).

3.2.5 Workflow

According to Cleveland (1995) “Workflow is defined as the coordination of tasks, data, and people to make a business process more efficient, effective, and adaptable to change. It is the control of information throughout all phases of a process” (p.2). Workflows can make the processes more efficient with various functions, such as “authoring, revising, routing, commentary, approval and by setting deadlines and milestones” (Cleveland, 1995, p. 2). It is a central aspect in document management because it give enterprises control and ability to monitor their business critical documents during their lifecycle (Campbell, 2007; Cleveland, 1995).

3.2.6 Library services – check-in/out, version control and security

“Not to be confused with what librarians consider to be library services, this is a term used specifically by the document management community to refer to document control mechanisms such as *checkin*, *checkout*, *audit trail*, *protection/security*, and *version control*.” (Cleveland, 1995, p.2)

Check-in and check-out functionality can be found from most of modern DMSs and it basically “allows only one user to edit a document at a time” (Components of an Electronic Document Management System, 2008).

When a user wants to edit a document, he/she has to use the check-out functionality. This prevents others from editing the document while it is being checked-out and modified, and they can only view the read-only copy of the document. Once the user is done modifying the document, he/she uses the

check-in functionality which allows other users to view or modify the updated document (Components of an Electronic Document Management System, 2008).

Version control is a process which uses check-in and check-out functionalities to keep track of all the changes being made to a document. A user can revert back to earlier versions if needed. It is especially useful for documents, such as user manuals or technical datasheets, which can change over time and require updating. Documents are generally given whole numbers for major revisions, such as 1.0, 2.0, etc. The Figure 4 below shows an example of version control.

User	Event	Version	File version	Date	Comment
Admin Admin	The document has been checked in	2.0	2.0	12/17/2010 18:46:23	made a change
Admin Admin	The document has been checked in	1.4	1.4	12/17/2010 18:08:34	
Admin Admin	The document has been checked in	1.3	1.3	12/17/2010 18:06:56	
Admin Admin	Document metadata have been changed	1.2	1.0	12/17/2010 16:11:55	
Admin Admin	Document metadata have been changed	1.1	1.0	12/17/2010 16:04:08	
Admin Admin	The document has been created	1.0	1.0	12/17/2010 16:02:47	

FIGURE 4. Version control in action (Online24x7 India Private Limited, 2013)

Searching and retrieving of documents is one of the major reasons why DMSs offers the productivity and efficiency enhancing effects. By classifying and indexing the documents, they can be easily found even from a huge database within a reasonable time frame. DMSs offer various ways to search for digital content and some of the most common ones are:

1. Browsing folder structure (similar to Windows Explorer)
2. Basic search functionality – allows the use of keywords that match either content or metadata.
3. Advanced search functionality – allows “combining several metadata fields to find documents as well as searching for words or phrases in documents’ contents” (Components of an Electronic Document Management System, 2008). Both basic and advanced search can be capable of ‘fuzzy’ search, which searches words closely resembling the original word.

Security of documents is crucial for most of the enterprises planning to implement a DMS solution. This can be achieved with rights management module, in which an administrator can apply permissions, such as read, write and view. These permissions can be applied to group(s) of users, single users, folders and even individual files.

Version control can be useful when it comes to security, as the administrators can see from version history if the document has been altered or a person without access has modified it (Components of an Electronic Document Management System, 2008; Document management system, 2016).

3.2.7 Document recovery and backups

“DMSs typically provide strong support for document backup, archiving, and disaster recovery” (Campbell, 2007, Basic Document Management). These functions are usually tied-up to the enterprises other backup systems to give the best possible protection against data loss in case of a natural disaster, fire hazards etc. Traditional paper document management is vulnerable to these kinds of hazards (Campbell, 2007).

4 RETURN ON INVESTMENT AND LIMITATIONS OF A DMS

There are many advantages to pick and implement the right ECM and more specifically DMS in one's company. One important advantage is clearly displayed by Return on Investments calculation. As mentioned in the introduction, M-Files had presented their DMS solution for Detection Technology Company in 2012 and had done a survey about the possible efficiency boost and the financial benefits the DMS would bring to the company. As it can be seen from the figure below, substantial savings can be realized in relatively short time.

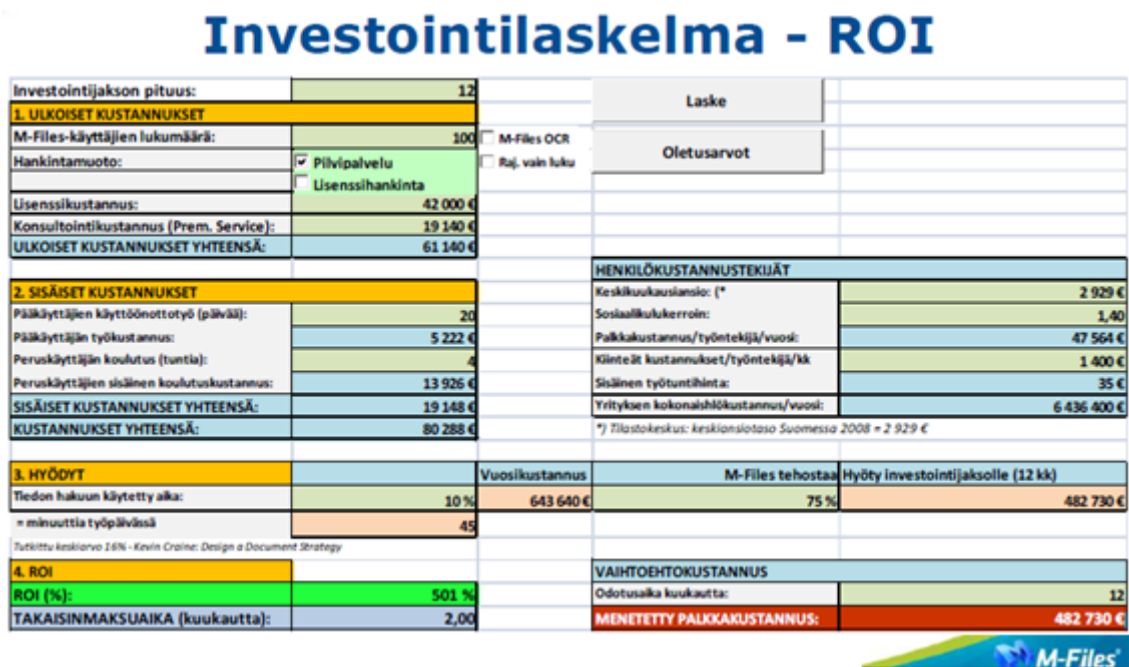


FIGURE 5. Return on investment calculations (M-Files, 2012, p.41)

This figure represents theoretical benefits the DT Company could gain in the future. It shows that on average, each worker spends 45 minutes managing/looking for documents, which corresponds to approximately 10% of their work day. Those calculations show that 643 640 euros are spent in that company every year just for workers managing/looking for documents. It also shows that theoretically, in the next 12 months 482 730 euros will be spent by the company without the implementation of this DMS.

From the figure above, it is easy to understand that on paper, the financial investment required to implement the M-Files DMS would pay itself off in 2 months. This is calculated using the median monthly income in Finland in 2008, and using the estimated time used with documents on daily basis as well as how much M-Files would boost the document handling efficiency.

Other companies have done similar kinds of calculations, and even researches have been done for various sizes of companies on that topic as shown in the figure below.

Increased Profitability by Business Size*			
Business Size	\$500,000 in annual revenue	\$1,000,000 in annual revenue	\$4,000,000 in annual revenue
Technology Investment	1.4% of revenues (\$7,000)	2% of revenues (\$20,000)	1% of revenues (\$40,000)
Staff Savings	1000 hours (0.4 of a full-time employee)	1500 hours (0.6 of a full-time employee)	6000 hours (2.4 full-time employees)
Overhead Savings	8.6% of revenues (\$43,000)	8.9% of revenues (\$89,000)	8.6% of revenues (\$342,000)
Profit Increase	41.2%	55.9%	40%
Business Value Increase	\$216,000	\$626,000	\$3,421,000

**Based on Laserfiche research. Download the full white paper, "ROI for RIAs," at www.laserfiche.com/ROI.*

FIGURE 6. Increased Profitability by Business Size (Laserfiche, 2007, p.7)

From the figure above, it is clear that major profit increases can be obtained from the implementation of a DMS in most company sizes. Theoretically, the implementation of a DMS is sound as it displays so often a fast return on investment as well as an improvement of the workers' efficiency. However, one must remain aware that while this is true on paper, things are more complicated in the reality of the field.

As Forcada Matheu (2005) explained, there are many drawbacks to keep in mind when thinking of investing time and resources in a DMS. A very complicated and important one is about the working culture and practices among a specific enterprise. Workers are used to work in a certain way and may have done so for

decades. Old habits die hard and for the implementation of a DMS to run smoothly, a complete implementation plan has to be developed, and the benefits of the implementation have to be 'sold' for the workers to be convinced without a doubt that this is the only real way to go. They have to be convinced that all the time and effort they are about to invest into the changing of their practices, workflow and processes is worth it in the end, for themselves and the company. This is not an easy task and should not be undertaken hastily.

More drawbacks mentioned by Forcada Matheu (2005) are that the DMS world is a fast changing one and it is in constant evolution. A company must be willing to research and invest into new versions and components, in order to remain up to date. The author also mentions that an effort has to be made for all documents produced and handled to be (turned) in electronic form to become digital content, and it is not as easy as it seems to achieve in practice. Paper sketches, notes, letters, drawings, invoices etc. are common place in the work life but will have to be turned into digital content in order to be placed and managed in the DMS and this requires efforts from the workers. The subsequent work on those documents, by multiple people at once, may be even easier to be done on paper but all have to understand the ultimate goal and purpose of the DMS work and implementation.

To emphasize the importance of the implementation plan of a DMS in a company, it is useful to keep in mind hypothetical examples where it was not done properly and where the implementation of a DMS was disastrous. This is not to discourage such implementation, but only to raise awareness towards the importance of the right strategy and to illustrate how it could go wrong if not done properly.

5 GOALS AND PURPOSE OF THE THESIS

To address the goals of the thesis, it can be said that the research question is: How can the right choice of content management and especially of DMS significantly enhance the efficiency of a small and medium size enterprises? This research question has already been answered partly in the theory chapters. To exemplify the research question, testing of DMSs were operated in order to choose a suited one for DT. To do so, the following goals were listed in the planning phase of the thesis:

- Evaluate DT's current document management solution
 - Find out weaknesses in order to point out areas which would benefit from the implementation of a DMS
- Gather theoretical knowledge about DMSs and their specifications
 - Familiarize oneself with theory by using books and online resources
 - Apply the knowledge in the following sections by choosing the DMSs to be tested
- Survey of currently top rated DMSs on the market
 - Set up criteria (quality, price, usability, extensibility etc.)
 - Set up categories for testing
 - Choose two suitable candidates for testing
 - Testing of the chosen candidates

After completing the goals listed above, the following goals were added when the focus of the thesis changed:

- Conclusion
 - Answering the research question by reviewing the literature and showing examples of Return on Investment for few different cases

6 METHODS

Now that the goals have been explained and developed in the previous chapter, there is an explanation of how each of these goals were achieved. There is a description of how the need of document management was evaluated along with the theoretical knowledge gathering. This is followed by an explanation of how the testing was elaborated.

6.1 Evaluation of DT's current document management solution

This evaluation was done at the beginning of the project. It has been explained in the preface and the introduction that the need to organise DT's digital content and to find a suited DMS option was present. Their network drive-based shares have become a burden to use with their limited revision control and user rights management, especially now with the increased amount of new employees. The lack of predefined process for document management might also cause unnecessary duplicate versions and this often leads to disorder and waste of time.

6.2 Gathering theoretical knowledge about DMS and their specifications

This gathering was done prior to the survey of DMSs, and was elaborated in chapters 2 and 3. This was achieved by reading books and online resources for gathering information.

6.3 Document management systems survey

The survey of currently top rated DMSs available on the market is explained in this section. There is an explanation as of how suitable candidates were chosen to be tested.

6.3.1 Setting up the criteria and the categories

The requirements from DT regarded pricing and type of licenses; integration with third party software (mainly MS Office and Sharepoint); highly customizable metadata, workflow and user-right management options. These requirements

excluded most of the free-to-use DMSs options, as maintaining, developing and administrating the whole DMS would require extensive amount of work from the DT's IT-department.

Therefore, the categories to survey and pick a DMS were chosen to fit the main areas of interest for the people working with documents. In relation to these most crucial parts, the selected categories to be rated for the comparison and analysis were mainly oriented towards usability and ease of access. Categories in question are the following: user interface usability, file saving, creating documents, searching, workflow, tasks, metadata structure, tutorials/manuals, favourites, templates.

The rest of the categories were mostly features. Here are some examples of these features: email integration, OCR support, mobile access, replication/backups, user right management/permissions, license types, client type, multi-site support and update pricing and frequency.

6.3.2 Choosing the test candidates

In the very beginning of the thesis, there were multiple options for document management systems to choose from. Choosing the suitable test candidates from a vast ocean of good options needed some narrowing down. Guidelines given by The Detection Technology company included the following: the DMS should be hosted on the providers end (Software as a service, SaaS), and it should have an external support service. Moreover, development and maintenance should be the providers' responsibility. The DMS has to operate with Microsoft Windows operating system and mobile/web access support and OCR would be preferred for converting paper archives into digital form.

The document management systems considered in that research phase were AutoEDMS, DocuShare by Xerox, Laserfiche Avante, M-Files by M-Files Inc., ThereFore by Canon and PinPoint by LSSP Corporation. From these options, which all fitted the criteria set before, three options were chosen on the basis of earlier interaction of DT members with Xerox, Canon and M-Files. The local office of Xerox and Canon in Oulu helped arranging the meetings, which would not have

been possible with some of the other providers who are located in different countries. Meetings were planned and held with all three DMS companies, in which the possible trial versions were discussed, while having a preview and presentation of their product. The final two candidates, M-Files and ThereFore, were chosen based on the preview of their product and discussions during the meeting.

6.3.3 Testing of the chosen candidates

Both of the products (M-Files and ThereFore) were tested by two IT-oriented experts. The most crucial parts of the DMS were tested. The selected categories to be rated for the comparison were mainly oriented towards usability and ease of access. Categories in question were rated on the scale of 1 to 5, and they are the following: user interface usability, file saving, creating documents, searching, workflow, tasks, metadata structure, tutorials/manuals, favourites, templates. The rest of the categories were mostly features, which received a yes/no answer.

The conclusion of the testing is displayed in the section about the test results, in 8.2. In there, proposition for suitable DMS is explained.

7 ACTUALIZATION

In the beginning of the thesis construction, the main goal and focus was in the testing and analysing three different document management systems with a planned test group consisting of 3-5 'basic users' who would have used the DMS in their daily work. This would have given a somewhat realistic picture of the working habits of the people who spend most of their time with documents. Due to hectic schedule at the office for the last two quarters of the year, I was not able to assemble the 'basic user' test group and the testing part was operated only by one person from the IT organisation as well as myself. As a result, the testing part lost some of its original purpose and it was decided to change the focus of the thesis to the whole concept of content management and have a wider analysis of how enterprises would benefit, mainly financially, from having a designated Content Management System or DMS.

8 RESULTS AND SYNTHESIS

After going through the different concepts of ECM and DMS, ROI and methodology with a testing practical example of a DMS for DT, this thesis has now covered and achieved what it was set out to do. It is important to choose the right DMS in order to get the most out of the system in use. Researching appropriately the best suited option for one's company's needs helps in preventing expensive mistakes.

In this section, an example of DMS testing is performed in order to contrast different DMS solutions for DT. The tested DMSs are weighted according to their rated categories. This final stage is used to exemplify how researching for a DMS option can be operated.

8.1 Testing results of the chosen DMS candidates

User license types were similar for both tested products (and for most of the DMSs in general) and they are the following:

- Named user license – assigned to individual login account and it can be used independently any time. This type of license is usually meant for key-users of the organization who work with the documents on daily basis.
- Concurrent user license – each login takes up one of these licences and it becomes available for other users after logging out. This is typically used by people occasionally working with DMS.
- Read-only license – same functionality as named user license but the user is only able to read (view) and not create nor modify data. For example, customers and employees who want to have a preview of technical documents, could use this type of license.

8.1.1 M-Files

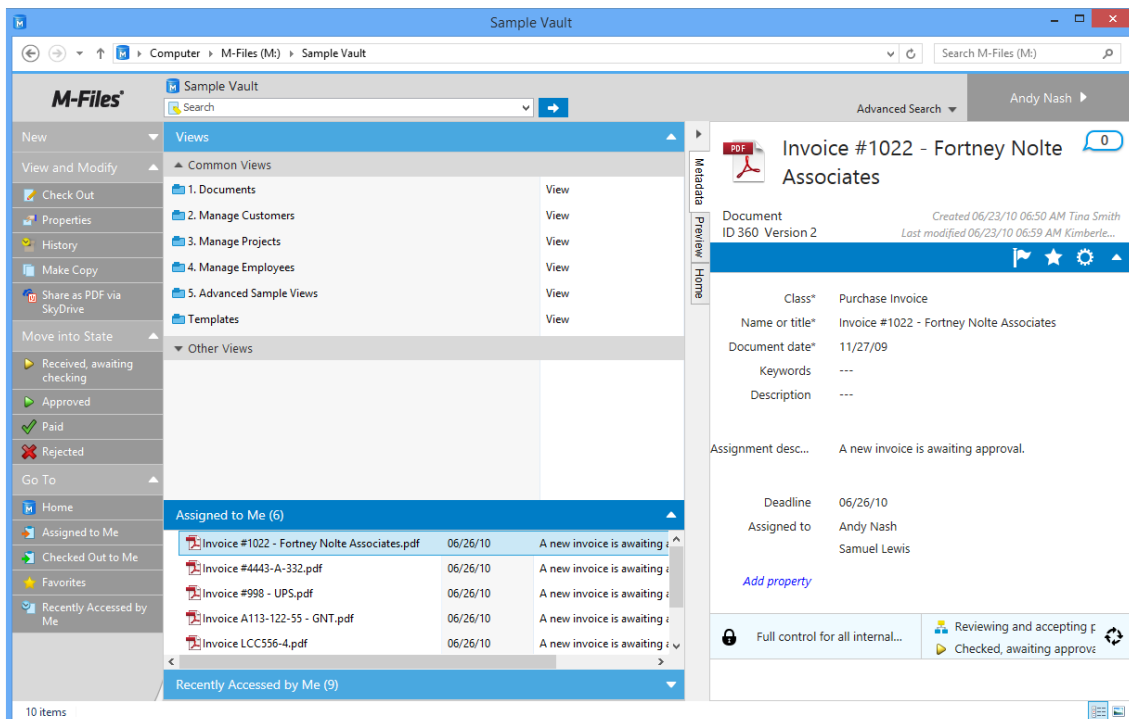


FIGURE 7. M-files desktop client interface (M-Files, 2012)

M-Files has been developed by M-Files Inc. and offers a highly versatile DMS solution with the familiar Windows Explorer User Interface (UI) and integrates with various products, including Windows Explorer, Microsoft Office, Outlook and SharePoint. Documents within M-Files can be accessed with three different client options: M-Files Desktop, M-Files Web and M-Files mobile apps. M-Files desktop and server software supports operating systems with various versions of Windows, including versions from Windows Vista to Windows 10 and Windows Server 2008 to Windows Server 2012 R2. Supported operating systems for mobile applications are: Windows Phone 8.0 or later, iOS 7.0 or later and Android 2.3.3 or later. The M-Files Web (cloud service) can be accessed with any operating system, as long as the browser is supported, making it available for Mac and Linux users. M-Files products are currently available in 29 different languages. More details about supported products, operating systems and languages can be found from their website. The M-Files online academy offers

tutorials for all the basic functions and several training options are available for IT- and business administrators and system architects. (M-Files, 2015).

M-Files comes with three possible deployment options: **1) On-premises server** - which is best suited for enterprises that have already invested in server hardware and systems. Using this option does not exclude the use of M-Files Web access and mobile applications outside the company premises. VPN connection can be used to access the data vault wherever the user is located. **2) Cloud server** – offers software as service (SaaS) flexibility with licences and scalability, which means the possibility of expanding storage and increasing the amount of user licences when needed. Cloud server is a great option for smaller companies, because it does not require significant capital investments and comes with flexible monthly billing. M-Files Cloud Vault also provides automated third-party back-ups to protect against data loss or theft. **3) Hybrid server** – is the combination of two options mentioned above. Organizations can use their existing hardware to run the data vaults and it is possible to use the cloud services (public or private cloud) also (M-Files, 2015).



FIGURE 8. M-Files clients (left side) are used to access M-Files Server (center), which manages the document vaults (right side) (M-Files, 2015)

8.1.2 ThereFore

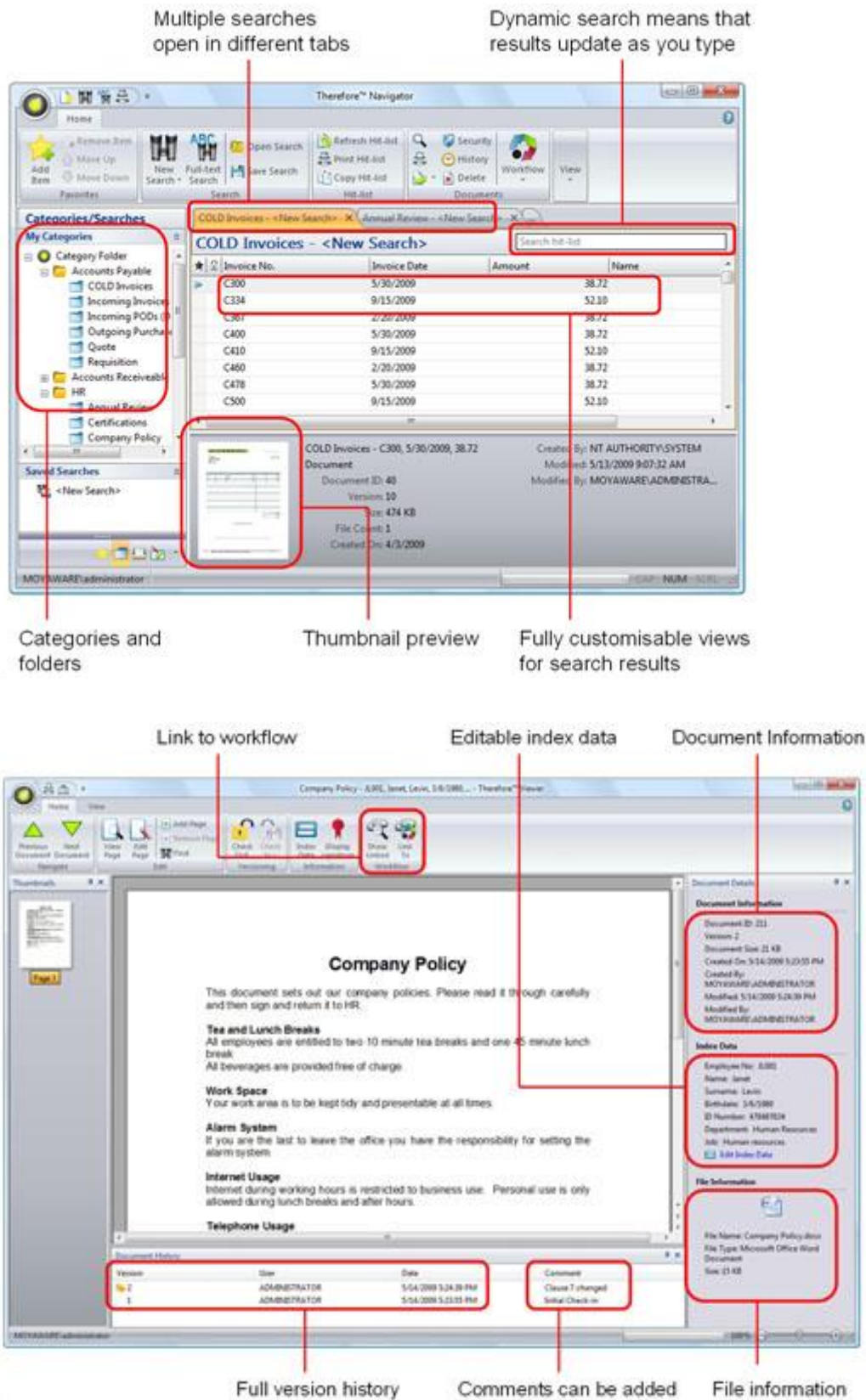


FIGURE 9. ThereFore client user interface (MPF SpA, 2015)

Canon's ThereFore solution offers highly secure and versatile DMS with an emphasis on information capture and regulatory compliance. ThereFore has a user interface similar to Microsoft Office products and all the different editions of ThereFore integrate seamlessly with Microsoft Office and Windows explorer. The Enterprise edition of ThereFore gives you the option for Microsoft SharePoint integration. Available editions of ThereFore are the following: Personal (one user, no workflows), Workgroup (5-50 users, no workflows), Essentials (5-50 users, SME, up to 5 workflows), Enterprise (2 to unlimited users, unlimited workflows).

ThereFore offers three typical client options: Microsoft Windows Client, Web Browser Client and Mobile App Client. Microsoft Windows Client supports Windows versions from Windows Vista to Windows 10. Web Browser Client can be used on any operating system, as long as the supported browsers are being used. Mobile App Client works with Apple IOS 5.0+ (iPhone, iPad), Android 2.2+ (smartphone, tablet) and Windows Phone. ThereFore also has Multi-Language Support for all the editions and full list of supported products, browsers, languages and capabilities can be found from their website (Canon U.S.A., Inc., 2015).

Improved regulatory compliance is one of the strengths of ThereFore DMS and it helps businesses to meet the document compliance regulations with automatic digital signatures. ThereFore comes with thorough user and admin manuals and does not offer similar online learning solution as M-Files. During the implementation phase, the product is tailored to specifically fit the needs of one's business, as it is extensively scalable. Typically implementation, including staff training, can be accomplished within a week.

8.2 Synthesis of test results

Both of the tested products ended up scoring close to each other, with only slight differences in few areas. The only notable difference was in the user interface usability, where M-Files has kept the familiar Windows Explorer interface on most of the parts and ThereFore has a new looking interface, closely resembling MS Office interface. Even though the interface in ThereFore looks similar to MS Office, some functionalities are different than what MS Office and Windows

explorer users are used to. As a result, M-Files felt slightly easier to use without any former knowledge of the products. In the light of this discussion, both products were suitable for DT.

9 CONCLUSION

The unstructured digital content companies have to handle is increasingly large. This can lead to waste of workers' time and ultimately companies economic losses. A solution to this problem was required by the Detection Technology company and this thesis aimed to present the problem at hand and a possible solution.

This thesis defined the problem of increasing amount of digital content to manage in a company. It also presented a solution in Enterprise Content Management and more specifically in Document Management Systems (DMS). Both concepts were defined, and their activities explained in the theoretical frame. More detailed descriptions of components of a DMS were highlighted in order for the reader to be able to grasp the most important parts of a DMS. The choice and implementation of a DMS in a company can be beneficial in many ways, and this was discussed in the section on Return On Investments and limitations of a DMS.

To enhance the understanding of what the research for the best DMS entails, a practical example was performed in this thesis, for the specific needs of the DT company. Their needs were described and a selection process for suitable DMS was demonstrated along with their testing. Finally, the tested DMSs were weighted, and a suggestion was then given to DT for good DMS options fulfilling their needs.

This thesis was encompassed in the following research question: How can the right choice of content management and especially of DMS significantly enhance the efficiency of a small and medium size enterprises? It is fair to say that the thesis achieve what it was set out to do. The goals enumerated in the chapter 5 were all met as explained in chapters 6, 7 and 8.

For the implementation of the DMS, further testing is required from a dedicated group of testers who work with documents on daily basis. Furthermore, many SMEs are facing the same problems as DT, and are having a deeper look into content management and its potential benefits might be helpful for many other enterprises.

There are numerous DMS on the market and finding the right solution for one specific company might be challenging. One commonly made mistake is to pick a DMS hastily because of the urgent need of digital content organization. However with the vast amount of DMS available, one has to carefully choose the DMS best suited for their company's needs. This requires time and patience, and a well elaborated implementation plan but will benefit the company in the end by having their needs properly addressed by the right DMS.

It should be noted that even if most of the thesis focuses on the beneficial sides of content management, a critical eye must remain. There is a risk in poorly implemented solution and this can be catastrophic for companies. While this can be scary, a careful approach in the choice and implementation of a DMS can be life changing for some workers, and beneficial in all aspects of their work as well as returning larger profits for the company in the end.

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APPENDICES

Appendix 1 DARWIN INFORMATION TYPING ARCHITECTURE

The Darwin Information Typing Architecture (DITA) is XML-based platform, first developed by IBM in the early 2000s. It was created for organizing digital content by concept, topic and task (Day, Priestley & Schell, 2005; Leslie, 2001; Priestley, 2001). This architecture is used for authoring and delivering sophisticated modular information, primarily used in technical communities. The main idea behind this architecture is on the reusing and linking of the digital content in forms of modules. In this way, one topic or concept can be linked and reused in many different documents, and delivered in many different platforms, which can be edited by the members of the company (Leslie, 2001; Priestley, 2001).

DITA is generally used for technical documentation in large enterprises which manufacture multiple different models of the same product (Day, Priestley & Schell, 2005). The Cisco Company, for instance, manufactures various different network related products, such as routers which are mainly composed of the same components, differing only slightly between the different models. The purpose of the use of DITA in this case, is to “create modular technical documents that are easy to reuse with varied display and delivery mechanisms, such as help sets, manuals, hierarchical summaries for small-screen devices, and so on” (Priestley, 2005, Creating new topic-based document types).

In technical fields, Content Management Systems (CMS) are commonly discussed with DITA. While DITA does not necessarily need a CMS to operate, CMSs will provide DITA with useful features. For example, a CMS source control and review tracking features could definitely be enhancing DITA topics and maps management (Benz, 2010, Maps).

