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IWVI

Comparison of Mobile Applications for Enterprise Content Management Systems

Bachelorarbeit

zur Erlangung des Grades eines Bachelor of Science (B.Sc.)
im Studiengang Wirtschaftsinformatik

vorgelegt von

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Abstract

This thesis is providing an overview over the current topics and influences of mobile components on Enterprise Content Management (ECM). With a literature review the core topics of enterprise mobility and ECM have been identified and projected on the context of using mobile Apps within the environment of ECM. An analysis of three ECM systems and their mobile software lead to an understanding of the functionalities and capabilities mobile systems are providing in the ECM environment. These findings lead to a better understanding for the usage of mobile Enterprise Content Management and is preparation. The thesis focuses the most important topics, which need to be considered for the usage and adoption of mobile Apps in ECM.

Zusammenfassung

Die vorliegende Bachelor-Arbeit bietet einen Überblick über die aktuellen Themen und Einflüsse von mobilen Komponenten innerhalb von Enterprise Content Management (ECM). Dabei wurden mit einer Literaturrecherche die aktuellen Kernthemen von Unternehmensmobilität und ECM identifiziert und in den Kontext einer Nutzung von mobilen Apps im Bereich ECM gerückt. Eine Untersuchung der Funktionsvielfalt und Fähigkeiten von drei ECM Systemen und deren mobilen Applikationen führten zu wichtigen Erkenntnissen für den Einsatz von mobile Enterprise Content Management und deren Vorbereitung. Die Bachelor-Arbeit fokussiert die wichtigsten Themen, die bei der Einführung und Nutzung von mobilen Apps im ECM berücksichtig werden müssen.

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List of Abbreviations

DM Document Management. 4

ECM Enterprise Content Management. 1

ECMS Enterprise Content Management Systems. 1

ECS Enterprise Content Software. 2

EDM Enterprise Document Management. 4

GSM Global System for Mobile Communication. 6

HSDPA High-Speed Downlink Packet Access. 1

IaaS Infrastructure as a Service. 11

ICT Information anc Communication Technology. 7

IRM Information Resource Management. 5

LTE Long-Term Evolution. 1

mECM mobile Enterprise Content Management. 8

PaaS Product as a Service. 11

SaaS Software as a Service. 11

UMTS Universal Mobile Telecommunications System. 1

1   Introduction

Enterprise Content Management (ECM) can be described as "the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes"[1]. This thesis investigates current Enterprise Content Management Systems (ECMS) and their possibilities for mobile data access. Therefore, the current ECMS and their mobile applications are analyzed regarding their functionality. The first chapter provides an introduction to Mobile Enterprise Content Management and the research investigation. It starts with a problem statement in Section 1.1 where the motivation for this thesis is included. Section 1.2 describes the research goals followed by the research questions which are answered during the thesis. At the end of this chapter in Section 1.3 an overview of the thesis is given.

1.1   Problem Statement

The technical achievements in the area of information and telecommunication technology have changed the practices in private usage and in companies rapidly. Since the introduction of new mobile radio standards like UMTS (Universal Mobile Telecommunications System) and HSDPA (High-Speed Downlink Packet Access) it is possible to use mobile devices with faster data transfer rates. The current 4G technology standard LTE (Long-Term Evolution) enables download rates of 50MBit/s to 100MBit/s (Meen, Prior, & Lam, 2015). Furthermore, the development of mobile devices itself and their capabilities has changed the ways of working with them. The resolution of screens, sensitivity and precision of touch screens and the computation power of mobile devices have been improved and lead to new possibilities for mobile usage (Tsai & Dong, 2013). These technical achievements are reflected by the steady growth of the market for Smartphones and mobile apps since 2007, the year of the iPhone introduction. Especially the estimated growth rate of app Stores, like the Apple App Store and the Google Play Store for Android devices, of 677%, shows that new possibilities for the use of mobile devices appeared (Giessmann et al., 2012).

The 'Statistisches Bundesamt' showed that mobile devices are widely spread and also the amount of mobile internet users is growing. From 2012 to 2013 the number of mobile Internet users in Germany has increased about 43%. The highest amount of mobile Internet users regarding to their age is be found in the group of 16 to 24 year old people. 81% of them are using mobile Internet while 61% of the people between 25 to 44 year old are taking advantage of this possibility (Statistisches Bundesamt, 2014). This will have an impact on organization since new and young employees are even more used to work with mobile devices than older employees. Also when it comes to personal computers the trends are towards mobility. The share of mobile computers in private households increased massively over the last years. In 2008 only 33% of mobile households had mobile computers in their possession which has changed to 65% in 2013 (Statistisches Bundesamt, 2013). It clearly shows that the number of stationary personal computers is decreasing which also points out the demand of mobility. These demands of private households coming along with technical improvements also have their impact on the way how employees work in enterprises.

The trend towards mobility in organizations is driven by technology developments and enables new ways of workflows and possibilities to execute tasks (Topi & Tucker, 2014) while there are also needs arising from employees who want to be able to perform tasks while being mobile, like they are used to in their private environment (Harper,

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[1]http://www.aiim.org/What-is-ECM-Enterprise-Content-Management, retrieved 19.2.2016

2003a). These private habits influence work life and also have an impact on the general demand for mobility in enterprises. In the year 2013 57% of German employees used their working time for business related travels or home office. This trend is growing and needs to be addressed from organizations in order to keep workflows efficient (IDC Central Europe GmbH, 2015). Thus organizations need to provide a solution for employees that is supposed to work during business travels or have the possibility to work in home offices.

In 2008 14% of German companies had mobile internet access. This number has increased to 33% within 6 years (Statistisches Bundesamt, 2012) and shows that organizations have recognized a need for mobile access to enterprise related information. More and more companies recognized that it is important to develop strategies for mobile access to enterprise content. Every second company in Germany implemented mobile strategies in the year 2015. This is a raise of 20% compared to the year 2012 (IDC Central Europe GmbH, 2015). But the literature analysis disclosed a lot of problems in the range of strategies and a mismatch between the expectations of IT decision makers about the expected and actual number of private mobile devices used within the company environment (Absalom, 2015), (Armando et al., 2013), (Olalere et al., 2015). This trend, called 'Bring Your Own Device' (BYOB) could lead to data security issues which need to be taken into account by organizations (TeleTrusT Deutschland e.V., 2006). More details about this topic are to be found in Section 2.4.3 of this thesis.

52% of companies with more than 10 employees provided their employees portable devices with access to the Internet for business related work. The Statistisches Bundesamt determinded that this percentage is increasing with the size of the company. 72% of these companies are enabling the access to the companies email system and 44% are enabling the access to documents in order to change or read them (Statistisches Bundesamt, 2012). There are different approaches for handling, maintaining and managing enterprise data and the access to it. Enterprises can use Fileservers, Enterprise Content Management Systems or Data-Transfers such as email. Email is still the widest spread and most used channel for communication and file distribution or sharing. But emails have weaknesses in long-term management, restrictions in file sharing and cause problems when the employee was absence for a while. Often times masses of emails arrive to the inbox. Some are important and some are not relevant at this time anymore. A difficulty exists in prioritizing and processing them. An information loss can not be debarred (Whittaker & Sidner, 1996). Thus organizations found other ways to manage information and documents. One of these are Enterprise Content Management Systems (ECMS), which are the main focus of this thesis. Even in this field different vendors offer different solutions. The market of ECMS is briefly described in section 2.5 in Chapter 2. Since the focus of this work relies on mobility related to ECMS, it investigates the Enterprise Content Solutions Alfresco, IBM Connections and OpenText Core and their mobile applications whereat the focus relies on the applications for mobile devices. Details about this analysis are explained in Chapter 4.

1.2   Research Objectives and Research Questions

In general this thesis outlines functionalities which are offered by the ECM and Enterprise Content Software (ECS) products Alfresco, IBM Connections and OpenText Core and their mobile components. In order to achieve this goal, the desktop and mobile version of these vendors are compared to each other. Thus differences between the vendors desktop solutions, the different mobile applications and also differences between the mobile application and their desktop version can be detected. Also unique approaches and different scopes of functionalities in the desktop and mobile versions of the vendors can be recognized. At the end individual strengths and weaknesses can be identified and lead to a better understanding of the aspects that need to be understood for using devices for

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Mobile Enterprise Content Management. In summary the research objectives (RO) are to

RO1 identify the functionalities and capabilities of mobile enterprise content management applications.

RO2 compare different ECMs according to their mobile and desktop capabilities.

RO3 detect general strengths and weaknesses of mobile ECMS.

RO4 provide recommendations on how to use mobile applications in ECM.

To address the objectives of this thesis the following research questions were defined. The questions are used as guidelines for the thesis and are answered during the thesis.

RQ1 Which functionalities of ECM Systems can be used within mobile applications?

RQ2 How does the capability of different mobile ECM and ECS Apps distinguish?

RQ3 What are general strengths and weaknesses of mobile ECM?

RQ4 What are the recommendations for using mobile ECM?

These research questions are answered in chapter 5 with the help of chapter 4 where a detailed analysis of the ECM systems and their mobile applications is conducted.
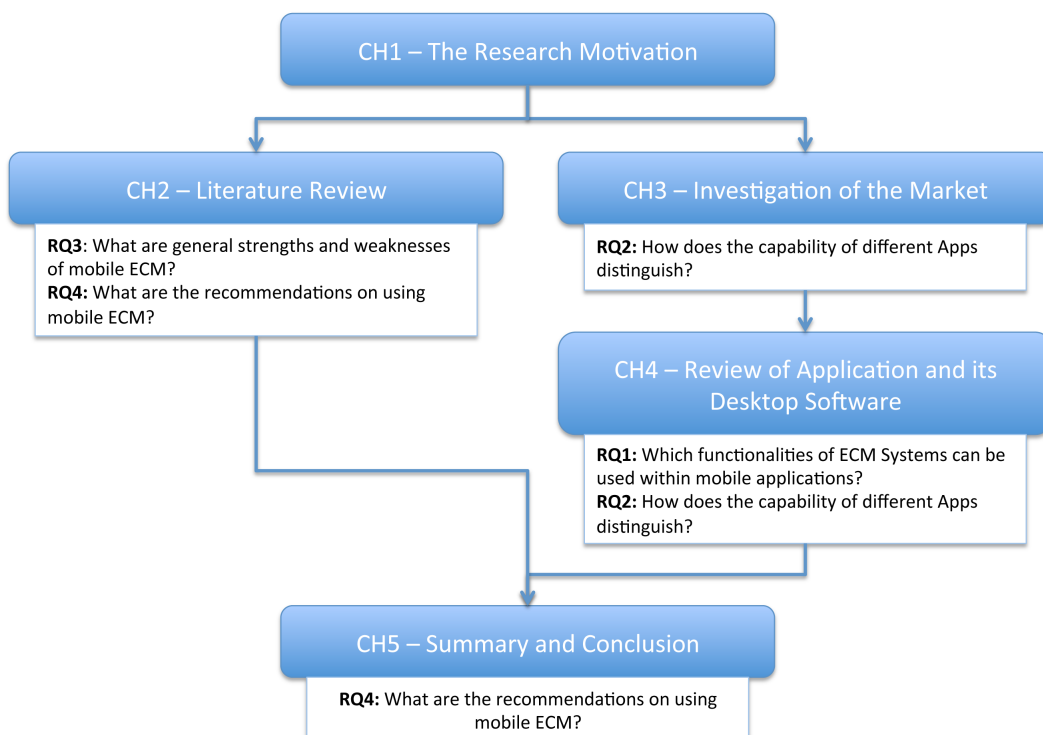
1.3   Outline of this Thesis

Figure 1: Overview of the Research (Author's Illustration)

This thesis consists of 5 chapters which describe the background and trends in the field of Enterprise Content Management. This first Chapter states the motivation of this

thesis and with the definition of the research questions which will be answered during the thesis. Chapter 2 provides the findings of the literature analysis and provides the sections 'History of Enterprise Content Managemen' (2.1), 'History of Enterprise Mobility' (2.2), 'Mobile Enterprise Content Management' (2.3), 'Current Trends in Enterprise Content Management' (2.4) and 'The Market' (2.5). In Chapter 3 the investigated ECS are introduced and analyzed subsequently according to their functionality in Chapter 4. At the end of this thesis, in chapter 5 a conclusion of the findings of this thesis is provided. Figure 1 gives an overview of the thesis' structure and indicates where information for answering the research questions can be found.

2 Literature Review

This chapter provides a historical view on Enterprise Content Management (section 2.1) and Enterprise Mobility (section 2.2). Besides, it defines and explains the concept of 'Mobile Enterprise Content Management' based on a literature review. At the end of the chapter the current topics in ECM are analyzed and are described in the sections 'Mobility', 'Cloud' and 'Security'.

2.1 History of Enterprise Content Management

The history behind the term Enterprise Content Management results from old human attempts to preserve knowledge. Philosophers tried to document their knowledge and the origins for their knowledge with documenting their findings for millennia even before that. Practically managing this knowledge was implicit and unstructured which it often still is nowadays (Wiig, 1999). The today's understanding of Knowledge Management (KM) was formed by an evolution (Wiig, 1997). Incremental approaches to organize knowledge systematically and to make it explicitly available, formed the understanding of KM which is present at the moment (Wiig, 1999). In order to completely understand KM it is necessary to investigate the relation of KM to 'knowledge' and 'information', which also needs to be distinguished carefully (Wiig, 1997), (Badii & Sharif, 2003). Henry defined three different levels of information; the first level consists of 'data', which for example is a set of numbers gained by an experiment and / or its records, while the second level is 'information'. Information is achieved by adding a context to data. An example would be weather data on temperatures, recorded in form of numbers, which will become interpretable information, if the unit degree Celsius is added. By adding human experience, skills or interpretations the third level of information is reached, which is called 'knowledge'. In this example knowledge would be, knowing which clothes are suitable for each temperature (Henry, 1974). Thus Enterprise Information Management is focusing on the management of information while knowledge management is aiming for the availability and accessibility of knowledge. The investigated Enterprise Content Management Systems have features to support the entire knowledge creation process from data over information to knowledge.

Organizing information or data which is captured in documents is a discipline called 'Document Management' (DM) or 'Enterprise Document Management' (EDM) and is part of the evolution towards ECM. Paperbound DM was state of the art but changed to "Electronic Document Management" caused by the introduction of computers. (Björk, 2002). More and more documents were accessible, storable and manageable on computers. This is why AIIM defines Document Management as "the use of a computer system and software to store manage and track electronic documents and electronic images of paper based

information captured through the use of a document scanner"[2]. Thus EDM is address-ing the management of files (Sprague, 1995). Other predecessors of ECM are consid-ered to be 'Information Resource Management' (IRM) and 'Knowledge Management' (km) (Päivärinta & Munkvold, 2005). ECM nowadays can be understood as a modern concept of IRM which is aiming to integrate semi- and unstructured data with formal databases. Formal databases had been the core concept of IRM. Modern ECM goes beyond EDM and IRM and integrates "new technical and organizational solutions to keep track of content together with its organizational production and use in all its imaginable technical forms" (Nordheim & Päivärinta, 2006).

As mentioned in the Introduction AIIM is defining Enterprise Content Management currently (2016) as "the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes" [3]. Be-fore, in the year 2003 AIIM expressed the definition of ECM as "The technologies used to capture, manage, store, deliver, and preserve information to support business processes" (Kampffmeyer, 2006) which shows that the actual management behind the technology was not yet taken into account. In the year 2005 AIIM excluded the Business Process Management (BPM) component in the definition: "Enterprise Content Management is the technologies, tools, and methods used to capture, manage, store, preserve, and deliver content across an enterprise." (Kampffmeyer, 2006). Thus again, the focus was more set on tools and technology to manage content in an organization and business processes were not taken into account compared to today. The earlier definitions of ECM focused the tools for capturing managing and storing information and not the coverage of the entire infor-mation life cycle described similar by Mack et al. (2001), Päivärinta & Munkvold (2005), Smith & Keen (2003) and Williams (2015).

Technical ECM-Solutions have evolved and introduced new features from time to time. One evolutionary step was the detection of the importance of Metadata. Metadata enables Information Retrieval and Dissemination, Resource Descriptions, Preservation and Reten-tion, Managing Users and Ownership and Rights Management (M-Files, 2012). Vendors identified the possibilities of using Metadata and included them into their Enterprise Con-tent Management Systems (ECMS). Thus information could be sorted by date, last access and other values. Even nowadays the usage of Metadata is not yet bailed out as Gartner determined in his research report of March 2012. Metadata is unlocking the value of data and requires management attention in order to not fail "critical activities such as informa-tion management, business process management and service-oriented architecture (SOA) initiatives" (Gartner, 2012).

Since the amount of data, which needs to be managed by organizations, is increasing more and more it is crucial to address this information and avoid unmanaged and thus un-structured information in the ECMS (Blair, 2004). Unstructured information and different file types of documents are a problem for organizations. As a result a trend towards XML files emerged (Andersen & Batova, 2016) which can be used with web-based ECMS. These files are structured, highly customizable and accessible via different devices, which is an important factor for enabling mobile access to the information in the ECMS. Thus using Web 2.0 technologies and XML will influence the future development of ECMS (Shegda et al., 2015).

Over time the needs of organizations were demanding to align IM towards business processes and best practices of a company. The Gartner research team describes legacy information management, search and content analytics, composite content applications and case management frameworks, electronic discovery, shared services and alternative

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[2]http://www.aiim.org/What-is-Document-Management, retrieved 19.2.2016
[3]http://www.aiim.org/What-is-ECM-Enterprise-Content-Management, retrieved 19.2.2016

models for ECM and content in the cloud as the most important topics of the year 2010 (Bell et al., 2010). Especially automated Document Management is important if documents need to be maintained, stored, deleted or handled with special treatment because of legal requirements. The requirements towards ECMS contain the ability to address compliance issues and workflows, defined by law or organizational guidelines (IDC Central Europe GmbH, 2015). This legacy IM can be processed and automated with the help of modern ECMS. Especially companies which have a huge amount of content that is bound to legal requirements, such as financial institutes or insurance companies, demand ECMS with the capability to handle those kind of processes. Also search and content analytics are important for "making unstructured data - whether "at rest" in a repository or in motion - searchable and analytically accessible which is a challenge for companies seeking to solve variety of business problems" (Bell et al., 2010). This topic is about reducing or avoiding redundancy, cleaning up useless content and improving the migration of content to other content containers. In summary topics about handling data and its metadata efficiently in order to achieve more structured information are of high interest.

With the expression "Composite content application and case management" Gartner expresses frameworks and templates, which are applied to a specific business process and integrated into an ECM platform. They should be supporting the information life cycle from capturing, storing and using to restoring content. Williams defines three major steps in the information life cycle which information is being in. The first step, the creation phase, consists of authoring and capturing information. This information needs to be described and organize to use it within organizations. This enables search and retrieve, which is already part of the major step 'Use'. Information is then used and reused, evaluated or appraised and at the end of its lifecycle retained or destroyed. This step is called 'disposition' (Williams, 2015). Vendord on the ECM market have different solutions to cover the information lifecycle. More companies and governments are asking for new obtaining methods of ECM capabilities like cloud hosting or on-premise rental via outsourcing. Hence a big impact on the ECM landscape is made by Content in the Cloud (Bell et al., 2010). A specific description of Clouds in company environments can be found in section 2.4.2.

The environment of ECM has changed massively in the past and is dependent on the organization's requirements which are versatile and dependent on the sectors where a company is positioned. A single solution for different needs is not available which leads to specialized solutions and customizable ECMS. ECM has a big impact on the organization, the efficiency of processes and thus influences costs and revenues. Organizations feel the significance of ECM and the importance of having an ECM strategy (H. A. Smith & Mckeen, 2003).

2.2   History of Enterprise Mobility

The history of Enterprise Mobility was directly correlated to the evolution of mobile devises, primarily the development of mobile phones. The first mobile telephone service was introduced by AT&T in 1946. A mobile phone needed to be adjusted manually to a free radio frequency in order to establish a connection to the regular telephone net. At the connection center an employee then set up a connection to the intended receiver. This concept was built upon a simplex radio connection which means that just one signal can be put through the connection at the same time (Kumar & Zahn, 2005).

From here mobile phones were improved by automatically setting up connection to free radio frequencies, duplex channels, faster transfer rates, more capacities for phone calls at the same time and a better reach of the net (Kumar & Zahn, 2005). A big change happened with the introduction of the digital Global System for Mobile Communication

(GSM) in the year 1993 which was a circuit-switching network optimized for full duplex voice telephony (Harper, 2003b). These developments were basically driven by organizations. Even after mobile device manufacturers made their system available to the public it needed time until mobile telephony was spread across private households. One of the main limitations were high costs. But over time the technology and devices got cheaper and in the mid nineties to the end nineties owning a mobile phone became a social standard (Harper, 2003b).

In that time the potential for a corporate usage of mobile phones for work related processes was not seen. The capabilities of mobile communications were compared with desktop computers which were faster and offered more functionality and thus resulted in disregarding mobile devices. Typing on mobile devices was considered to be inefficient, the navigation was cumbersome, costs were high and the devices were slow (Harper, 2003b). But the technology development improved these issues and especially since the introduction of modern smartphones, such as the Apple iPhone in the year 2007 the understanding of mobile devices and their capabilities changed completely. Since then the capabilities of mobile devices like smartphones and tablets have been improved steadily (Giessmann et al., 2012).

Benefited by the introduction of improvements of the GSM, the improvements G3 (UMTS) and G4 (LTE) got realized and nowadays, the data transfer rate can reach between 50MBit/s to 100MBit/s in LTE nets (Meen et al., 2015). This changed the use cases of mobile devices dramatically. As mentioned in Chapter 1, mobile devices for accessing the mobile Internet are widely spread in private households. As against organizations which still have difficulties to allow and use mobile devices within the organizational environment (Basole, 2005). Basole stated that "for enterprise adoption and use of mobile information and communication technologies (ICT), such as laptops, smart phones and other handheld devices, is well recognized. Any technology that can deliver tangible business benefits, by making information more accessible, is generally considered a good thing." (Basole, 2008). Benefits such as higher user convenience, efficiency, productivity, decision-speed and also process improvements can be achieved (Basole, 2008), (Basole, 2004).

Expected wide-spread adoptions of mobile solutions in enterprise environments has not been as extensive as expected (Basole, 2005). Often stated reasons for the slow adoption are based on technology related concerns, like security and privacy issues. However, also strategical and organizational reasons are mentioned to cause a lack of understanding mobile solutions, their impact on the organizations environment and the uncertainties in changing the enterprise towards mobility (Basole, 2004).

The Critical Adoption Factors are displayed in figure 2. Basole names four distinct but still related categories which are influencing the adoption of mobile solutions. These factors defined by Basole based on findings of other researchers are of individual, organizational, technological and environmental nature (Basole, 2005).

The individual factor describes the organizational perspective on technology adoption and includes innovativeness, degree of skills and perceived values. It is basically focusing on the end-user of the new technology (Agarwal et al. (1997), Legris et al. (2003) and Sarker & Wells (2003)).   The organizational factor describes all influences emerged by the organizational enterprise structure. Components are the top level management support, organizational culture, technological and structural readiness, financial and infrastructural resources, size of the company, availability of support staff and others (Agarwal et al. (1997), Damanpour (1991) and Cooper & Zmud (1990)).   Technology factors are amongst others relative and competitive advantage, complexity, compatibility with existing infrastructure and perceived benefits (Tornatzky & Klein, 1982). Other researchers also mentioned costs and the ease of use (Agarwal, Tanniru, & Wilemon, 1997). The environ-
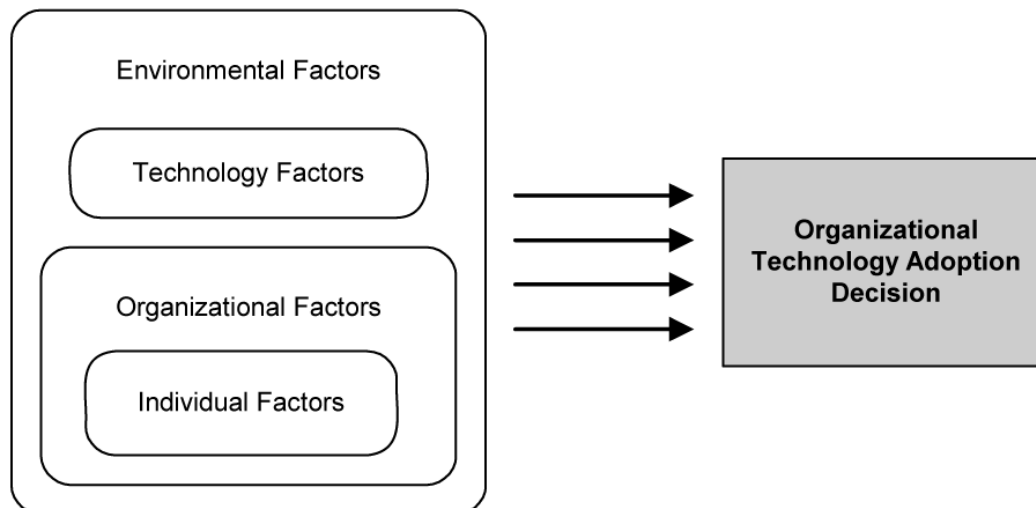
Figure 2: Critical Adoption Factors (Basole, 2005)

mental factors are determined by regulations, market conditions, customer and supplier relationships and influences of vendors (Damanpour, 1991).

Earlier mentioned benefits can be reached, but organizations need to overcome barriers and need to evaluate process changes and the impact of mobile components, in order to enable company-wide mobile thinking and to successfully adopt mobile solutions to their already existent organizational structure and infrastructure. Security issues need to be evaluated and handled and other factors, like technical support capabilities need to be provided.

2.3   Mobile Enterprise Content Management

The definition of Mobile Enterprise Content Management (mECM) is based on the already mentioned definition of ECM: "Enterprise Content Management (ECM) is the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes"[4]. But it is extending this definition by a mobile component. MECM is a discipline which is subordinated to ECM since the capabilities of mobile devices are still not reaching the computation capacity level of modern personal computers. Also the access to the enterprise environment is limited by the available transfer-rate, which is dependent on the geographical mobile radio[5].

Another aspect is that the entire range of managing tasks is not needed while being on the move. Important decisions can still be made in the company. But for example approvals for specific documents or publications, reporting travel expenses during the travel or mobile scanning are a task which can easily be handled remotely (Sommerhäuser, 2014). Thus mECM extends the ECM toolbox by some device specific features, but is not able to use all powerful ECM implements.

2.4   Current Trends in Enterprise Content Management

The following section is covering the current trends in the disciplin enterprise content management and is containing three main parts. These three parts are mobility, Cloud and

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[4]http://www.aiim.org/What-is-ECM-Enterprise-Content-Management, retrieved 19.2.2016
[5]http://www.jaemobi.com/blog/71-mobile-content-management-system (Last accessed on 22.09.2015)

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security which are the main factors when it comes to current and future enterprise content management. The trends are explained with statistical ressources or practical experiences from people who are working in related areas. The ressources are thus more focussing on journal articles.

2.4.1 Mobility

With the increasing number of mobile Internet users which has increased about 43% within the year 2013 (Statistisches Bundesamt, 2014) and the increasing number of smartphones which are in usage (Bundesverband Informationswirtschaft; Telekommunikation und neue Medien e.V., 2012) private households get more and more used to daily appearance and usage of electronic devices. Since the original purpose of a mobile phone was giving mobility to owners in the sense of being able to communicate whenever and wherever. This core functionality has not changed at all even though the mobile phones got more powerful and increased their functionality range enormously.

While phone calls where the main medium of communication in the beginning of mobile phones the focus has shifted toward E-Mails in the past years. 72% of the companies with more than 9 employees in Germany provided their employees mobile access to their E-Mails (Statistisches Bundesamt, 2012). E-Mails have been a communication and knowledge transfer channel but often have been looked at isolated. Bitkom reported that E-Mails need to be included into the Enterprise Information Management and thus into the knowledge base of a company. A lot of knowledge is transferred via E-Mail but the long-time accessibility of that knowledge is often difficult because E-Mails have an unstructured character (Statistisches Bundesamt, 2012). BITKOM recommends to include E-Mail Management into the ECM strategies which also accompanies with the capabilities of current mobile devices. Functionalities like taking pictures or displaying media files are enlarging the ability of mobile working and enable more complex and remotely work processes. Mobile phones can now be integrated into the ECM processes and handle work that goes beyond E-Mail reading and writing.

One big advantage of current mobile devices is the already named ability to take pictures. This functionality can be integrated into ECM processes and is part of the first component of the information lifecycle, the creation phase (Williams, 2015). Especially insurance companies can profit from this functionality. It avoids paper filled forms and can increase the agility of the enterprise in matters of customer relationships (Clarke, 2014a). An ECMS can help out to detect filled fields and transfer the hand-written information into electronic data. This results in accelerated processes and reduces papers. Related to that also the reduction of paperwork or the manual transfer from information on the paper to the system by employees is stinted. Even though workload for the control of the scanning results need to be handled manually (Clarke, 2014a).

Apart from the technical capabilities of devices the workplace itself became more mobile. In the year 2013 57% of employees in Germany spend their working time for business related travels or home office. This trend is going upwards (IDC Central Europe GmbH, 2015) and shows that there is a basic need of facilitating access to business content for employees who need enterprise documents while being on the move.

The IDC Central Europe GmbH detected in 2013 that every second company implemented strategies for Mobility, which is an increase of 20% compared to the year 2012 (IDC Central Europe GmbH, 2015). This shows that the topic is of high interest for every company and that companies are currently working respectively defining strategies for this matter. From a companies view this topic cannot be avoided since it brings a lot of security and compliance risks with it when it is unmanaged (TeleTrusT Deutschland e.V., 2006). If a company is not able to provide services of file sharing to their employeers

they will help themselves out with own solution (IDC Central Europe GmbH, 2015) which means that enterprise information - possibly sensitive data - is transported out of the company environment (Clarke, 2014b). A more detailed description of these security risks can be found in Section 2.4.3.

Sue Clark is pointing out another consequence of companies which are missing an information management system to their employees. In her Ovum Paper of 2015 she determinded: "Any employer that does not allow employees to access the content they require to do their job on a mobile device is going to risk its competitiveness." (Clarke, 2015). This competitiveness is caused by dissatisfaction arise due to ineffectiveness and complex information gathering respectively searching processes.

If it is not possible for traveling employees to make decisions while being on the move the result will be decelerated processes, media disruptions and hence a cost potential (Sommerhäuser, 2014). That is the reason why ECM users want their solutions to be able to have online access functionalities, online editing and functionality for down- and uploading content. They want their mobile device to have similar working capabilities as their computer in the office. They also want to have access to their E-Mails for making agreements and want to be able to forward tasks and documents (Sommerhäuser, 2014).

Another requirement for enabling these mobile needs is the design of the solution or application itself. Employees should use the application and will just accept it when the user experience is positive. Important aspects of an application were listed by Sommerhäusers article in IT-Director and are Simplicity, efficiency, beauty of design, automation of workflows and user friendliness as the leading factor. If these requirements are not fulfilled the acceptance of the application will not be high and employees will find ways to avoid the application. This will then lead to a decrease of data quality (Sommerhäuser, 2014).

Since mobile devices often come with limitations in comparison with standard personal computers solutions have to be adjusted to these circumstances. Especially the size of screens and missing keyboards are changing the way of usage. The widely spread PDF format for displaying DinA4 papers in an electronic form are problematic on smartphones and tablets (Schlücker & Grumser, 2014). Another Problem for mECM is the amount of different vendors and models of mobile devices on the market. It is not enough to provide a solution for one operation system. Ovum has the opinion that at least support for iOS, Android, Windows Phone and BlackBerry needs to be provided (Clarke, 2015). The realization of applications for each operation system increase development and maintaining costs wherefore Schlücker sees the solution in HTML5, which is able to display the same content on big computer displays and other smaller devices like smartphones and tablets. Also researchers detected benefits in using web technologies (Nordheim & Päivärinta, 2006). XML files for example can be interpreted by numerous devices and can be included into web-based user interfaces (Tsai & Dong, 2013). Thus thin clients can be achieved and the content accessed via browser solutions or really lightweight Apps.

2.4.2 Cloud

The second big topic when it comes to current trends withing ECM is the concept of Clouds. "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2011). The characteristics of a Cloud, described by the National Institute of Standards and Technology consist of an On-Demand self-service which means that a customer can provide computing capabilities like network storage or server time without interacting with the

service provider, which reduces support and maintaining costs (vom Brocke & Simons, 2014). Broad network access and resource pooling is another essential component of a cloud. It can be described as the sharing of applications and computing capabilities which are running on the cloud with other users in the same cloud network. Clouds are also designed to be elastic about its capabilities. They are able to react to the amount of computation power which is needed at a specific moment and the cloud will adjust its energy consumption according to that (Mell & Grance, 2011).

Clouds can be used on the basis of different Service Models, thus as Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Tsai & Dong, 2013).

A SaaS based Cloud is hosted by a service provider and contains the Cloud infrastructure, which consists of cloud functionality enabling hardware and software, and the applications which are accessible by the user. In general access to the applications is possible via a thin client interface, like a web browser or a program interface. In case of SaaS the customer does not manage the underlying infrastructure, networks, servers, operating systems or software capabilities. The user is just capable of making limited configurational settings of the application (Tsai & Dong, 2013).

If the service model Platform as a Service is used the service provider is maintaining the Cloud infrastructure but offers the customer the possibility to customize the Cloud on the application level. Developers can use libraries, tools and languages provided by the cloud provider. Thus the customer has the control over the application capabilities and is able to customize the software and the responsibility of maintaining the operational system, networks and hardware is still on the service provider (vom Brocke & Simons, 2014).

Within the third model, Infrastructure as a Service, the provided capabilities by the service provider are comprising "processing, storage, networks, and other fundamental computing resoruces where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications" (Mell & Grance, 2011). The customer is responsible for managing the operating systems and deployed applications while the service provider is maintaining the infrastructure layer (vom Brocke & Simons, 2014).

Clouds can also be distinguished by their deployment model. A private cloud and its infrastructure is provisioned for a single organization exclusively. It can be owned, managed or operated by the company itself or a third party including a combination of a third party and an organization. A community cloud is a cloud which is provisioned "for exclusive use by a specific community of consumers from organizations that have shared concerns" (Mell & Grance, 2011). It can be owned, managed or operated by one or many of the organizations or a third party including combinations of both. Public clouds are provisioned to the general public. They can be owned, managed or operated by organizations which are business, academic or government related. One of the most important cloud deployment models in business environment are hybrid clouds which are combinations of two distinguished cloud infrastructures. They consist of unique entities that are able to interact with each other to provide data and application portability (Mell & Grance, 2011). For example a private cloud for internal documents could be combined with a community cloud where partners can get have access to specific documents. In this way a company can manage which documents are shared with partner companies and which are staying in the private cloud for internal usage.

The AIIM Industry Watch "Content in the Cloud - making the right decision" determined that Cloud computing in business environments is not a new aspect at all. Examples which are proofing this statements are web-based email or cloud web-development which have been available since many years. A new trend though is that many enter-

prise and core office applications are striving into the Cloud. AIIM sees the decision about moving to the cloud or not is nowadays outdated since the usage of clouds gets more and more popular and socially accepted. Enterprises do not have a choice and need to offer a user-friendly cloud service to their employees (AIIM, 2012).

This report also refers to "almost emotional" decisions of enterprises in the past about installing Clouds in the business environment or not. The reasons for that has often been the physical location of the server or Cloud. Sourcing out the Cloud infrastructure to a service provider was understood as having potential losses of content safety and security, ownership clearance and compliance satisfaction (AIIM, 2012). Especially IT department members and the department of information/records management are opponents of Clouds. While Business users are asking for and consultants are seeing the future in cloud applications. As mentioned earlier it is important to address the needs of the employees otherwise they will find a own strategy for avoiding the problems. These solutions might include open clouds and thus would end up in export of enterprise information which is in general assumed to be sensitive (IDC Central Europe GmbH, 2015). 30% of the interviewed companies have detected an increasing usage of unofficial cloud solutions for content-sharing (AIIM, 2012) while only a few are fulfilling this need. As mentioned before this is an important topic for companies.

Currently 26% of the questioned companies are using cloud based file-sharing, 20% are creating social media and web content in a cloud and 15% are using sales and marketing applications in the cloud while 38% are not using any cloud application. This shows that many companies have not yet made experience with the usage of clouds. Because only 4% of the companies who are using cloud services have reported incidents of data loss, security intrusion or long-term unavailability from cloud or SaaS applications (AIIM, 2012).

Cloud Computing in general creates potential benefits to the cloud, such as cost savings, flexibility, scalability and access control (AIIM, 2012). Access control management is becoming simpler with the use of clouds because the system itself is centralized. Thus it is also easier to handle short-term access to the information for external coworkers or other partners (IDC Central Europe GmbH, 2015).

The recommendations of AIIM to enterprises are to adopt cloud services to their business environment. 75% of the companies which adopted clouds to their environment are saving costs. In order to reach this point security concerns need to be evaluated again since they "are still holding back cloud adoption, but the majority of users now admit that cloud service providers actually have better security in place than they have on their own servers" (AIIM, 2012). The effective internal and external collaboration and more flexible applications are big operational benefits of cloud-based content systems and should not be rated as dispensable.

2.4.3   Security

Earlier mentioned trends are affecting the security of enterprise information and need to be taken into account in enterprise content management. TeleTrust Deutschland e.V. reported serious and high risk potential in the usage of private devices in the enterprise environment. Risks are appearing because it is not possible for the IT-Department to control or track the enormous amount of private mobile devices which are nowadays present in the environment of organizations (Scarfò, 2012). Because of these control difficulties security policies need to be defined which regulate the access to sensitive enterprise information. Encryption, access rights and technical protections need to be evaluated (Ilvonen, 2015) and realized. Olalere et al. suggests to use special authentication and monitoring methods to reduce risks of BYOD (Olalere et al., 2015).

The potential of Malware which is transported into enterprise networks via private devices is also hard to avoid and control. In the period from 2004 to 2010 F-Secure categorized 517 families of mobile viruses, worms and trojans (Polla, Martinelli, & Sgandurra, 2013) Also the effort of integration and administration of different devices are providing risks because of the high fluctuation and heterogeneity of mobile devices. TeleTrust recommends to apply continuous security checks to these devices and in medium-term change to company owned devices with a central administration to keep risks on a controllable level (TeleTrusT Deutschland e.V., 2006).

Companies have to define strategies for remote access to the ECMS and need to come up with solutions for storing information on a mobile devices locally without loosing track of it. The importance of this aspect is reported by the Ovum report "2015 Trends to Watch: Enterprise Mobility". 58% of all employees have used their private mobile devices for work purposes in 2012. This number has increased to 69% in 2014. Bringing private devices to the work environment is called 'Bring your own device' (BYOB). Only 30% of these 69% have signed any kind of management policy that governs the usage. This means that 70% of employees are acting without the knowledge of the ECM department or at least are not acting within defined policies (Absalom, 2015). This is a problem since organizations need to ensure that they act within the law. The increasing use of private devices for accessing enterprise content results in a need to remotely remove the content data from the private device again (Clarke, 2014b).

The Ovum report also determined that there is a big mismatch between the actual number of employees using BYOB (65%) and what the IT-decision makers think. They expect about 26% of the employees doing so (Absalom, 2015). This makes clear that the problem was underestimated for the last past years and needs to be handled with.

Companies are asking for End-to-End Encryption for file transfers, encrypted data and the possibility of rights management. Interviewed German companies rate rights management as really important since they always want to know when, where, on which channel and on which device enterprise information viewable and editable. Companies also want to control the permissions to install other applications on a specific device (Sommerhäuser, 2014).

Riegler and Nowottka expect that mobile applications will never replace classic ECMS but trends are leading towards complements of these systems. Hybrid solutions will be present in future time (Sommerhäuser, 2014). IDC is making the same statements and sees an ideal way in enabling access to information by using On-Premise systems which are able to share content whenever it is needed and can be removed from the Cloud as soon the need is not present anymore. Thus the raw and original data is still saved in the ECM system and has not been touched for the sharing process (IDC Central Europe GmbH, 2015).

2.5 The Market of ECM Software

The market of Enterprise Content Management Systems is highly competitive and has been growing the last years. In 2005 MyNabb stated that the market will reach a revenue potential of $3.9 billion in 2008 (McNabb, 2005). The Gartner Group reported software and maintenance revenue of $2.9 billion in the ECM market in 2007 (Shegda et al., 2008). Both estimations are based on different statistics, which explains the discrepancy. But the potential of the market is displayed by both numbers. A forecasted 15% annual growth rate from 2014 to 2018 from $5.5 billion to $9.443 billion is expected (The Radicati Group, 2014). The Gartner Magic Quadrant for ECM of 2014 also mentioned a market revenue of $5.1 billion in the year 2013, which underlines this expectation. This shows the fast

growing market potential in the software market for ECMS and explains the presence of a high numbers of competitors.

Another factor for the complexity of the market situation appeared due to the inconsistent understanding of different ECM related expressions. Böhn calls it the Market of Buzzwords because "a fundamental problem for ECM is the lack of generally accepted, broadly used terms" (vom Brocke & Simons, 2014). Even though definitions for several components and areas of ECM exist, like mentioned in section 2.1, users and vendors of ECMS are interpreting terms in a different way. So that the same expression are often used to describe different kinds of solutions. Additional to that the areas which are covered by ECM software components can overlap and do not have clear classifications. Each vendor tries to differentiate himself from competitors by being unique and innovative and by bringing up new terms, to express his putative unique solution. The result is an increasing lack of common understanding of ECM related terms (vom Brocke & Simons, 2014).

Examples for missunderstandings are Document Management and Enterprise Content Management. The German market understands DM as a synonym for ECM, because DM is expected to include process management. In other markets these expressions are differentiated, like in the beforehand made definitions. Another good example would be Archive, which is often understood as a long-time archive for documents in the sense of records management, but vendors also use the term archives for general safekeeping of content (vom Brocke & Simons, 2014).

The Gartner Group analyses the ECM market situation frequently with the help of the "Magic Quadrant" which displays and compares the current position of ECM vendors rated by their ability to execute and their completeness of vision. The resulting plot shows four quadrants. The quadrant which describes a low level of the ability to execute and a low level of the completeness of vision is called "Niche Players". A high level of the ability to execute are "Challengers". A low level of the ability of execute but a high level of the completeness of vision are "Visionaries". If both rating measures of a ECMS vendor are high he is named a "Leader" (Shegda et al., 2008).

This thesis investigates software of the three vendors Alfresco, IBM and OpenText. The market position of these vendors in the ECM market and the development of it can be seen in the following figures 3, 4 and 5.

In 2008 (Figure 3) Alfresco was rated as a niche player who had one of the lowest performances in the ability to execute. IBM and OpenText were both rated as leaders, IBM with better performances in the ability to execute than OpenText and OpenText was considered to be one of the best performers in the completeness of vision (Shegda et al., 2008).

Two years later (Figure 4) Alfresco made huge steps forward in the completeness of vision and crossed the border to a visionary. IBM overtook OpenText in the completeness of vision and was leading these three vendors (Bell et al., 2010).

In 2014 (Figure 5) improvements of Alfrescos market position can be detected again. The ability has improved but the vendor is still rated as a visionary in the market of ECM. OpenText lost ground against IBM again, which is considered to be the overall market leader in ECM (Gilbert et al., 2014).

The Gartner Group also reports that Alfresco is evolving from its open-source background towards enterprise solutions, which are based on tested and licensed software. This is proved by the number of partners and licensed users, which was growing over the last years. One reason for the fast growth is the open standards software of Alfresco. This concept offers interoperability with other already present products in an enterprise environment[6] (Gilbert et al., 2014).

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[6]https://wiki.alfresco.com/wiki/Open_Source_Licensing, retrieved 22.2.2016

challengers | leaders

IBM
EMC
Open Text
Oracle
Microsoft
Hyland Software
Interwoven
Vignette
Xerox
HP
SAP
Objective
Ever Team
Day
SunGard Data Systems
Saperion
Alfresco
Xythos Software

niche players | visionaries

completeness of vision

As of September 2008
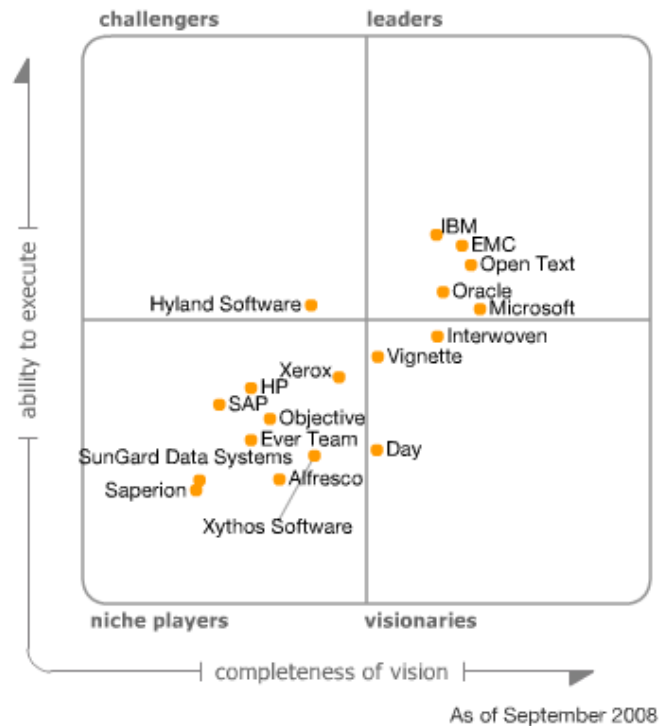
Figure 3: Magic Quadrant 2008 (Shegda et al., 2008)

IBM is described as a strong vendor because its ability to use its scale. The company offers one of the broadest product portfolios in the ECM field and especially supports large multinational companies. The products of IBM are serving different features for transactional content management and products vary from being focused on social and collaboration aspects, content and predictive analytics, portal management, business process management (BPM) and others. Customers can build their system upon combination of these products. IBM is well known in the fields of financial services, insurance and government and has a wide user range there (Gilbert et al., 2014).

The second leader when it comes to market shares is OpenText. The main strategy of OpenText in the past years was to set up partnerships in order to defend their market position. For example a partnership with SAP facilitated the entry to fields where SAP is strong. OpenText products are focusing on time planning solutions, synchronization and sharing functionalities and Clouds (Gilbert et al., 2014).

The market has grown heavily in the past and this trend will not change within the next years. Especially the market for medium-sized companies is highly competitive since large vendors have difficulties to address the exact needs of these customers. Thus it is expected that ECM software will change more and more to module-based packages, which can be chosen by the customers to fulfill their needs (vom Brocke & Simons, 2014).

Investigating two software solutions (IBM Connections and OpenText Core) from two vendors of the leader quadrant and one from the visionary area (Alfresco) seemed to be promising to gain an overview about the capabilities of ECM software. Other reasons for the choice of the investigated ECM software are stated in Section 3.
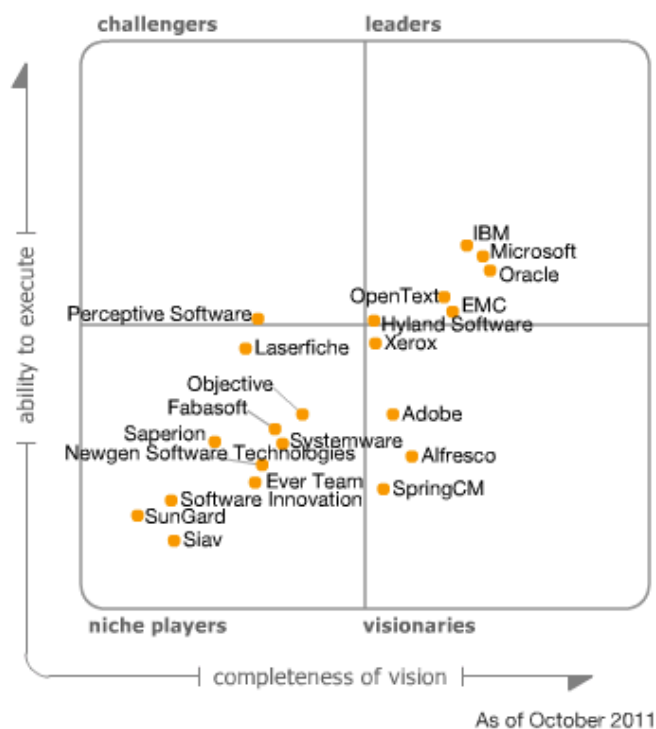
Figure 4: Magic Quadrant 2010 (Bell et al., 2010)

3 Investigated Enterprise Content Management Systems

This chapter provides Information about the three investigated Enterprise Content Management Systems and their mobile Applications. The chapter is devided in three parts. Section 3.2 describes the open-source software Alfresco, section 3.3 introduces IBM Connections and section 3.4 contains brief information about OpenText Core.

3.1 Choice of investigated Enterprise Content Management Systems

The choice of investigating these three Desktop and mobile Applications was based on their availability. All of them were accessible via the university network of the university Koblenz-Landau, Campus Koblenz or usable without costs (OpenText Core). Additional to that it seemed interesting to investigate software with different core competences. IBM Connections was originally developed as a Groupware but got extended by social media functionality (Jeners, 2015) and thus, has a focus on social interactions. OpenText Core is the only cloud service in this analysis. It is hosted by OpenText and was accessible for free, if just a single user is assigned to a space. Alfresco is an open-source software and is compared to the other two investigated Applications more settled in the "traditional fields" of Enterprice Document, e.g. Enterprise Content Management. At the beginning of this thesis it was also considered to analyze Microsoft Sharepoint, which was discarded since Microsoft is not providing a single mobile Application for the SharePoint service.

The Applications and vendors are introduced in the following sections while the analysis, comparison and results of the investigation are to be found in Chapter 4.
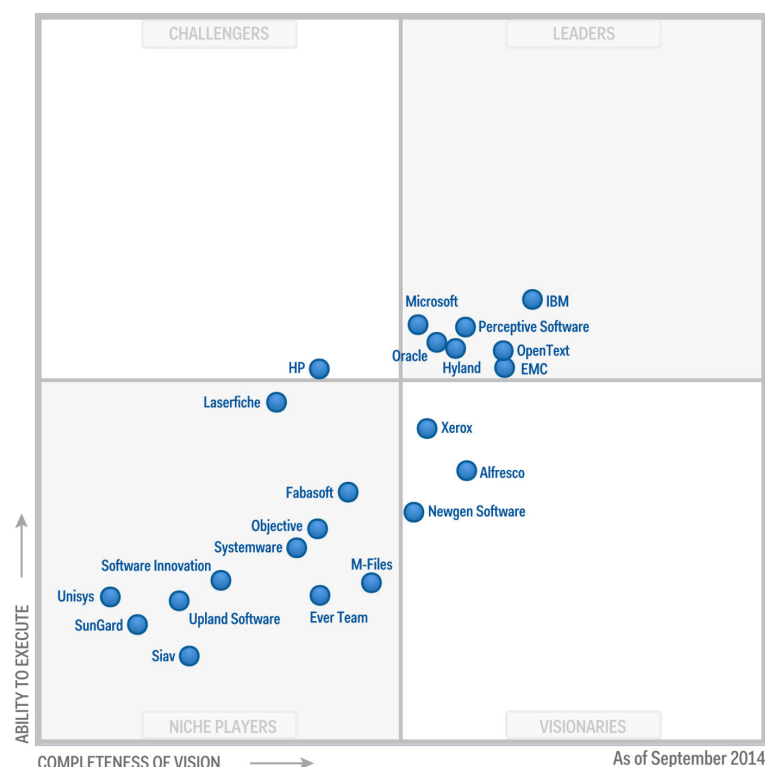
Figure 5: Magic Quadrant 2014 (Gilbert et al., 2014)

3.2 Alfresco

Alfrescos' Community version was initially released in October 2005 and was available as a full open-source version in April 2006[7]. The first enterprise version 'ECM Enterprise' was released in July 2006[8]. The enterprise versions were final community versions, which were stabilized and certified for enterprise customers and also offer support services. Currently three versions are available, Alfresco One, Alfresco in the Cloud and Alfresco Community Edition[9].

Alfresco One is described by Alfresco with high availability, highly customizable and a simplified administration. It is connected via a selective content-sync to the SaaS Alfresco in the Cloud. Modules and add-ons are available and include content encryption, records management, analytics and media management. A full time service for business critical content and compliance is also included in the enterprise version Alfresco One. Alfresco is a solution for project teams, which do not need or want to have an on-premise installation or server administration. It is restricted in terms of customizations and does not offer the full range of modules and add-ons. Alfresco Community Edition is intended for developers and supposed to run in a non-critical environment. The reasons are missing resources for fixing issues, because Alfresco does not offer support for this version. Thus it needs to be installed, managed and maintained by the user. Alfresco Community Edition does not offer support for additional modules, storage policies or clustering compared to Alfresco One. A mobile Client is offered for all three version, even though the Community Edition mobile Client does not offer functionality for mobile device content encryption. Alfresco

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[7]https://wiki.alfresco.com/wiki/Early_Community_Plan_of_Record, retrieved 22.2.2016
[8]https://wiki.alfresco.com/wiki/Enterprise_Plan_of_Record, retrieved 22.2.2016
[9]https://www.alfresco.com/products/pricing

just offers support for Alfresco One and Alfresco in the Cloud[10].

The investigated "Community Edition" is a free software which is licensed under LGPLv3 (GNU Lesser General Public License)[11]. This standard was published by the Free Software Foundation (FSF) in 1991. It allows companies and developers to extend the functionality of their own software by integrating the software licensed under LGPL without being forced to publish the source code of their own components (B. Smith & Foundation, 2007). Alfresco Community Edition is supported by a Community and different forums but not by Alfresco or certified partners.

The Core Platform of the Community Edition contains a consistent repository, a team collaboration interface, productivity App integrations including Microsoft Office and Google Docs and the ability to install Add-Ons. Additionally it contains the module records management and is accessible via mobile Apps for iOS and Android.

Alfresco is an open-source software, which is installed on university servers. The correlated mobile App was tested in Version 1.6 on a Sony Xperia Z3 Compact with Android version 5.1.1 installed.

3.3   IBM Connections

IBM Connections was released under the name "IBM Lotus Connections" on June 29 in 2007. IBM Louts Connections was consistently improved and extended with new functionality. In the year 2009 new collaboration technologies such as wikis, files, microblogging and social search / analytics have been added to version 2.5. With Version 3.0.1 the name was changed to "IBM Connections" in 2011. IBM Connections is defined as a social network platform[12]. The latest IBM Connections version (5.0) constists of the following modules, which are integrated to one environment so that each module can interact with another one[13].

- Homepage
- Profiles
- Communities
- Blogs
- Micro-Blogs
- Bookmarks
- Mail

- Activities
- Wikis
- Files
- Forums
- Social Analytics
- Polls and Surveys
- Docs

The homepage contains an overview about the recent information. Since IBM Connections is a social network platform, a main feature of it are 'Profiles'. Each user has its own Profile page where information about certain skills, current projects or resposibilities can be shared. This enables the possibility to search for others. 'Communities' are used for collaborative work on a specific topic. The module 'Blogs' is a blogging service which can be used to share latest personal or group information. 'Microblogs' are primarily used to share current information about updates on the homepage. The module 'Ideation Blogs' contains crowd-sourced functionality for ideas. 'Bookmarks' offer the possibility to save links to specific pages of interest. IBM Connections contains the module 'Activities' which enables task management for a group of people which is working on a collaborative project. Within the module 'Files' it is possible to store and share files and define the access rights to them. It also includes tagging functionality. Wikis are a sites where information

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[10]https://www.alfresco.com/products/enterprise-content-management
[11]https://wiki.alfresco.com/wiki/Open_Source_Licensing, retrieved 22.2.2016
[12]http://www-03.ibm.com/software/products/en/conn (Last accessed on 1.9.2015)
[13]http://www-03.ibm.com/software/products/en/conn#othertab2 date

can be collected and displayed in a structured way. The 'Forum' plugin is a discussion area where employees can discuss and share experiences. The search functionality of IBM Connections can be used to search projects, content, information or persons. With the help of social analytics activities and the commitment of users, habits can be analysed. The component Polls and Services enables to publish polls and surveys to specific members of the social business network. 'Docs' integrates functionality for creating, editing and previewing documents such as text documents, presentations and tables.

The investigated IBM Connections is running on the UniConnect-Platform (UCT), which is a hosted-service especially for educational institutions. It is a private platform provided for research and teaching purposes[14]. The hosted Desktop version, which was analysed is version 4.5 while the mobile App was in version 5.5.2[15].

3.4   OpenText Core

OpenText Core was released in February 2015 and is a cloud-based file sharing and collaboration solution based on SaaS. The service OpenText Core is hosted by OpenText and described by OpenText to comprise functionality for adhering organizational policies for information management and security, as well as support for email. Emails can include storing attachments together with messages. Additionally an advanced search is provided, including searches for keywords, tags, filters, people, comments and discussions [16]. Thus OpenText Core has a clear focus on file-sharing with the help of cloud technology.

The Desktop version ran in version 2.0.0.[17] while the mobile Application was 1.0.12.5 during the investigation[18]. All 'Desktop versions' mentioned in this thesis were used via the Web-Browser Firefox 44.0.2 and Desktop-Clients like for example the 'OpenText Web-Edit-Client' were not part of this analysis.

4   Review of ECM Systems and their mobile Applications

4.1   Analysis

The following sections of this chapter provides information about the execution of the analysis (section 4.1.1), the tool used for documenting the results (section 4.1.2). In section 4.2 the results of the analysis are presented. The analysis is structured in three subcomponents, which are the Comparison of the Desktop Software of the different vendors (section 4.2.1, the comparison of the capabilities compared to each other (section 4.2.2) and in section 4.2.3 the mobile Apps are compared to their Desktop software. At the end of this chapter in section 4.3 the results are summarized and a conclusion is presented.

4.1.1   Details of Execution

The analysis of the Desktop, respectively Web, Software and the correlated mobile App of the ECMS Alfresco, IBM Connections and OpenText Core was processed with the help of components of 'User Acceptance Testing' described by Ganesh, et al., albeit not all components of this testing method have been followed. The origin of 'User Acceptance Testing'

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[14]http://uct.de/leistungen/uniconnect-plattform/, retrieved 22.2.2016
[15]Google Playstore, retrieved 22.2.2016
[16]http://www.opentext.com/what-we-do/products/opentext-core
[17]https://core.opentext.com/support/, retrieved 22.2.2016
[18]Google Playstore, retrieved 22.2.2016

is executed after the development of software in order to evaluate whether planned functionalities are realized and usable in a comfortable way. The test is done by actual users of the software, who are following a beforehand defined test plan (Ganesh et al., 2014).

Since this thesis is not about an evaluation of software development and different software is tested, a unified test plan could not be defined. The analysis was started by taking one software under investigation and analyzing all functionalities offered by the User Interface (UI). Whenever a new functionality was found, which the software was able to perform, it was named and inserted into the comparison table. In the second iteration the next software was investigated. If it was able to perform the functionality already named in the table, it was marked as "possible", if it was feasable to perform the action with restrictions, or by using other steps it was marked as "possible with restrictions". If the software was not including the functionality it was marked with "not possible". In the comparison table these expressions are replaced by symbols and colors as shown in figure 6.

Figure 6: Legend for Table Entries (Author's Illustration)

If new functionality was found during the second iteration it was also added to the table. This inserted functionality then needed to be checked for availability in the software of the first iteration. The analysis took six software applications into account, Alfresco (Web), Alfresco mobile App, IBM Connections (Web), IBM Connections mobile App, OpenText Core (Web) and OpenText Core mobile Application and thus took 6 iterations. Functionalities in the table are grouped by subordinated concepts or actual existent structures within the examined software to increase readability of the table.

4.1.2   Comparison Matrix

The comparison matrix contains the columns Functionality, Alfresco, Alfresco Dektop, IBM Connections, IBM Connections Desktop, OpenText Core, OpenText Core Desktop. Functionality describes the found software functionality and the row offers the information, if the different software applications are capable to perform this operation by using the already introduced legend (Figure 6). The other columns list the software applications whereat the "[Software Name] Desktop" fields are representing the Web Version of each software used via the Web-Browser Firefox 44.0.2. Whenever restrictions to a functionality were present an additional information row was inserted, which describes the functionality in the row above. The table is able to hide these rows, as well as all Columns with the mobile Apps and, respectively or the columns with the Desktop software. Hence a better overview could be achieved when just specific software applications are compared. Figures provided in the following chapters and the appendix might show the table with activated hide-functionalities.

An excerpt of the comparison matrix in which hide-functionalities are deactivated is provided in figure 7. The full table is to be found in the appendix.

4.2   Evaluation

The following section is subdivided into a comparison of the Desktop Software of each vendor (Section 4.2.1), a comparison of the mobile Applications of each vendor (Section

ECM Comparison
of mobile Applications and Web Software

☐ Hide Additional Information

☐ Hide App Comparison

☐ Hide Desktop Comparison

Functionality	Alfresco	Alfresco Desktop	IBM Connections	IBM Connections Desktop	Opentext Core	Opentext Core Desktop
Repositories	**Repositories**	**Repositories**	**Files**	**Files**		
Display Repositories	✓	✓	✗	✓	✗	✓
Create Repositories	✗	✓	✗	✗	✗	✓
Different Views	✗	✓	✗	✓	✗	✗
Different Sorting Options	✗	✓	✗	✓	✗	✗
				Date, popularity, name		
Upload Repository	✗	✓	✗	✗	✗	✗
Download Repository as .zip	✗	✓	✗	✗	✗	✗
Copy to ...	✗	✓	✗	✗	✗	✗
Move to ...	✗	✓	✗	✗	✗	✗
Manage Rules	✗	✓	✗	✗	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Collaboration Spaces	**Sites**	**Sites**	**Communities**	Communities		
Display Sites	✓	✓	✓	✓	✗	✗
Display Site Dashboard	✗	✓	✗	✓	✓	✓

Figure 7: Excerpt of Comparison Matrix (Author's Illustration)

4.2.2) and at the end a comparison between mobile Applications and the correlated Desktop software (Section 4.2.3). This evaluation is the basis for the conclusion provided in Section 4.3.

4.2.1 Comparison of Desktop Software

Figure 8 shows an excerpt of the comparison of the Desktop Software of each vendor in the functional group of an collaboration space. These are basically the elements, where collaboration in Alfresco or IBM Connections is taking place and teams work together. In Alfresco these collaborative spaces are called 'Sites' and in IBM Connections named 'Communities'. A common use-case is to set up collaboration spaces for projects or teams. Besides that, Alfresco and IBM Connections are offering own file-storages for each account and other services, that are not directly having a collaborative character. This means that these collaborative spaces are an element of the ECMS.

OpenText Core in contrast does not have spaces for teams or collaborative projects as a subcomponent of the ECMS like in Alfresco or IBM Connections. Instead it just offers the possibility to share files with other members. In general OpenText Core is just a cloud-based file sharing or storage software. The functionality offer is very limited, compared to Alfresco and IBM Connections.

The functionality scope of Alfresco and IBM Connections within Sites, respectively Communities does not differ that much. Both offer overviews or dashboards of the collaboration space main page and contain search functionality for files, members, topics, etc. In both ECMS it is possible to create new collaboration spaces even though it was not possible for the author to execute this action in IBM Connections due to missing rights. Alfresco offers records management within a Site, which is not available in IBM Connections. Both vendors follow the same principle for including more functionality to the team space. Different extensions, such as Forums, Wikis and Bookmarks are available via modules, that can be included to the collaboration space. Alfresco offers a Calendar, while IBM Connections offers an 'Events' page which is similar to a Blog. Apart from that, the core capabilities in the area of collaboration are even between Alfresco and Connections. OpenText Core does not offer this collaboration technology at all.

Collaboration Spaces	Sites	Communities	
Display Sites	✓	✓	✗
Display Site Dashboard	✓	✓	✓
Display Favorite Sites	!	✗	✗
Search Sites	✓	✓	✓
Create Site / Community	✓	!	✗
Edit Site / Community Details	✓	✓	✗
Create Collaboration Site	✓	!	✗
Create Records Management Site	✓	✗	✗
Display Memberlist	✓	✓	✗
Add Members	✓	✓	!
Disconnect / Leave from Collaboration Space	✓	✓	✗
Mark Collaboration Space as Favorite	!	✗	✗
Unmark Collaboration Space as Favorite	!	✗	✗
List Documents / Show Library in Collaboration Space	✓	✓	✗
Copy Link to Collaboration Space	!	!	✗
Refresh current Site	✓	✓	✗
Show Updates / News Stream	✓	✓	✗
Stop Following	✓	✓	✗
List Tasks	!	✓	✗
Add Task to Collaboration Space	!	✓	✗
Forums Functionality available	✓	✓	✗
Bookmarks Functionality available	✓	✓	✗
Wiki Functionality available	✓	✓	✗
Calendar Functionality available	✓	✗	✗
E-Mail to Community Members	✗	✓	✗
Link other Community	✗	✓	✗
Create Subcommunity	✗	✓	✗

Figure 8: Excerpt of Desktop Software Comparison (1) (Author's Illustration)

Alfresco and Connections include Bookmarks whenever they are activated within a group space. This function is a simple bookmark collection, which includes creation, editing and deletion of bookmarks. Both vendors offer the same functionality scope within this module. OpenText Core does not offer bookmark functionality or any additional module.

As mentioned earlier the module for time scheduling is available in both systems even though the realization is different. Alfresco includes a calendar with a calendar overview comparable to other software like Microsoft Outlook. This overview is not available in Connections. However, also in Connections it is possible to create, edit and delete appointments. Instead of displaying appointments in a calendar Connections uses a simple site to display all appointments in a list. Another additional function, not available in Connection, is a RSS-Feed for changes in calendar. Again, OpenText Core is not offering such a service.

The module Wiki can be inserted to the collaboration spaces of both, Alfresco and Connections. As shown in figure 9, both systems offer core Wiki functionalities, like creating a wiki, editing a wiki page or subpage or versioning. However, Connections has connected a social commenting functionality and is able to compare two versions of a wiki page in one window, also files can be attached to a page. The 'Following' functionality for receiving alerts when a Wiki has been edited is following different approaches of the vendors. IBM is including a timeline where all recent changes are displayed, while Alfresco is offering a customizable Dashboard. The dashboard can be adjusted to personal preferences of the user and the notification functionality needs to be chosen or disabled from the dashboard.

Blogs are available in Alfresco and IBM Connections. The scope of functionality does not differ from the two vendors except for the possibility to 'like' a Blog post, which is only available in Connections and might be familiar for users of current social networks.

Wikis			
View Wiki	✓	✓	✗
Edit Wiki	✓	✓	✗
Create Pages / Subpages	✓	✓	✗
Add Comment	✗	✓	✗
Versions	✓	✓	✗
Compare Versions	✗	✓	✗
Restore old Version	✓	✓	✗
Appendix	✗	✓	✗
Follow Wiki	◐	✓	✗
Disable Following	◐	✓	✗

Figure 9: Excerpt of Desktop Software Comparison (2) (Author's Illustration)

Apart from that, both vendors included a view on the Blog and its Blog-Entries, a view for recent Blog-Posts and a view about details of a Blog-Posts. In both software it is possible to comment Blog-Posts and to receive an RSS-Feed.

An ideation Blog is available in IBM Connections and not included in Alfresco. It is based on the functionality of Blogs, which were mentioned before, but extend their functionality by a rating system. A user can express his support for an ideation post by clicking on support. These support clicks are counted and displayed, so that good ideas are displayed with a higher priority.

As mentioned in the 'History of Enterprise Content Management' (Section 2.1) a core capability of ECM is the management of documents or files. Therefore it is important to compare the file handling capabilities. Alfresco (Files), IBM Connections (Library)[19] and OpenText Core do include capabilities for displaying folders, sort files and folders in a list, download files as a .zip file. All applications have a 'copy to' or 'move to' function for files. Folders can be created and files of any file-type can be uploaded. Connections and Alfresco are also able to create folders from beforehand defined templates and are capable of uploading repositories and not just single files. Alfresco extends these possibilities by different views on the listed files, where more or less details and previews can be chosen. Also rules and access rights can be assigned to each file. The sole ECM software, which can create files without using external software is Alfresco. It offers the creation of Text, HTML, XML and Microsoft Word, Powerpoint and Excel documents. It is also possible to create documents by a defined template.

All investigated applications offer a Shared Documents folder which belongs to a user. From here a user can manage and share his files with other users. The functionality of Shared Documents in Alfresco is equal to normal files. IBM has restricted its 'Files' functionality compared to the before mentioned 'Library' in many points. It is not possible to use different detail levels for viewing the files. Also functions for copying or moving files are missing. Folders can not be created from templates and the creation of special document types like Word, Powerpoint, Excel, Text, HTML, XML or a document from a template is not possible. OpenText Core is restricting itself to core functionalities again. The system is able to display and search shared documents, list them with different sorting option and offers capabilities for downloading them as a .zip file, or copying and moving files.

When it comes to the editing or usage of files OpenText Core offers limited possibilities again. The software offers functions for deleting, commenting, downloading and liking specific files. Properties like the name can be edited within the software but this functionality is restricted to the files' properties. IBM Connection expands this basic func-

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[19]This analysis investigated the plugin Library which is an extension and not part of the basic IBM Connections. The file management in the basic package is named 'Files' and less powerful than 'Library'.

tionality with the possibility to upload a new version of the file, which means versioning is included in Connections. Also files can be linked to workflows. Files can be shared, liked, edited. Details can be viewed, the file can be added to a folder, they can be followed/unfollowed. Old versions can be deleted or restored. Attributes of the files can be edited and the file can be moved or copied to specific folders. Alfresco additionally offers the creation of a review task from a file and a preview of the file in the web software. This is however limited to certain file types, such as Microsoft Office files, HTML, Text and XML. A file can be declared as a Record or as a Version Record and also be linked to an option for automatic Declarations. Thus it offers Record Management possibilities, which are not addressed by the other two solutions.

Figure 10 the editing functionalities for folders offered by the applications. OpenText Core shows limited Attributes of the folder, is able to delete it and can download, copy or move a folder. IBM Connections is stronger because its able to show a folders attributes, to edit these attributes, delete a folder and show the containing files in a gallery. The path to a folder can be copied from the browser URL field, because it has an absolute path. Compared to Alfresco and OpenText Core the IBM software is missing downloading, copying and moving functionalities for folders.

Folders			
Show Attributes	✓	✓	⚠
Edit Attributes	✓	✓	✕
Delete	✓	✓	✓
Show files in gallery	✓	✓	⚠
Copy Link to Folder	✓	✓	✕
Add to Favorites	✓	⚠	✕
Comment	✓	✕	✕
Download as .zip	✓	✕	✓
Copy to ...	✓	✕	✓
Move to ...	✓	✕	✓
Manage Rules	✓	✕	✕
Manage Rights	✓	✕	✕
Manage Aspects	✓	✕	✕

Figure 10: Excerpt of Desktop Software Comparison (3) (Author's Illustration)

Another interesting aspect within ECM is task management. OpenText Core does not offer any task management related solutions. Thus just Alfresco and Connections are compared here. Both offer the possibility to list taks, display active tasks or tasks which are assigned to the user. In both web applications, the task details can be displayed and tasks can be listed with the help of different filters. In this way unfinished tasks or tasks with a specific due date can be viewed. Alfresco offers the possibility to create Ad-Hoc tasks which are is not available in Connections. In both software solutions tasks can be assigned to a person and prioritized. A feature which is offered by Connections is the actual organization of tasks, which can be grouped to sections or activities. It is also possible to add subtasks to a task.

All three desktop applications include a view for synchronized data and offer search functionality. In Alfresco and Connections profiles of the users can be displayed even though the profiles of IBM Connection can include much more personal information. These profiles can be edited and in both systems users can follow other user's actions.

4.2.2 Comparison of mobile Applications

This section provides the results of the comparison between the three mobile application Alfresco, IBM Connections and OpenText Core tested on a Sony Xperia Z3 Compact with

Android 5.1.1 installed.

Starting with the repository, the Alfresco mobile App is able to display the repositories, but no other actions can be performed. IBM Connections does not offer any functionality related to the repositories, neither does OpenText Core.

The Collaboration Sites are accessible via the mobile Apps of all vendors. OpenText Core provides a Collaboration Space Dashboard, while Alfresco and Connections just offer a basic overview of their collaboration spaces, but also include a button for displaying all favorite collaboration spaces and search functionality for content within the collaboration spaces. Both can also display the memberlist of a collaboration space, whereas just Connections offers the option to add members from the mobile application. Within both mobile Apps it is possible to disconnect or leave the collaboration space, to mark or unmark the space as a favorite, to list all documents or files shared in space. The functionality scope of Connections is wider compared to Core and Alfresco. Connection also includes direct functions to copy the link to a collaboration space, which is quite handy for sharing the location of the space in a comfortable way. Also the current view can be refreshed, a news stream or the latest updates can be displayed, following the collaboration space and receiving notifications about updates can be denied. Connections mobile App is also able to list the tasks connected to a collaboration space, to add new tasks and functionality for modules such as Forums, Bookmarks and Wikis is available.

Functionality for the modules Bookmarks, Forums, Calendars, Wikis, Blogs or Ideation Blogs is neither available in Alfresco, nor in OpenText Core. These finding are displayed in figure 11. In contrast to Connections mobile App which includes the functionality scope of the desktop software into the App. Except for overview or listing restrictions, the available functions are the same as in the desktop version.

Bookmarks			
Create Bookmarks	⊗	✓	⊗
Add Bookmark to Favorites	⊗	✓	⊗
Edit Bookmark	⊗	⊗	⊗
Delete Bookmark	⊗	⊗	⊗
Forums		Discussions	
Different Views (Detailes/Simple)	⊗	⊗	⊗
Create New Topic	⊗	✓	⊗
Delete Topic	⊗	✓	⊗
Edit Topic	⊗	✓	⊗
Reply	⊗	✓	⊗
Answers shown in hierarchical order	⊗	✓	⊗
Edit	⊗	✓	⊗
Show profile of reply author	⊗	✓	⊗
Add to Favorites	⊗	✓	⊗
RSS-Feed	⊗	⊗	⊗
Recommendation to answer	⊗	⊗	⊗
Calendar	Calendar	Events	
Display Calendar	⊗	⊗	⊗
Create Appointment	⊗	✓	⊗
Edit Appointment	⊗	✓	⊗
Delete Appointment	⊗	✓	⊗
iCal-Feed	⊗	⊗	⊗

Figure 11: Excerpt of mobile Application Comparison (1) (Author's Illustration)

Comparing the capabilities of managing files in the component Files of Alfresco and Library of Connections shows that both apps have quite equal capabilities. OpenText Core is offering core functionalities, which means that all Apps can display folders, show the files in a preview or gallery style, create folders, capture photos and upload photos from the mobile phones gallery. Alfresco and Connections are extending this functionality scope of

Core by the possibility to upload any document from the local storage, create a document within the app, create a word, powerpoint or excel document with the help of additional Apps. In case of Alfresco, the Microsoft mobile Office Apps need to be installed and for Connection the 'Connections Editor' needs to be running on the mobile device. Alfresco and Connections can also upload captured videos or videos from the phones gallery. Alfresco can even record sound files and create Text documents from the Files menu. Connections has a slight advantage when it comes to the listing and sorting of files. The mobile application can use different sorting options and also different views on the list, which include more or less details, dependent on the users preferences. An illustrations of these findings is presented in figure 12.

Files	Files	Library	
Display Folders	✓	✓	✓
Different Views on Content (Detailed, Less Detailed, ...)	✗	✓	✗
Different Options for Sorting	✗	✓	✗
Show as Gallery	✓	✓	⚠
Upload Repository	✗	✗	✗
Download as .zip	✗	✗	✗
Copy to ...	✗	✗	✗
Move to ...	✗	✗	✗
Manage Rules	✗	✗	✗
Manage Rights	✗	✗	✗
Manage Aspects	✗	✗	✗
Create Folder	✓	✓	✓
Create Folder from Template	✗	✗	✗
Upload Document	✓	✓	✗
Create Document	✓	✓	✗
Create Word Document	✓	✓	✗
Create Powerpoint Document	✓	✓	✗
Create Excel Document	✓	✓	✗
Create Text Document	✓	✗	✗
Create HTML Document	✗	✗	✗
Create XML Document	✗	✗	✗
Create Document from Template	✗	✗	✗
Capture Photo	✓	✓	✓
Upload Photo from Gallery	⚠	✓	✓
Capture Video	✓	✓	✗
Upload Video from Gallery	⚠	✓	✗
Record Sound	✓	✗	✗
Follow File	✗	✗	✗
Disable Following File	✗	✗	✗

Figure 12: Excerpt of mobile Application Comparison (2) (Author's Illustration)

For shared documents all apps provide an overview of the files and search functionality. Connections again is offering different views and sorting options. The creation of documents in Alfresco and Connections is equal to the options in the management of files.

When it comes to editing files or file attributes, Core is just offering functionality for deleting, commenting, downloading, sharing and liking files. Alfresco and Connections are capable of versioning of and thus uploading a new version of a file. They also include functions for deleting, commenting, downloading, favorizing, sharing, liking, editing and viewing details. In the area of versioning, both apps are able to restore old version. Alfrescos mobile App is able to create a review task from the shared files menu and also other kinds of workflow can be linked to the file. Connections in contrast offers functionality for copying links to specific files, add folders, follow or unfollow a document or delete old version of a file.

Managing folders in the mobile application of Core is not possible. Alfresco and Connections offer capabilities to show and edit attributes of a folder, delete a folder, show

containing files in a gallery view and to add the folder to the favorites. Connections has the possibility to copy the link to the folder again, while Alfresco is able to add comments to folders.

Due to the architecture of the Core Cloud, it is not possible to access the mobile device storage from the application. Also Connections has restrictions in this case. It is not possible to download files to the devices storage. However, an upload or release of a local file to the ECM is possible. Additional to that Alfresco also offers an integrated local file-browser, the possibility to add a file to the mobile ECM folder, to create a local file from a file stored in Alfresco and also a settings menu and help is available.

Task management can be managed with Alfresco and Connections. Connections is able to perform all actions of the desktop version, which are: listing the tasks, displaying active tasks, displaying tasks assigned to a user, displaying task details, filtering tasks by their status or assignees, adding an assignee and prioritizing tasks and grouping of tasks in sections and creating subtasks. Except for the grouping option Alfresco is offering the same functionality scope. Connections however extends the functionality of Alfresco by also offering, to copy the link to a task, add a task to the favorites and like mentioned before, grouping tasks and creating subtasks.

All mobile applications offer search possibilities and synchronized data. Alfresco and Connections are able to follow other peoples actions. Within Connections mobile App, the profiles can be viewed and changed, which is not executable in the Alfresco App.

In summary the differences of the mobile apps are big. Alfresco does not offer any of the additional modules and is including less functionality than the IBM Connections applications. OpenText Core is just providing core functionality for the storage and sharing of files and is not supporting ECM in a wide range.

4.2.3 Comparison of Desktop Software and mobile Application

Since the capabilities of the Desktop software and mobile applications have already been described in detail, the following section will provide short information about the results of the comparison between the Desktop Software and its mobile application. The sections structure is starting with Alfresco and continues with IBM Connections to end with Open-Text Core.

Alfresco The mobile application of Alfresco is not able to perform any Repository management tasks which are executable in the Web software. It is just able to display and browse the existent repositories. The capabilities of the App in Alfresco Sites are restricted compare to the Desktop software. The Site Dashboard can not be viewed, sites or records management sites can not be created or edited. Also it is not able to add members, to show updates or a news stream. The displaying of tasks or adding tasks is not possible. The modules Bookmarks, Forums, Calendars, Wikis, Blogs are not accessible via the mobile Alfresco App at all. In the area of files the mobile software is missing different views and sorting options. The vendor also did not include organizational functionality for files, such as download as a compromised folder, copy or move the file to another place, management of rights, rules or aspects. It was also not possible to create a folder from a template in the mobile applications. Furthermore, the mobile App misses features for the creation of HTML, XML documents or the creation of documents from templates. In the area of shared files the same restrictions are present as in the area of files. Editing is also limited for example by missing versioning or preview functionality. Moreover, the declaration as a record or a version record is not possible with the mobile App. The handling of folders also laggs the organizational move, copy and right management functions. Task

management is not restricted and offers the same function scope as the Web software of Alfresco but editing profiles is another missing functionality in the App.

IBM Connections The IBM Connections mobile App is similiar in its functionality scope to the Desktop Software. It is also missing different views and sorting options in repositories or content of collaboration spaces. The Communities in Connections can also not be created, edited or details be shown. But it is possible to mark a community as a favorite which is not possible in the Desktop software. Another restricting is that the application is not able to send an E-Mail to Community members, to link another Community to the current Community or to create a Subcommunity. In the module Bookmarks the App can mark a bookmark as a favorite again. But the mobile software is not able to edit or delete bookmarks. In forums the RSS-Feed option and the recommendation feature are not available but again it is possible to add a forum to the favorites. The events functionality contains the same as the Desktop Software. When it comes to wikis, the application is able to execute the same actions as the desktop software except for the editing of a page. Features of Blogs and Ideation Blogs are available and in both, the App and the Desktop Version. When it comes to the file library, the mobile App of Connections is also missing the organizational features like download as a .zip file, copy or move file to different location, or crate a folder from a template. But it is possible to capture or upload pictures or videos from the mobile devices camera, respectively gallery. It is also not possible to follow the actions of a file or unfollow it. In the area of shared files, the app does not have restrictions. The app even overs an integrated solution to create Word, Powerpoint or Excel documents even though the additional App 'Connections Editor' needs to be installed on the mobile device. The editing of files is almost as powerful as possibilities in the Desktop software. It excludes functionality for creating a task from a chosen file, and copying or moving a file is not possible but the wanted outcome can be achieved by adding a certain file to another destination. The mobile software of Connections can enter the mobile filebrowser for uploading files but not for downloading them and does not offer settings or a help view. Like Alfresco the mobile software contains a Favorites folder where all elements are gathered, that have been marked as a favorite. Task management is not restricted on the mobile device and contains the same features as the Desktop version, which is the same for search functionality, editing and viewing profiles or following other people actions. Thus the IBM Connections mobile application contains the same functionality if small restrictions are not taken into account.

OpenText Core The mobile software of OpenText Core contains the same features as the Desktop version except for copying or moving files to another destination. One feature of the mobile software, which is not available in the desktop version, is the usage of the mobile device's camera. Core can upload pictures taken with the camera or stored within the gallery of the mobile device.

4.3 Conclusion

4.3.1 General Strengths

Gartner describes the greatest strength of the vendor IBM in the breadth of its content management capabilities. The vendor offers a wide portfolio which is including social and collaboration features, predictive analytics, portal management, case management, business process management and storage manegement (Gilbert et al., 2014). These general strength assigned to IBM are pointed out in Connections as well. With its wide range

of included features (Blogs, Wikis, Forums) the software offers different channels for information exchange. Compared to Alfresco an OpenText Core the range of possibilities is much greater.

Gartner assignes a good knowledge of the ECM market needs to Alfresco and points out that the company is focussing on the User Interface and the mobile needs of the market (Gilbert et al., 2014). The navigation in the App and desktop version is easy to anticipate. Contents and functionalities are easy to find and powerful in their capabilities without overloading the user interface of the mobile devices.

OpenText has a relationship with SAP which enables expansions to the markets where SAP is strong. Especially the cloud solutions received good ratings from the clients for their usability and functionality (Gilbert et al., 2014). Within the analysis the lightweight App offered a smooth user experience with a intuitive user interface.

Generel strength of all vendors is, that they have experiences in matching the customer needs which gets clear when the apps are used. The design is focussing on the important features who need to work while being on the move. The big strength of the Apps is to be able to enter Enterprise Content from anywhere at anytime in a way that does feel intuitive and not limiting.

4.3.2 General Weaknesses

"One of IBM's greatest strengths also poses its greatest challenge: The breadth of its product and solution portfolio may make it hard for some customers to understand where to start or how to extend their current offerings. IBM's sales teams sometimes lead with different offerings, adding to confusion over its road map. IBM supports three core content repositories, and offers several BPM offerings between IBM FileNet Content Manager and IBM Business Process Manager, as well as search capabilities based on both Lucene and Vivisimo. Cloud adoption among ECM buyers has been slow, although interest is picking up. IBM recently released IBM Navigator on Cloud, which provides a SaaS ECM platform, running on IBM's SoftLayer cloud. This is a start, but IBM will need to continue to bolster its cloud investments to address buyers' changing needs. IBM has one of the largest installed bases for content management, but its growth in this market has slowed. Existing customers are staying put, and IBM is successful at upselling and cross-selling to them. To maintain its market share leadership and reach new customers, IBM will need to continue with its investments in cloud capabilities and solutions that draw on its extensive portfolio, to enable rich, content-based ecosystems" (Gilbert et al., 2014). The App Connections misses a feature to link files or documents to activities which is better performed by Alfresco. Also the capability range of the Desktop version is quite large and the realisation of the same functionality in the App for the usage on a mobile devices is coming to its limits. The App seems to be quite overloaded and the navigation through the different features is complicated.

"Alfresco has changed aspects of its pricing model, which has caused some issues with existing customers. In the past, Alfresco had more of an unlimited-user approach to support. The quality of firms delivering Alfresco implementation services varies considerably, as the open-source nature of the basic offering enables anyone to deliver implementation services. Enterprises that are considering Alfresco One, the Enterprise platform, should work with Alfresco to find a trained partner with strong references. Compared with the leading ECM vendors, Alfresco is a relatively small organization backed by venture funding. Enterprises should work with it to understand its product road map, which is evolving rapidly" (Gilbert et al., 2014). The application of Alfresco is focussing on core features needed in mobile Enterprise Content Management. These are accessing content and managing activities particularly approval workflows (Sommerhäuser, 2014). Alfresco included

these capabilities into their App in a lightweight and clearly arranged a way that makes it easy to understand the navigation menu and being able to work with it without the need to spend time in order to learn the software. Since Alfresco is reduced to the core features it is not possible to set up a proper discussion board like it is in IBM Connections. Thus a weakness was detected in the range of capabilities that go beyond information and worklow management.

"Although OpenText has a very broad product portfolio, some of it has been accumulated through acquisitions which has resulted in a complicated architecture with some redundant components. OpenText needs to be more responsive to concerns about its product road map and the longevity of its technology. Some clients have expressed concerns that OpenText's product prices are too high and too difficult to calculate. Some Gartner clients continue to complain about the weakness of OpenText's post-sales support" (Gilbert et al., 2014). The cloud service Core from OpenText only offers a simple cloud based file sharing system which is not really able to go beyond it. Core itself does lack important features that are covering Enterprise Process Management aspects in correlation with files and documents.

5 Summary and Conclusion

This chapter provides a summary and answers the research questions in section 5.1. The research contribution of this thesis is outlined and possible research objectives within the topic of mobile ECM are proposed (Section 5.2). Afterwards a short conclusion about this thesis is given.

5.1 Research Questions

In the beginning of this thesis the research objectives were defined. With the help of correlated research questions, which have been answered in the different sections of this thesis, the research objectives could be addressed.

The first research question **RQ1** was **Which functionalities of ECM Systems can be used within mobile applications?** The researcher found out that the limitations of usable functionality on mobile device is restricted by three major influences. Firstly, the technical and ergonomic characteristics of the mobile device. The computation power and battery life can have a limiting influence on the capability to proceed complex actions. Also the screensize has an impact on the amount of information that can be displayed in a comfortable way. The depth and scope of menus affects the user experience regarding the user interface. Secondly, the ECM software can limit the functionality on mobile devices. This depends on the ECM vendors strategy about how and when to integrate mobile devices into ECM processes. Thirdly, security implementations can limit the availability of features. In summary the scope of functionalities in the mobile software can be equal to the desktop version but can also be restricted by mentioned influences.

Research Question two is **RQ2: How does the capability of different mobile ECM and ECS Apps distinguish?** The elements where differentiation of ECM software products are possible are mentioned in the answer to **RQ1**. The ECM software market provides numerous different approaches and every vendor follows a different focal points. This means that the differentiation of capabilities can be huge. Mainly, the strategies a vendor is pursuing with a mobile ECM App are influencing the general capabilities.

The third question, **RQ3** was **What are general strengths and weaknesses of mobile ECM?** The main strengths of mobile ECM are at the same time its triggers. Mobile ECM enables work processes during business travels and home offices and addresses the needs

of enterprises and employees at the same time. The camera of mobile devices is a strength in capturing and scanning documents within the creation phase of the information life cycle. The general weaknesses are security issues that come along with the new devices in the company environment which need to be addressed and managed. Often times mobile devices are included into the company environment with the BYOD principle. Thus one device is used for private and organizational processes and sensitive data could be misused.

Research Question four **RQ4** is **What are the recommendations for using mobile ECM?** Since the capabilities and functionality scopes of mobile ECM Apps can differ a lot, it is important to carefully analyze the organization's needs before adopting a solution. In addition to that, security mechanisms and policies need to be defined and resources for device and security management need to be considered.

5.2   Research Contribution and Future Work

By addressing the research objectives and answering the research questions the author sensitized for current trends and aspects that need to be taken into account when organization want to enable mobile components in their ECM. Mobile ECM technology and its market are changing rapidly. The installation of mobile components into the enterprise environment are challenging and and time consuming. This thesis points out which aspects need to be considered for making decisions about the future usage and processes for which the mobile component has a supportive role.

Topics that could not be analyzed deeply within this thesis are security issues, especially when it comes to 'Bring your own Device'. It is mandatory to understand the problems and solutions for adopting mobile devices into organizations with this approach. Further research on this topic and how vendors of ECM software address this topic would help out to clarify core aspects of mobile ECM security. Within this research it would also be interesting to analyze security mechanisms within mobile ECM Apps.

Another important research could be the development of a framework which supports and leads through important decision that need to be made before adopting mobile Enterprise Content Management.

Since the topic of mECM is not yet widely investigated by scientific research and only a small body of research addresses mobile devices at work (Sørensen, 2014), this thesis is pointing out focus points which are of further interest. Within the scheduled research time of six month for this thesis it was not possible to cover more detailed aspects. However the thesis highlights the important topics that are relevant for mobile Enterprise Content Management and provides a basis for further research.

5.3   Concluding Remarks

This thesis analyzed current topics in the field of ECM by a literature analysis and provides an investigation about the functions of the current mobile applications Alfresco, IBM Connections and OpenText Core and their Desktop software. This leads to an understanding of differences between different vendors and how the strategic approaches behind each application could effect organizational processes.

Mobile Enterprise Content Management is not just a component which is adopted to the organizational environment and will pay off its benefits. It is part of a complex system and has huge influences on enterprise processes, organizational structures, document handling and processing and the information design (Sørensen, 2011). Thus it is important to not underestimate this ECM component.

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Appendices

Full Comparison of Desktop Software

ECM Comparison

of mobile Applications and Web Software

- ☒ Hide Additional Information
- ☒ Hide App Comparison
- ☐ Hide Desktop Comparison

Functionality	Alfresco Desktop	IBM Connections Desktop	Opentext Core Desktop
Repositories	**Repositories**	**Files**	
Display Repositories	✓	✓	✓
Create Repositories	✓	✗	✓
Different Views	✓	✓	✗
Different Sorting Options	✓	✓	✗
Upload Repository	✓	✗	✗
Download Repository as .zip	✓	✗	✗
Copy to ...	✓	✗	✗
Move to ...	✓	✗	✗
Manage Rules	✓	✗	✗
Manage Rights	✓	✗	✗
Manage Aspects	✓	✗	✗
Collaboration Spaces	**Sites**	Communities	
Display Sites	✓	✓	✗
Display Site Dashboard	✓	✓	✓
Display Favorite Sites	!	✗	✗
Search Sites	✓	✓	✓
Create Site / Community	✓	!	✗
Edit Site / Community Details	✓	✓	✗
Create Collaboration Site	✓	!	✗
Create Records Management Site	✓	✗	✗
Display Memberlist	✓	✓	✗
Add Members	✓	✓	!
Disconnect / Leave from Collaboration Space	✓	✓	✗
Mark Collaboration Space as Favorite	!	✗	✗
Unmark Collaboration Space as Favorite	!	✗	✗
List Documents / Show Library in Collaboration Space	✓	✓	✗
Copy Link to Collaboration Space	!	!	✗
Refresh current Site	✓	✓	✗
Show Updates / News Stream	✓	✓	✗
Stop Following	✓	✓	✗
List Tasks	!	✓	✗
Add Task to Collaboration Space	!	✓	✗
Forums Functionality available	✓	✓	✗
Bookmarks Functionality available	✓	✓	✗
Wiki Functionality available	✓	✓	✗
Calendar Functionality available	✓	✗	✗
E-Mail to Community Members	✗	✓	✗
Link other Community	✗	✓	✗
Create Subcommunity	✗	✓	✗
Bookmarks			

Create Bookmarks	✓	✓	✗
Add Bookmark to Favorites	✗	✗	✗
Edit Bookmark	✓	✓	✗
Delete Bookmark	✓	✓	✗
Forums			
Different Views (Detailes/Simple)	✓	✗	✗
Create New Topic	✓	✓	✗
Delete Topic	✓	✓	✗
Edit Topic	✓	✓	✗
Reply	✓	✓	✗
Answers shown in hierarchical order	✓	✓	✗
Edit	✓	✓	✗
Show profile of reply author	✓	✓	✗
Add to Favorites	✗	✗	✗
RSS-Feed	✓	✓	✗
Recommendation to answer	✗	✓	✗
Calendar	Calendar	Events	
Display Calendar	✓	✗	✗
Create Appointment	✓	✓	✗
Edit Appointment	✓	✓	✗
Delete Appointment	✓	✓	✗
iCal-Feed	✓	✗	✗
Wikis			
View Wiki	✓	✓	✗
Edit Wiki	✓	✓	✗
Create Pages / Subpages	✓	✓	✗
Add Comment	✗	✓	✗
Versions	✓	✓	✗
Compare Versions	✗	✓	✗
Restore old Version	✓	✓	✗
Appendix	✗	✓	✗
Follow Wiki	!	✓	✗
Disable Following	!	✓	✗
Blogs			
View Blogs	✓	✓	✗
Different Views (Details / Simple)	✓	✗	✗
Different Sorting of Blog Entries	✓	✓	✗
Add New Blog	!	!	✗
My Blogs	✗	✗	✗
Recent Posts	✓	✓	✗
Read Later	✗	✗	✗
New Blog Entry	✓	✓	✗
Show Blog Entry	✓	✓	✗
Bookmark Blog Entry	✗	✗	✗
Comment Blog Entry	✓	✓	✗
Like Blog Entry	✗	!	✗
Copy Blog Entry Link	!	!	✗
Add Blog Entry to Favorites	✗	✗	✗
Add Blog Entry to "Read Later"	✗	✗	✗
RSS-Feed	✓	✓	✗
Ideation-Blogs			
Ideation Blogs available	✗	✓	✗
Functionality for rating idea (support or no support)	✗	✓	✗
Files	Files	Library	
Display Folders	✓	✓	✓

	Shared Documents	Files	
Different Views on Content (Detailed, Less Detailed, ...)	✓	✗	✗
Different Options for Sorting	✓	✓	✓
Show as Gallery	✓	✗	!
Upload Repository	✓	✓	✗
Download as .zip	✓	✓	✓
Copy to ...	✓	✓	✓
Move to ...	✓	✓	✓
Manage Rules	✓	✗	✗
Manage Rights	✓	✗	✗
Manage Aspects	✓	✗	✗
Create Folder	✓	✓	✓
Create Folder from Template	✓	✓	✗
Upload Document	✓	✓	✓
Create Document	✓	✗	✗
Create Word Document	✓	✗	✗
Create Powerpoint Document	✓	✗	✗
Create Excel Document	✓	✗	✗
Create Text Document	✓	✗	✗
Create HTML Document	✓	✗	✗
Create XML Document	✓	✗	✗
Create Document from Template	✓	✗	✗
Capture Photo	✗	✗	✗
Upload Photo from Gallery	✗	✗	✗
Capture Video	✗	✗	✗
Upload Video from Gallery	✗	✗	✗
Record Sound	✗	✗	✗
Follow File	!	✓	✗
Disable Following File	!	✓	✗
Shared documents	**Shared Documents**	**Files**	
Display Shared Documents	✓	!	✓
Search Shared Documents	✓	!	✓
Different Views	✓	✗	✗
Different Options for Sorting	✓	✓	✓
Show Gallery	✓	✓	!
Upload Repository	✓	!	✗
Download as .zip	✓	✓	✓
Copy to ...	✓	✗	✓
Move to ...	✓	✗	✓
Manage Rules	✓	✗	✗
Manage Rights	✓	✗	✗
Manage Aspects	✓	✗	✗
Folder available	✓	✓	✗
Create Folder from Template	✓	✗	✗
Upload Document	✓	✓	✗
Create Document	✓	✓	✗
Create Word Document	✓	✗	✗
Create Powerpoint Document	✓	✗	✗
Create Excel Document	✓	✗	✗
Create Text Document	✓	✗	✗
Create HTML Document	✓	✗	✗
Create XML Document	✓	✗	✗
Create Document from Template	✓	✗	✗
File Properties/Edit			
Upload New Version	✓	✓	✗
Create Review Task	✓	✗	!

Action	Col1	Col2	Col3
Create Workflow linked to File	✓	✓	✗
Delete	✓	✓	✓
Commment	✓	✓	✓
Download	✓	✓	✓
Favorite	✗	✗	✗
Share	✓	✓	!
Like	✓	!	✓
Edit	✓	✓	!
Details	✓	✓	✗
Copy Link	✓	✓	!
Add to Folder	✓	✓	✗
Follow/Unfollow	✓	✓	✗
Delete old version	✓	✓	✗
Restore old version	✓	✓	✗
Edit Attributes	✓	✓	✗
Display in Browser	✓	✗	✗
Copy to ...	✓	✓	✗
Move to ...	✓	✓	✗
Manage Rights	✓	✗	✗
Manage Aspects	✓	✗	✗
Change Type	✓	✗	✗
Declare as Record	✓	✗	✗
Declare as Version Record	✓	✗	✗
Option for Declaration Automation	✓	✗	✗

Folders

Action	Col1	Col2	Col3
Show Attributes	✓	✓	!
Edit Attributes	✓	✓	✗
Delete	✓	✓	✓
Show files in gallery	✓	✓	!
Copy Link to Folder	✓	✓	✗
Add to Favorites	✓	!	✗
Comment	✓	✗	✗
Download as .zip	✓	✗	✓
Copy to ...	✓	✗	✓
Move to ...	✓	✗	✓
Manage Rules	✓	✗	✗
Manage Rights	✓	✗	✗
Manage Aspects	✓	✗	✗

Local Filebrowser

Action	Col1	Col2	Col3
Local Files File Browser (Display)	!	!	!
Add File to mECM folder	!	!	!
Upload file to ECM	!	!	!
Release file to ECM	!	!	!
Create file to local files	!	!	!
Settings (Display)	!	!	!
Help (Display)	!	!	!

Favorites

Action	Col1	Col2	Col3
List of Files marked with "favorite"	✗	✗	✗

Task Management

Action	Col1	Col2	Col3
List Tasks	✓	✓	✗
Display Active Tasks	✓	✓	✗
Display Tasks assigned to Me	✓	✓	✗
Task/Details	✓	✓	✗
My Tasks (Display) different Filters	✓	✓	✗
Create Task (Ad-Hoc Task)	✓	✗	✗

Feature	Col1	Col2	Col3
Create Task (Approval Task)	✓	✗	✗
Grouping of Tasks in Sections/Activities	✗	✓	✗
Add Assignee	✓	✓	✗
Priorization of Tasks	✓	✓	✗
Copy Link to Task	⚠	✓	✗
Add Task to Favorites	✗	✓	✗
Create Sections Within Task	✗	✓	✗
Create Subtasks	✗	✓	✗
Others			
Synchronized Data (Display)	✓	✓	✓
Search	✓	✓	✓
Profiles	⚠	✓	✗
Edit Profiles (Tags, E-Mail, About)	✓	✓	✗
Follow other peoples actions	✓	✓	✗

Full Comparison of Mobile Software

ECM Comparison

of mobile Applications and Web Software

☒ Hide Additional Information

☐ Hide App Comparison

☒ Hide Desktop Comparison

Functionality	Alfresco	IBM Connections	Opentext Core
Repositories	**Repositories**	**Files**	
Display Repositories	✓	⊗	⊗
Create Repositories	⊗	⊗	⊗
Different Views	⊗	⊗	⊗
Different Sorting Options	⊗	⊗	⊗
Upload Repository	⊗	⊗	⊗
Download Repository as .zip	⊗	⊗	⊗
Copy to ...	⊗	⊗	⊗
Move to ...	⊗	⊗	⊗
Manage Rules	⊗	⊗	⊗
Manage Rights	⊗	⊗	⊗
Manage Aspects	⊗	⊗	⊗
Collaboration Spaces	**Sites**	**Communities**	
Display Sites	✓	✓	⊗
Display Site Dashboard	⊗	⊗	✓
Display Favorite Sites	✓	⚠	⊗
Search Sites	✓	✓	⊗
Create Site / Community	⊗	⊗	⊗
Edit Site / Community Details	⊗	⊗	⊗
Create Collaboration Site	⊗	⊗	⊗
Create Records Management Site	⊗	⊗	⊗
Display Memberlist	✓	✓	⊗
Add Members	⊗	✓	⊗
Disconnect / Leave from Collaboration Space	✓	✓	⊗
Mark Collaboration Space as Favorite	✓	✓	⊗
Unmark Collaboration Space as Favorite	✓	✓	⊗
List Documents / Show Library in Collaboration Space	✓	✓	⊗
Copy Link to Collaboration Space	⊗	✓	⊗
Refresh current Site	⚠	✓	⊗
Show Updates / News Stream	⊗	✓	⊗
Stop Following	⊗	✓	⊗
List Tasks	⊗	✓	⊗
Add Task to Collaboration Space	⊗	✓	⊗
Forums Functionality available	⊗	✓	⊗
Bookmarks Functionality available	⊗	✓	⊗
Wiki Functionality available	⊗	✓	⊗
Calendar Functionality available	⊗	⊗	⊗
E-Mail to Community Members	⚠	⊗	⊗
Link other Community	⊗	⊗	⊗
Create Subcommunity	⊗	⊗	⊗

Bookmarks			
Create Bookmarks	✗	✓	✗
Add Bookmark to Favorites	✗	✓	✗
Edit Bookmark	✗	✗	✗
Delete Bookmark	✗	✗	✗

Forums	Discussions		
Different Views (Detailes/Simple)	✗	✗	✗
Create New Topic	✗	✓	✗
Delete Topic	✗	✓	✗
Edit Topic	✗	✓	✗
Reply	✗	✓	✗
Answers shown in hierarchical order	✗	✓	✗
Edit	✗	✓	✗
Show profile of reply author	✗	✓	✗
Add to Favorites	✗	✓	✗
RSS-Feed	✗	✗	✗
Recommendation to answer	✗	✗	✗

Calendar	Calendar	Events	
Display Calendar	✗	✗	✗
Create Appointment	✗	✓	✗
Edit Appointment	✗	✓	✗
Delete Appointment	✗	✓	✗
iCal-Feed	✗	✗	✗

Wikis			
View Wiki	✗	✓	✗
Edit Wiki	✗	✗	✗
Create Pages / Subpages	✗	✓	✗
Add Comment	✗	✓	✗
Versions	✗	✓	✗
Compare Versions	✗	✓	✗
Restore old Version	✗	✓	✗
Appendix	✗	✓	✗
Follow Wiki	✗	✓	✗
Disable Following	✗	✓	✗

Blogs			
View Blogs	✗	✓	✗
Different Views (Details / Simple)	✗	✗	✗
Different Sorting of Blog Entries	✗	✓	✗
Add New Blog	✗	✓	✗
My Blogs	✗	✓	✗
Recent Posts	✗	✓	✗
Read Later	✗	✓	✗
New Blog Entry	✗	✓	✗
Show Blog Entry	✗	✓	✗
Bookmark Blog Entry	✗	✓	✗
Comment Blog Entry	✗	✓	✗
Like Blog Entry	✗	✓	✗
Copy Blog Entry Link	✗	✓	✗
Add Blog Entry to Favorites	✗	✓	✗
Add Blog Entry to "Read Later"	✗	✓	✗
RSS-Feed	✗	✗	✗

Ideation-Blogs			
Ideation Blogs available	✗	✓	✗
Functionality for rating idea (support or no support)	✗	✓	✗

Files	Files	Library	
Display Folders	✓	✓	✓
Different Views on Content (Detailed, Less Detailed, ...)	✗	✓	✗
Different Options for Sorting	✗	✓	✗
Show as Gallery	✓	✓	!
Upload Repository	✗	✗	✗
Download as .zip	✗	✗	✗
Copy to ...	✗	✗	✗
Move to ...	✗	✗	✗
Manage Rules	✗	✗	✗
Manage Rights	✗	✗	✗
Manage Aspects	✗	✗	✗
Create Folder	✓	✓	✓
Create Folder from Template	✗	✗	✗
Upload Document	✓	✓	✗
Create Document	✓	✓	✗
Create Word Document	✓	✓	✗
Create Powerpoint Document	✓	✓	✗
Create Excel Document	✓	✓	✗
Create Text Document	✓	✗	✗
Create HTML Document	✗	✗	✗
Create XML Document	✗	✗	✗
Create Document from Template	✗	✗	✗
Capture Photo	✓	✓	✓
Upload Photo from Gallery	!	✓	✓
Capture Video	✓	✓	✗
Upload Video from Gallery	!	✓	✗
Record Sound	✓	✗	✗
Follow File	✗	✗	✗
Disable Following File	✗	✗	✗
Shared documents	Shared Documents	Files	
Display Shared Documents	✓	✓	✓
Search Shared Documents	✓	✓	✓
Different Views	✗	✓	✗
Different Options for Sorting	✗	✓	✗
Show Gallery	!	✓	!
Upload Repository	✗	✗	✗
Download as .zip	✗	✗	✗
Copy to ...	✗	✗	✗
Move to ...	✗	✗	✗
Manage Rules	✗	✗	✗
Manage Rights	✗	✗	✗
Manage Aspects	✗	✗	✗
Folder available	✓	✓	✗
Create Folder from Template	✗	✗	✗
Upload Document	✓	✓	✗
Create Document	✓	✓	✗
Create Word Document	✓	✓	✗
Create Powerpoint Document	✓	✓	✗
Create Excel Document	✓	✓	✗
Create Text Document	✓	✗	✗
Create HTML Document	✗	✗	✗
Create XML Document	✗	✗	✗
Create Document from Template	✗	✗	✗
File Properties/Edit			

	Col 1	Col 2	Col 3
Upload New Version	✓	✓	✗
Create Review Task	✓	✗	✗
Create Workflow linked to File	✓	✗	✗
Delete	✓	✓	✓
Commment	✓	✓	✓
Download	✓	✓	⚠
Favorite	✓	✓	✗
Share	✓	✓	⚠
Like	✓	✓	✓
Edit	✓	✓	✗
Details	✓	✓	✗
Copy Link	✗	✓	✗
Add to Folder	✗	✓	✗
Follow/Unfollow	✗	✓	✗
Delete old version	✗	✓	✗
Restore old version	✓	✓	✗
Edit Attributes	⚠	✓	✗
Display in Browser	✗	✗	✗
Copy to ...	✗	⚠	✗
Move to ...	✗	⚠	✗
Manage Rights	✗	✗	✗
Manage Aspects	✗	✗	✗
Change Type	✗	✗	✗
Declare as Record	✗	✗	✗
Declare as Version Record	✗	✗	✗
Option for Declaration Automation	✗	✗	✗
Folders			
Show Attributes	✓	✓	✗
Edit Attributes	✓	✓	✗
Delete	✓	✓	✗
Show files in gallery	✓	✓	✗
Copy Link to Folder	✗	✓	✗
Add to Favorites	✓	✓	✗
Comment	✓	✗	✗
Download as .zip	✗	✗	✗
Copy to ...	✗	✗	✗
Move to ...	✗	✗	✗
Manage Rules	✗	✗	✗
Manage Rights	✗	✗	✗
Manage Aspects	✗	✗	✗
Local Filebrowser			
Local Files File Browser (Display)	✓	✗	✗
Add File to mECM folder	✓	⚠	✗
Upload file to ECM	✓	✓	✗
Release file to ECM	✓	✓	✗
Create file to local files	✓	✗	✗
Settings (Display)	✓	✗	✗
Help (Display)	✓	✗	✗
Favorites			
List of Files marked with "favorite"	✓	✓	✗
Task Management	Activities		
List Tasks	✓	✓	✗
Display Active Tasks	✓	✓	✗
Display Tasks assigned to Me	✓	✓	✗

Feature	Col1	Col2	Col3
Task/Details	✓	✓	✕
My Tasks (Display) different Filters	✓	✓	✕
Create Task (Ad-Hoc Task)	✓	⚠	✕
Create Task (Approval Task)	✓	✕	✕
Grouping of Tasks in Sections/Activities	✕	✓	✕
Add Assignee	✓	✓	✕
Priorization of Tasks	✓	✓	✕
Copy Link to Task	✕	✓	✕
Add Task to Favorites	✕	✓	✕
Create Sections Within Task	✕	✓	✕
Create Subtasks	✕	✓	✕

Others

Feature	Col1	Col2	Col3
Synchronized Data (Display)	✓	✓	✓
Search	✓	✓	✓
Profiles	✕	✓	✕
Edit Profiles (Tags, E-Mail, About)	✕	✓	✕
Follow other peoples actions	✓	✓	✕

Full Comparison of Desktop and Mobile Software

ECM Comparison

of mobile Applications and Web Software

- ☐ Hide Additional Information
- ☐ Hide App Comparison
- ☐ Hide Desktop Comparison

Functionality	Alfresco	Alfresco Desktop	IBM Connections	IBM Connections Desktop	Opentext Core	Opentext Core Desktop
Repositories	**Repositories**	**Repositories**	**Files**	**Files**		
Display Repositories	✓	✓	✗	✓	✗	✓
Create Repositories	✗	✓	✗	✗	✗	✓
Different Views	✗	✓	✗	✓	✗	✗
Different Sorting Options	✗	✓	✗	✗	✗	✗
				Date, popularity, name		
Upload Repository	✗	✓	✗	✗	✗	✗
Download Repository as .zip	✗	✓	✗	✗	✗	✗
Copy to ...	✗	✓	✗	✗	✗	✗
Move to ...	✗	✓	✗	✗	✗	✗
Manage Rules	✗	✓	✗	✗	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Collaboration Spaces	**Sites**	**Sites**	**Communities**	Communities		
Display Sites	✓	✓	✓	✓	✗	✗
Display Site Dashboard	✗	✓	✗	✓	✓	✓
Display Favorite Sites	✓	⚠	⚠	✗	✗	✗
			Just accessible from Favorites Menu			
Search Sites	✓	✓	✓	✓	✗	✓
			1. Seach my Communities 2. Search Public Communities 3.Search This Community 4.Search Communities By Name			
Create Site / Community	✗	✓	✗	⚠	✗	✗
				Rights need to be granted		
Edit Site / Community Details	✗	✓	✗	✓	✗	✗
Create Collaboration Site	✗	✓	✗	⚠	✗	✗
				collaboration spaces are the only choice		
Create Records Management Site	✗	✓	✗	✗	✗	✗
Display Memberlist	✓	✓	✓	✓	✗	✗
Add Members	✗	✓	✓	✓	✗	⚠
						not executable in free version
Disconnect / Leave from Collaboration Space	✓	✓	✓	✓	✗	✗
Mark Collaboration Space as Favorite	✓	⚠	✓	✗	✗	✗
		Star serves more like a ranking functionality for site overview				
Unmark Collaboration Space as Favorite	✓	⚠	✓	✗	✗	✗
		Star serves more like a ranking functionality for site overview				
List Documents / Show Library in Collaboration Space	✓	✓	✓	✓	✗	✗
Copy Link to Collaboration Space	✗	⚠	✓	⚠	✗	✗
			via browser	via browser		
Refresh current Site	⚠	✓	✓	✓	✗	✗
	not direct function, go back in menu and to view again					
Show Updates / News Stream	✗	✓	✓	✓	✗	✗
Stop Following	✗	✓	✓	✓	✗	✗
List Tasks	✗	⚠	✓	✓	✗	✗

Feature		Tasks are seperated and not linked to a specific collaboration space				
Add Task to Collaboration Space	✗	⚠	✓	✓	✗	✗
Forums Functionality available	✗	✓	✓	✓	✗	✗
Bookmarks Functionality available	✗	✓	✓	✓	✗	✗
Wiki Functionality available	✗	✓	✓	✓	✗	✗
Calendar Functionality available	✗	✓	✓	✗	✗	✗
E-Mail to Community Members	⚠	✗	✗	✓	✗	✗
Link other Community	✗	✗	✗	✓	✗	✗
Create Subcommunity	✗	✗	✗	✓	✗	✗

Bookmarks

Feature						
Create Bookmarks	✗	✓	✓	✓	✗	✗
Add Bookmark to Favorites	✗	✗	✓	✗	✗	✗
Edit Bookmark	✗	✓	✗	✓	✗	✗
			Permissions not granted			
Delete Bookmark	✗	✓	✗	✓	✗	✗

Forums (Discussions)

Feature						
Different Views (Details/Simple)	✗	✓	✗	✗	✗	✗
Create New Topic	✗	✓	✓	✓	✗	✗
Delete Topic	✗	✓	✓	✓	✗	✗
Edit Topic	✗	✓	✓	✓	✗	✗
Reply	✗	✓	✓	✓	✗	✗
Answers shown in hierarchical order	✗	✓	✓	✓	✗	✗
Edit	✗	✓	✓	✓	✗	✗
Show profile of reply author	✗	✓	✓	✓	✗	✗
Add to Favorites	✗	✗	✓	✗	✗	✗
RSS-Feed	✗	✓	✗	✓	✗	✗
Recommendation to answer	✗	✗	✗	✓	✗	✗

Calendar (Calendar | Calendar | Events | Events)

Feature						
Display Calendar	✗	✓	✗	✗	✗	✗
Create Appointment	✗	✓	✓	✓	✗	✗
Edit Appointment	✗	✓	✓	✓	✗	✗
Delete Appointment	✗	✓	✓	✓	✗	✗
iCal-Feed	✗	✓	✗	✗	✗	✗

Wikis

Feature						
View Wiki	✗	✓	✓	✓	✗	✗
Edit Wiki	✗	✓	✗	✓	✗	✗
Create Pages / Subpages	✗	✓	✓	✓	✗	✗
Add Comment	✗	✗	✓	✓	✗	✗
Versions	✗	✓	✓	✓	✗	✗
Compare Versions	✗	✗	✓	✓	✗	✗
Restore old Version	✗	✓	✓	✓	✗	✗
Appendix	✗	✗	✓	✓	✗	✗
Follow Wiki	✗	⚠	✓	✓	✗	✗
		via dashboard				
Disable Following	✗	⚠	✓	✓	✗	✗
		via dashboard				

Blogs

Feature						
View Blogs	✗	✓	✓	✓	✗	✗
Different Views (Details / Simple)	✗	✓	✗	✗	✗	✗
Different Sorting of Blog Entries	✗	✓	✓	✓	✗	✗
Add New Blog	✗	⚠	✓	⚠	✗	✗
		Blogs are apps to be used within Sites		Blogs are apps to be used within Communities		
My Blogs	✗	✗	✓	✗	✗	✗
Recent Posts	✗	✓	✓	✓	✗	✗
Read Later	✗	✗	✓	✗	✗	✗
New Blog Entry	✗	✓	✓	✓	✗	✗
Show Blog Entry	✗	✓	✓	✓	✗	✗
Bookmark Blog Entry	✗	✗	✓	✗	✗	✗
Comment Blog Entry	✗	✓	✓	✓	✗	✗
Like Blog Entry	✗	✗	✓	⚠	✗	✗
				Recommendation		
Copy Blog Entry Link	✗	⚠	✓	⚠	✗	✗
		Copy Link from Bowser		Copy Link from Bowser		
Add Blog Entry to Fovorites	✗	✗	✓	✗	✗	✗
Add Blog Entry to "Read Later"	✗	✗	✓	✗	✗	✗
RSS-Feed	✗	✓	✗	✓	✗	✗

Ideation-Blogs

Feature		same functionality as normal Blog				
Ideation Blogs available	✗	✗	✓	✓	✗	✗

			not directly available in main menu, but in community space			
Functionality for rating idea (support or no support)	✗	✗	✓	✓	✗	✗
Files	**Files**	**Files**	**Library**	**Library**		
Display Folders	✓	✓	✓	✓	✓	✓
Different Views on Content (Detailed, Less Detailed, ...)	✗	✓	✓	✗	✗	✗
Different Options for Sorting	✗	✓	✓	✓	✗	✓
Show as Gallery	✓	✓	✓	✗	⚠	⚠
		Media View				
Upload Repository	✗	✓	✗	✓	✗	✗
Download as .zip	✗	✓	✗	✓	✗	✓
Copy to ...	✗	✓	✗	✓	✗	✓
Move to ...	✗	✓	✗	✓	✗	✓
Manage Rules	✗	✓	✗	✗	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Create Folder	✓	✓	✓	✓	✓	✓
Create Folder from Template	✗	✓	✗	✓	✗	✗
Upload Document	✓	✓	✓	✓	✗	✓
	just single file, no folder or mutliple files uploadable					
Create Document	✓	✓	✓	✗	✗	✗
	*word, powerpoint, excel, text can be					
Create Word Document	✓	✓	✓	✗	✗	✗
	*word mobile needs to be installed		*IBM Connections Editor must be installed			
Create Powerpoint Document	✓	✓	✓	✗	✗	✗
	*powerpoint mobile needs to be installed		*IBM Connections Editor must be installed			
Create Excel Document	✓	✓	✓	✗	✗	✗
	*excel mobile needs to be installed		*IBM Connections Editor must be installed			
Create Text Document	✓	✓	✗	✗	✗	✗
Create HTML Document	✗	✓	✗	✗	✗	✗
Create XML Document	✗	✓	✗	✗	✗	✗
Create Document from Template	✗	✓	✗	✗	✗	✗
Capture Photo	✓	✗	✓	✗	✓	✗
Upload Photo from Gallery	⚠	✗	✓	✗	✓	✗
Capture Video	✓	✗	✓	✗	✗	✗
Upload Video from Gallery	⚠	✗	✓	✗	✗	✗
Record Sound	✓	✗	✗	✗	✗	✗
Follow File	✗	⚠	✗	✓	✗	✗
Disable Following File	✗	⚠	✗	✓	✗	✗
Shared documents	**Shared Documents**	**Shared Documents**	**Files**	**Files**		
Display Shared Documents	✓	✓	✓	⚠	✓	✓
Search Shared Documents	✓	✓	✓	⚠	✓	✓
				Documents already available in Cloud can be shared		
Different Views	✗	✓	✓	✗	✗	✗
Different Options for Sorting	✗	✓	✓	✓	✗	✓
Show Gallery	⚠	✓	✓	✓	⚠	⚠
Upload Repository	✗	✓	✗	⚠	✗	✗
Download as .zip	✗	✓	✗	✓	✗	✓
Copy to ...	✗	✓	✗	✗	✗	✓
Move to ...	✗	✓	✗	✗	✗	✓
Manage Rules	✗	✓	✗	✗	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Folder available	✓	✓	✓	✓	✗	✗
Create Folder from Template	✗	✓	✗	✗	✗	✗
Upload Document	✓	✓	✓	✓	✗	✗
Create Document	✓	✓	✓	✗	✗	✗
Create Word Document	✓	✓	✓	✗	✗	✗
Create Powerpoint Document	✓	✓	✓	✗	✗	✗
Create Excel Document	✓	✓	✓	✗	✗	✗
Create Text Document	✓	✓	✗	✗	✗	✗
Create HTML Document	✗	✓	✗	✗	✗	✗
Create XML Document	✗	✓	✗	✗	✗	✗

Feature	Col1	Col2	Col3	Col4	Col5	Col6
Create Document from Template	✗	✓	✗	✗	✗	✗
File Properties/Edit						
Upload New Version	✓	✓	✓ *Version cannot be changed with minor changes: 2.1 -> 2.2, Version automatically changed by changes in document	✓ *Version cannot be changed with minor changes: 2.1 -> 2.2, Version automatically changed by changes in document	✗	✗
Create Review Task	✓	✓	✗	✗	✗	⚠
Create Workflow linked to File	✓	✓	✗	✓	✗	✗
Delete	✓	✓	✓	✓	✓	✓
Commment	✓	✓	✓	✓	✓	✓
Download	✓	✓	✓	✓	⚠	✓
Favorite	✓	✗	✓	✗	✗	✗
Share	✓	✓ *All messengers, Bluetooth, E-Mail, SMS, Calendar, or other Applications	✓	✓	⚠	⚠
Like	✓	✓	✓	⚠ files can be defined as 'recommended'	✓	✓
Edit	✓	✓ *Filename, Title, Description, Author	✓	✓	✗	⚠
Details	✓	✓ *Properties: version, name, Titel, mimetype, author, file size, creator, creation date, editor, edit date, path to file	✓	✓	✗	✗
Copy Link	✗	✓	✓	✓	✗	⚠
Add to Folder	✗	✓	✓	✓	✗	✗
Follow/Unfollow	✗	✓	✓	✓	✗	✗
Delete old version	✗	✓	✓	✓	✗	✗
Restore old version	✓	✓	✓	✓	✗	✗
Edit Attributes	⚠	✓	✓	✓	✗	✗
Display in Browser	✗	✓	✗	✗	✗	✗
Copy to ...	✗	✓	⚠ Functionality not directly avaible: Add File to Folder can be used	✓	✗	✗
Move to ...	✗	✓	⚠ Functionality not directly avaible: Add File to Folder can be used	✓	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Change Type	✗	✓	✗	✗	✗	✗
Declare as Record	✗	✓	✗	✗	✗	✗
Declare as Version Record	✗	✓	✗	✗	✗	✗
Option for Declaration Automation	✗	✓	✗	✗	✗	✗
Folders						
Show Attributes	✓	✓	✓	✓	✗	⚠
Edit Attributes	✓	✓	✓	✓	✗	✗
Delete	✓	✓	✓	✓	✗	✓
Show files in gallery	✓	✓	✓	✓	✗	⚠
Copy Link to Folder	✗	✓	✓	✓	✗	✗
Add to Favorites	✓	✓	✓	⚠	✗	✗
Comment	✓	✓	✗	✗	✗	✗
Download as .zip	✗	✓	✗	✗	✗	✓
Copy to ...	✗	✓	✗	✗	✗	✓
Move to ...	✗	✓	✗	✗	✗	✓
Manage Rules	✗	✓	✗	✗	✗	✗
Manage Rights	✗	✓	✗	✗	✗	✗
Manage Aspects	✗	✓	✗	✗	✗	✗
Local Filebrowser						
		Dependent on the File System of the OS		Dependent on the File System of the OS		
Local Files File Browser (Display)	✓	⚠	✗	⚠	✗	⚠
Add File to mECM folder	✓	⚠	⚠	⚠	✗	⚠
Upload file to ECM	✓	⚠	✓	⚠	✗	⚠

Feature						
Release file to ECM	✓	!	✓	!	✗	!
Create file to local files	✓	!	✗	!	✗	!
Settings (Display)	✓	!	✗	!	✗	!
Help (Display)	✓	!	✗	!	✗	!
Favorites						
List of Files marked with "favorite"	✓	✗	✓	✗	✗	✗
	*day of favorization, file size		All elements with favrization are displayed in one list			
Task Management			Activities			
List Tasks	✓	✓	✓	✓	✗	✗
	*priority, name, type		*name, due date, author			
Display Active Tasks	✓	✓	✓	✓	✗	✗
Display Tasks assigned to Me	✓	✓	✓	✓	✗	✗
Task/Details	✓	✓	✓	✓	✗	✗
	*priority, name, type, due date, comments					
My Tasks (Display) different Filters	✓	✓	✓	✓	✗	✗
	*status, due date, priority, assigned people			last update, due date, name		
Create Task (Ad-Hoc Task)	✓	✓	!	✗	✗	✗
			Activity needs to be created first			
Create Task (Approval Task)	✓	✓	✗	✗	✗	✗
Grouping of Tasks in Sections/Activities	✗	✗	✓	✓	✗	✗
Add Assignee	✓	✓	✓	✓	✗	✗
Priorization of Tasks	✓	✓	✓	✓	✗	✗
Copy Link to Task	✗	!	✓	✓	✗	✗
		possible via brwoser				
Add Task to Favorites	✗	✗	✓	✓	✗	✗
Create Sections Within Task	✗	✗	✓	✓	✗	✗
Create Subtasks	✗	✗	✓	✓	✗	✗
Others						
Synchronized Data (Display)	✓	✓	✓	✓	✓	✓
Search	✓	✓	✓	✓	✓	✓
				All Connections, Status Updates, Profiles, Communities, Files, Wikis, Activities, Forums, Blogs, Bookmarks		
Profiles	✗	!	✓	✓	✗	✗
Edit Profiles (Tags, E-Mail, About)	✗	✓	✓	✓	✗	✗
Follow other peoples actions	✓	✓	✓	✓	✗	✗