Scandinavian Journal of Information Systems

Volume 18 | Issue 2 Article 4

2006

Contemporary Issues of Enterprise Content Management

Bjørn Erik Munkvold
Agder University College, bjorn.e.munkvold@uia.no

Tero Päivärinta
Agder University College, Tero.Paivarinta@hia.no

Anne Kristine Hodne
Agder University College, akhodne@lyse.net

Elin Stangeland
Agder University College, elin.stangeland@ub.uib.no

Contemporary Issues of Enterprise Content Management

The Case of Statoil

Bjørn Erik Munkvold,Tero Päivärinta, Anne Kristine Hodne and Elin Stangeland

Agder University College, Kristiansand, Norway
bjorn.e.munkvold@hia.no, tero.paivarinta@hia.no, akhodne@lyse.net and elin.stangeland@ub.uib.no

Abstract. The concept of Enterprise Content Management (ECM) represents integrated enterprise-wide management of the life cycles of all forms of recorded information content and their metadata, organized according to corporate taxonomies, and supported by appropriate technological and administrative infrastructures. Based on a case study of a Norwegian oil company (Statoil), we identify a wide range of issues related to management of content, infrastructure, and change. The ECM perspective is found to integrate and extend the existing research areas of information resource management and document management, as well as the repository model of knowledge management. ECM thus deserves further attention beyond its current market hype, as a potential area of IS research crossing several previously separate areas of information management from the viewpoint of the enterprise.

Keywords: enterprise content management, content management strategy, electronic document management, information resource management, knowledge management

1 Introduction

The concept of *Enterprise Content Management* (ECM) comprises "the strategies, tools, processes, and skills an organization needs to manage its information assets over their life cycle", including all digital assets such as documents, data, reports, and web pages (Smith and McKeen 2003a). Emphasis on managing content across the enterprise has recently emerged out of the extensive integration of various information management technologies since the 1990s.

The field of web content management emerged in the mid-1990s as a response to the challenges of managing corporate web pages, which quickly grew to large-scale and structurally complex information resources (Boiko 2002; Nakano 2002). The ever-increasing functionality of web-based information systems soon started to merge with traditional document management functionality (Balasubramanian and Bashian 1998) and groupware systems (Dennis 1998). Moreover, the new millenium has seen accelerating integration between transactional data systems and data warehouses with web-based interfaces and enterprise information portals (Becker et al. 2003; Morrison et al. 2002). Finally, modern mobile devices have provided new interfaces to access corporate information resources (Lamming et al. 2000). All this requires robust content management systems to create, store, deliver, browse, and access heterogeneous data. Such systems must cover everything from well-structured transaction data, via more or less structured XML-tagged content, e-mails and discussion forums, to voluminous digital files still often stored as "one chunk" of data. From the viewpoint of the enterprise, ECM needs to coordinate information management across often heterogeneous IT architectures (Ross 2003), involving numerous technical formats to be accessed through varying interfaces and devices.

According to a survey of Yankee Group among 750 medium and large U.S businesses, 63% of companies were increasing their investments on ECM in 2004 together with enterprise portal technologies while only 7% planned to spend less money on ECM than before (Surmacz 2003). Consulting institutions publish reports on the content management market and products, and practitioner-oriented books emerge (Boiko 2002; Nakano 2002). There are professional associations focusing on the theme, such as AIIM International (www.aiim.org), and a number of commercial vendors (e.g., IBM, Microsoft, and Vignette) and open-source communities are providing content management software for the enterprise with varying functionality. For example, www.opensourceCMS.com listed 62 content management-related open source software systems in May 2004.

The practitioner community around the concept of content management thus represents considerable market potential for a cluster of vendors and consultancies. Accordingly, current consulting language tends to focus on technological functionality. For example, Meta Group defines ECM as

> …the technology that provides the means to create/capture, manage/secure, store/retain/destroy, publish/distribute, search, personalize and present/view/print any digital content (i.e. pictures/images/text, reports, video, audio, transactional data, catalog, code). These systems primarily focus on the capture, storage, retrieval, and dissemination of digital files for enterprise use. (Meta Group, in Weiseth et al. 2002, p. 20).

Our search in major academic outlets and databases showed that there has not yet been much focus in information systems (IS) research on the concept of ECM from the viewpoint of an organization utilizing content management technology. (We searched for the phrase "content management", in title or abstract, in the electronic databases of ACM, AIS, IEEE, Springer, and EBSCOhost. This was assumed to give a general-level picture of the current status of content management as a research topic within the IS discipline.) The articles that explicitly address content management mainly report on particular technical functionality of content management software (Kerer et al. 2002; Surjanto et al. 2000; Tyrväinen et al. 2003), or provide purely conceptual suggestions (Goodwin and Vigden 2002; Han and Pape 2002).

Few articles refer to an organizational context for content management. Two exceptions here include a study on the evolution of a software product developed for web content management needs of IBM (Weitzman et al. 2002), and a case study comparing four software packages for web content management in a multinational financing company according to their framework for justifying IT investments (Hallikainen et al. 2002). Further, we only found three articles speaking of content management as an enterprise-wide initiative. Smith and McKeen (2003a) provide an introduction to the ECM concept and discuss key issues related to its deployment and governance based on input from a focus group of industry knowledge managers. They conclude that very few companies have yet reached a stage of developing and implementing a comprehensive ECM strategy. Based on one case study, O'Callaghan & Smits (2005) suggest a content portfolio framework for defining which content to manage within an enterprise. Scott et al. (2004) describe the emergence and evolution of three content management related projects in J.D. Edwards, suggesting lessons learned for four development phases of knowledge management.

In summary, Smith and McKeen (2003a, p. 657) conclude that "…there is no clear definition what it [ECM] means, how it should be done, and who

should do it." The fact that Scott et al. (2004) state their article to represent "evolution of knowledge management at J.D. Edwards", although the focus of the case report is mainly content management, confirms that ECM as a concept has yet to be established as a distinct area in IS research.

We seek to build an understanding of the enterprise perspective on content management. This is pursued in two ways. First, we add to the scarce body of empirical research on ECM by reporting initial findings from a major ECM project in Statoil, a Norwegian oil company. This ECM project represents a comprehensive strategic effort towards integrating knowledge resources throughout the entire corporation. By identifying and discussing key issues related to Statoil's strategic ECM initative, this study presents in-depth insights from evolving industry practice. Second, we scrutinize the ECM concept by discussing how the issues identified are related to the following previously "established" areas of IS research: information resource management (IRM), electronic document management (EDM), and knowledge management (KM). Through this analysis we hope to demarcate ECM as a better defined area of IS research.

The next section presents the case context and the research approach applied. This is followed by the results from the data analysis, assessing the major ECM issues. The identified issues are then compared with the scope and focal issues of related research areas. The final section presents conclusions and implications.

2 Case Overview

2.1 Brief Presentation of Statoil

Statoil is the world's third largest exporter of crude oil, with approximately 25,000 employees in 33 countries and a total revenue exceeding US $ 61 billion (2005). Statoil corporate IT (Information Technology), with about 600 employees, is responsible for maintaining the large portfolio of IT applications across the company.

During our study, where the data collection took place in 2002-03, Statoil's main platform for document management and workflow was Lotus Notes, including a Notes-based virtual project room (Sarepta Arena), and an electronic archive. Numerous other applications were also used for file creation and data storage, including discipline-specific applications and databases, intra- and extranet applications, and file structures in MS Office 2000. An

ERP (Enterprise Resource Planning) solution (SAP) covered a proportion of business processes and related databases across the organization.

Typical of many large corporations, Statoil's IT architecture had evolved gradually into a broad portfolio of technologies with partly overlapping functionality and applications. As a result, the company's information was scattered across a number of different storage media and applications, with the total number of databases estimated to exceed 5,500. This again created major challenges related to information retrieval, version control and information quality across the enterprise.

2.2 Statoil's Vision for ECM

To address these challenges, Statoil launched a major ECM program, constituting a fundamental part of the company's holistic "e-Collaboration strategy" (Weiseth et al. 2002). Statoil here adopts MetaGroup's definition of ECM, presented in the introduction. This implies that information from external and internal information suppliers should ideally be managed regardless of what application is used for creating it, and regardless of format. Further, all technical processes in the information life cycle should be automated, from creation to archival, with content delivered to the recipient independent of time, place or media.

The Statoil ECM initiative represents a wide development program for the enterprise, covering tools, services, and organizational development initiatives between 2002-2005 (Weiseth et al. 2002). The program was organized in several sub-projects, addressing topics such as (Weiseth et al. 2002):

- basic content management solution
- automatic archiving
- long-term storage with separate data index
- automatic security level of information based on metadata
- integration of existing standard office tools
- corporate yellow pages
- one common portal framework
- training services for content management solution
- implementation of guidelines for the use of third party solutions (e.g., in projects with partners)
- establishing required e-learning modules

The overall goal was to establish a corporate "knowledge reservoir" that

> provides global access to and the management of a common pool of digital assets used to collaborate, support work processes and share information

between the company and their customers, employees and business partners (Kleppe 2002).

Coordinated and role-based access to this knowledge reservoir was to be provided through an enterprise portal.

Statoil's goal for its planned ECM-initiatives went far beyond alleviating single problems and limitations, to achieve a broad-based foundation for more effective collaborative work practices. As will be discussed, this vision implies several challenges.

3 Research Process

A qualitative case study was chosen as the research strategy to provide a holistic investigation of a contemporary phenomenon within its real-life context (Yin 1989). The enterprise-wide scope of Statoil's ECM program gives this exploratory case study a *revelatory* nature, justifying a single-case study design (Yin 1989). This report covers the initial phase of the program, including the strategy and scope definition for ECM in 2002.

Our data sources include interviews, corporate documents and presentations, and supplementary discussions with participants in the ECM program. Eight persons were interviewed, holding key roles related to information management in the business units of Statoil. These interviewees were selected by the corporate e-collaboration disciplinary advisor, functioning as the champion for content management in Statoil. The interviews were semi-structured, focusing on three areas:

1. Existing practices, experiences, and challenges related to the different stages of the information management life cycle (creation and use, storage and archiving, distribution and retrieval, maintenance and deletion);
2. The informants' expectations for the planned ECM initiatives; and
3. Statoil's future needs related to information management.

Former theory on the information management life cycle thus served as an initial guide to the design and data collection, while still preserving "a considerable degree of openness to the field data", as recommended by Walsham (1995, p. 76).

The interviews lasted from 45-60 minutes and were taped and transcribed. The discussions with ECM project members supplemented the interviews with status updates on the planned ECM initiatives. E-mail was used for follow-up questions to the informants. We also gained access to extensive Statoil docu-

mentation, including existing standards for document management in Statoil, survey reports and analyses of their existing use of collaboration technologies and related practices, and reports and presentation material on the new e-Collaboration strategy and related ECM initiatives.

The data analysis was a stepwise process, involving all four authors. First, a preliminary analysis of the transcribed interviews and documents was conducted, searching for statements concerning ECM issues, i.e. problems, challenges, goals, and development initiatives related to content management. The researchers then separately developed categorizations of these issues, which were compared and merged into a preliminary set of common categories. This was followed by additional document analysis, resulting in a revised set of six common categories (Figure 1). The identified categories are all grounded in the data collected from the case organization and interpreted based on the researchers' previous knowledge of the field. In this sense, our data analysis followed the principles of open-coding (Strauss and Corbin 1990). The analysis results were made available to the informants for verification of the researchers' interpretations (Miles and Huberman 1994), thus increasing the validity of the study (Yin 1989).

The next section presents the results of the categorization. Following Eisenhardt (1989), comparison with both contrasting and similar findings in the literature is considered an important part of the qualitative data analysis. In the Discussion section, we compare our findings with current empirical research on ECM and related areas. Through this, the study intends to contribute both to the existing theory related to information management in organizations, and related organizational practice.

4 Results

4.1 Overview of ECM Issues in Statoil

The concept of ECM involves several issues beyond the content management technology and software functionality often highlighted by the vendors. Figure 1 summarizes the major ECM issues resulting from our analysis.

Statoil's rationale for ECM resides in the aim of *effective and efficient e-collaboration* between the organizational stakeholders, including customers and other partner organizations, and the basic content management solution representing the core foundation of Statoil's e-Collaboration strategy (Weiseth et al. 2002). ECM here provides integrated solutions for handling all digital

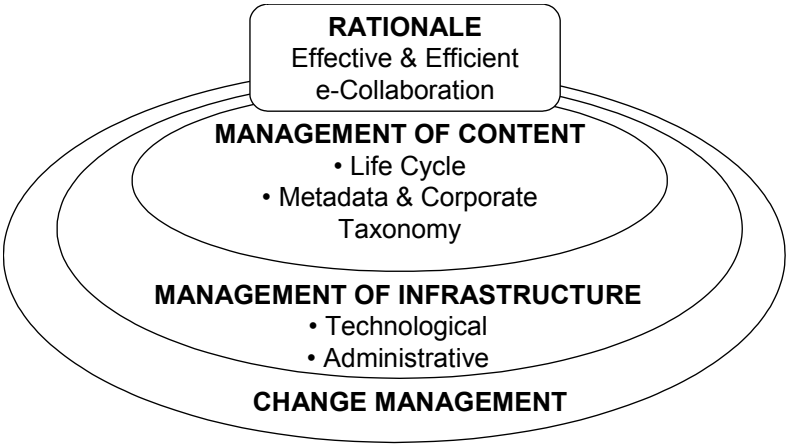

Figure 1. Major categories of contemporary ECM issues in Statoil

information content in one form or another (documents, e-mails, calendars, etc.). This also include taxonomies and metadata of content resources and communication applications provided in enterprise portals, static and dynamic channels for publishing content via multiple channels, content management for particular applications and domains (such as engineering), document management and workflow applications. The realization of this ECM solution requires management of several issues, categorized in our analysis as *Management of Content*, *Management of Infrastructure* and *Change Management*.

Table 1 summarizes the issues identified and mapped under the categories from Figure 1. These issues together represent a holistic picture of ECM from the perspective of the case organization. In the following sections we discuss the issues identified within each of these categories.

Category	*Issues*
E-Collaboration	Routines for e-collaboration across business processes and organizational units Standards for inter-organizational e-collaboration with customers and partners

Table 1: Summary of ECM issues in Statoil

Category	*Issues*
Content Life Cycle	Ensuring content capture into a shared ECM system from production/receipt Informing about content with references to shared storage instead of copied content Numerous existing heterogeneous content databases Controlled archiving immediately from production Version management, especially of compound content with multiple producers Possibility for standardized workflows Application-independent storage format(s) Routines for controlled archival and retention Integrated accessibility, search, retrieval, and effective reuse across the corporation
Metadata and Corporate Taxonomy	Capturing contextual organizational metadata with content produced/received Easy and maximally automated production of content metadata Awareness of the importance of metadata among content producers Guidelines how to define, maintain, and utilize corporate taxonomy (in general and in connection to selected ECM technologies)
Technological Infrastructure	Technological integration of standardized tools: integrated content production, storage, distribution, and access/retrieval environments Tools to support standard ”application-independent” content formats Technological issues related to information security
Administrative Infrastructure	Meaningful administrative routines related to content life cycle Awareness of relevant routines among content producers Administrative issues related to information security Establishing support/service organization for ECM
Change Management	User motivation for required technological and administrative changes: - General opposition to standardization - Reluctance to new technology adoption Updating user skills (in managing content and utilizing information technology) Facilitation of corporate services related to ECM Organizational resources and competence to carry through ECM development Justification and evaluation of investments in ECM

Table 1: Summary of ECM issues in Statoil

4.2 Management of Content

We identified two logically separable, although intertwined, subcategories related to the management of content: *management of content life cycle* and *management of metadata and corporate taxonomy.*

Management of content life cycle. The interviews showed that, unlike within corporate IT services which strive to keep up with the latest technological developments, the term content management had yet to become widely adopted in the business units in Statoil. Document management was still the most familiar term and business units primarily saw content management as corresponding to their traditional document management solutions. In contrast, the content management champions in corporate IT were looking forward towards the potential applications of modern content management technology and portal solutions, which would blur the prevailing borderlines between file management, web pages, and connections to the structured transaction databases and data warehouses. That is, whereas corporate IT personnel were already developing the future-oriented content management strategy, the business units still spoke the language of the existing systems. The concept of document management represented the common term for planning, organization and execution of the following tasks: capture, distribution, registration, storage, retrieval, transformation, securing, and destruction of documents. These functions related to document instances are referred to as the document (or content) life cycle.

As the new content management and collaboration solutions introduce new challenges to manage content units of a smaller granularity than files of the existing document types, the existing document management standards needed to be renewed to correspond to the new terminology. Statoil thus faced several challenges in the management of the content life cycle functions and their integration.

The *capture*/*storage* of content into a shared system lacked control, regardless of whether this content was produced in-house or received from external sources. For instance, personal e-mail-boxes stored a major amount of e-mails and attachments, although the broader relevance of this material implied a need for it to be more systematically shared and stored. Important documents as well were sometimes saved plainly on personal file folders after their production and first-hand delivery (typically through e-mail), despite the espoused policy to utilize the shared document management systems, such as Sarepta Arena. The following statements from two of the business unit representatives illustrate this problem:

> …[I]n reality, there are too many who work just with their e-mail-boxes, and too few who work with Arena-databases.
>
> A great deal of the information I need is stored in the different e-mail-boxes in Notes. Knowing where this information is stored and navigating in this e-mail-box system is a huge problem.

The problems in content capture caused further inefficiency when people were *distributing* document copies as e-mail attachment files, instead of informing others about new shared content via reference links. Although some units did better than others in this area, depending on their application infrastructure, the enterprise-scale challenge still remained.

The thousands of existing heterogeneous content databases involved stand-alone intranet and extranet applications, and more than 800 databases of archived (file-based) documents and other content elements, such as Lotus Notes postings, web content, e-mails, etc. Although these could be technically shared across the enterprise they were not logically shared, as people were more or less unaware of the existence, contents, and relevance of a great number of these. In this jungle of options of where to store each piece of content after its production or receipt, it was rather understandable that many pieces of content never ended up into a shared document management system. The above-mentioned problems in capturing the content also hindered systematic *archiving* of content, which should ideally take place in the immediate connection to their production processes.

Many of the heterogeneous document applications lacked *version management* facilities, especially those that managed compound documents and their parts from multiple authors. In relation to this challenge and content *publication* in general, the possibility for standardized *workflows* was identified as a central requirement for the future solution.

The storage of files in their production format made retrieval difficult after some years, as the applications to view and re-produce the files and/or templates tend to change. On the other hand, storage in a changed format can make content re-use more difficult, if the original application still exists. This is a relevant problem especially for certain types of content with a life cycle exceeding a few years, which highlights the need for application-independent storage format(s).

There were no embedded routines for *retention* of information in the production, storage or archiving systems. This resulted in redundant storage and accumulation of content. The "cleaning and deleting of information" was not highly prioritized among the employees. Typically, the clean-ups of content occurred in the form of campaigns:

> It takes place as part of conversion to new systems, at least. And then, yes, it does happen from time to time, there are some units that take on the responsibility and then does it once a year, that is if we're lucky. But once a year, or every other year.

On the other hand, Statoil also needs to carefully comply to a number of external regulations and guidelines for document storage and archival. For example, the fact that Statoil is listed in the New York Stock exchange requires the company to follow the Sarbanes-Oxley act for traceability of economic transactions and documents. In a largely distributed enterprise, these challenges are far from trivial.

Finally, *search, retrieval*, and *reuse* of content appeared problematic due to the heterogeneity of content formats and databases. No integrated search facility covered even all the shared databases/repositories. Information retrieval across business units was regarded as problematic despite shared unit-level systems, as different business units had different taxonomical and physical structures for their information resources. For example, part of the Notes databases were not integrated with corporate search tools. Hence, the employees could not be sure that a search result was complete within a topic, nor that they got the latest version available. The challenge of integrated accessibility, search, and retrieval of information across the corporation was to be solved in the future ECM solution.

Management of metadata and corporate taxonomy. At the time of this study, the idea of metadata held by the interviewees corresponded rather straightforwardly to the concept of document metadata (Murphy 1998). This had been implemented by corporate IT for describing content objects in general, regardless of data formats. There was a lack of contextual or organizational metadata (ibid.) to describe the original business context in which the piece of content was created, in addition to the generic metadata elements (such as author, date, title). For example, if a document reader had difficulties with interpreting the content, s/he often needed to contact the content producer or owner personally to get additional information. Still, several informants stated that metadata was the sole responsibility of archivists, not the content producers:

> I don't believe that this [metadata] is something which is much recognized out there in our organization, I think we take it easy and leave it to those who can do it [archivists].

The interviewees identified a major challenge in easy, automated production of organizational metadata attached to the content objects, as well as in creating awareness among the content producers of its importance. All in all, the issue of metadata, especially the contextual metadata, thus represented a trade-

off between efficient production/capture of content and effective retrieval and reuse.

In addition to the metadata attached to individual content objects, the issue of *corporate taxonomy* as a whole was raised. In Statoil, this concept represents the logical structuring of the overall information resource from varying viewpoints (e.g. in terms of shared electronic folders and other such categorizations), and the guidelines on how to do that. In addition to structuring information resources as such, the corporate taxonomy was thus intended to fulfil the following purposes:

- function as the basis for users to navigate through content collections and to conduct searches
- provide a basis for defining and coordinating access rights to content collections
- categorize user roles and their business responsibilities
- serve as a basis for automatic creation of organizational metadata on content pieces, according to the role-based modelling of users and their explicit relationships with certain business contexts.

Corporate taxonomy was regarded as a fundamental part of ECM in Statoil, combined with software required to support the maximum automated definition and maintenance of this taxonomy.

4.3 Management of Infrastructure

Technological infrastructure. The existing infrastructure in Statoil related to content management included a large number of heterogeneous and parallel applications, providing several alternatives for producing and storing information. Partly, this reflected the heterogeneous information needs of the different business areas in Statoil, requiring function-specific applications for handling data as diverse as seismological data and stock prices. However, it was also a problem that there were too many individual tools and shared applications with overlapping functionality:

> …it's too much of 'each man his tool,' or his macro or his spreadsheet.

In general, the lack of application integration represented a problem throughout the content life cycle. For instance, the system for managing documents was poorly integrated with several production packages. While document copies could reside in several different systems, changes and updates were typically registered only in one of these. With increasing focus on external collaboration, for example with other oil companies, suppliers and partners, standardized technological solutions for this became increasingly important.

While some units have developed their own extranet solutions for sharing information with partners and subcontractors, no standard solution for content sharing with external partners existed.

The integration of standardized applications and tools throughout the content life cycle thus represented the major technological challenge in the future. Moreover, Statoil required these tools to be user-friendly, intuitive, and easily accepted and adopted by a majority of users. For instance, contemporary search tools had been regarded unsatisfactory due to long response times. In addition, the e-mail distribution of content was often provoked by technical problems in the current solutions for distributing links (resulting in annoying error messages for target audiences). In connection to a standardized device portfolio, common portal solutions to access information and applications globally, and advanced networks and wireless solutions, robust technological integration represented a crucial issue in Statoil's vision of e-collaboration.

Changes in production tools over time created another challenge to ECM. For instance, after Statoil changed office tools from Lotus Smartsuite to MS Office 2000 numerous potentially relevant documents in the file formats of the former package still existed, hindering effective utilization of this content. Hence, a technological challenge concerned developing an application infrastructure that could produce and utilize application-independent and standardized content formats which would live over changes in the application portfolio.

A technology-related issue resided in providing appropriate tools to ensure information security, including technologies for public key identification, electronic signatures, and e-mail encryption. An important part of the e-collaboration strategy was also to establish technical services for secure collaboration with external parties, such as other oil companies, suppliers and partners. In a survey of existing collaborative work practices in Statoil, more than 70% of the respondents collaborated with external partners on a monthly or more frequent basis. An extranet service based on Lotus Sametime was deployed for meeting this demand.

Administrative Infrastructure. The administrative infrastructure consisted of policies, routines, and procedures for content management, and the organizational roles required for following these. Several routines for traditional document management had been defined at the corporate level. However, these were followed inconsistently in the business units; a survey among employees in one unit indicated that only 22% of the respondents knew about the governing standards for document management, as illustrated by the following statement:

> …[W]e have more like good ideas and intentions than structured routines and processes to follow.

Further, although local routines for information management were stated to exist in the business units, their degree of operationalization varied strongly. In general, the large number of routines was regarded as a problem:

> Yes, there are very many, very many routines. Probably… so many routines that people cannot relate to them. You just distance yourself from some.

The issue of information security also related to the administrative infrastructure. A few years ago, Statoil changed its policy regarding information security from a "need to know" to a "need to restrict" principle. This principle implies that all information in Statoil should be open and available to employees, unless specifically stated otherwise. Each individual is responsible for ensuring that information is made available to contribute to the company's value creation. This requires that information owners are defined for sensitive content. The information owner then manages access to this, and documents the reasons for restricted access rights. The latter is important for others to be able to take over this task in case the information owner leaves this position. When working within Statoil offices, external consultants have access to databases including internal information. This may also constitute a security hazard, requiring an explicit administrative policy and actions.

Finally, the ECM program included establishing a service organization to maintain the corporation-wide ECM. This covered definitions of future responsibilities for training and supporting users, partners and internal advisors in ECM issues, and developing a collaborative network to share knowledge of ECM throughout the corporation (Weiseth et al. 2002).

4.4 Change Management

Several user-related issues requiring change management were identified. The first was a general opposition to tool and content standardisation combined with reluctance to adopt new technology. Clearly, fluent user skills in managing content and motivation to utilize the related tools were required. A survey of existing use of collaboration technologies in Statoil identified lack of user training as a major cause for frequent underutilization of the technologies. The way in which the technology was introduced also sometimes created opposition. Several employees had experienced new software or hardware just being "dropped" in their offices without further guidance, so that they were not able to make full use of the tools. Frequent upgrades and shifts also caused some frustration. Some argued that rather than implementing new technologies, improved exploitation of the existing ones should be prioritized.

> …[We need] more focus on the routine and competence side than on tools, it is always nice to acquire new tools, but as a rule they do not give major effects in application.

To tackle these issues, corporate services providing training and active user support for ECM were regarded as crucial. However, a challenge in this was the sometimes limited resources available for individual subprojects in the business units, especially related to the technical competence needed for integration and piloting of ECM solutions.

The issue of how to justify investments in ECM for the top management emerged at the beginning of the program, and an action research effort was conducted to establish such an evaluation model and related measures (Hu et al. 2004). Traditional financial measurements such as return on investment (ROI), which focus on specific business cases for particular organizational groups and units, were considered artificial and inappropriate for this project which pursued infrastructural and enterprise-wide contributions:

> Our decision-makers simply don't believe in the overwhelming ROI calculations.

However, a challenge remained in identifying a main stakeholder to be responsible for facilitating the overall, ex post evaluation of the ECM program, as this represents a considerable effort and requires a motivated customer inside the corporation.

5 Discussion

The discussion is organized in three parts. First, we compare the insights from the Statoil case with the scarce academic literature on content management from the viewpoint of the enterprise. Second, we demarcate the area of ECM in relation to the established IS research areas of Information Resource Management (IRM), Electronic Document Management (EDM), and Knowledge Management (KM). Finally, based on this discussion, we provide implications for further research and practice in this area.

5.1 Comparison of Statoil Findings with Other ECM-Related Studies

In the following discussion, we compare and contrast the issues identified in the Statoil case study (Table 1) with two studies that also address the enterprise view on content management, i.e. the studies by Scott et al. (2004) (the

J.D. Edwards case) and Smith and McKeen (2003a) (focus group interviews of knowledge managers), referred to in the introduction to this paper.

With regard to the rationale and scope of ECM, the Statoil case provides an example of a strategic, corporate-wide ECM approach, as called for by Smith and McKeen (2003a). In contrast, the data collected by Smith and McKeen (2003a) and Scott et al. (2004) indicated that most, if not all, contemporary content management initiatives were group level or unit level efforts pursuing tactical benefits such as web content management, intranet, and publication of manuals.

The Statoil data confirms the importance of a holistic focus on content life cycle, from capture/creation to long-term retention or deletion, as a core characteristic of ECM (Smith and McKeen 2003a). In comparison, the J.D. Edwards case (Scott et al. 2004) discusses less about the whole life cycle rather than the individual functions of content creation, publication, and sharing through the web or intranet. Moreover, the Statoil case underlines the challenges concerning the management and integration of already existing voluminous and heterogeneous content resources that have evolved over time, and highlights the need for application-independent content formats.

Regarding content metadata and corporate taxonomy, Statoil recognizes the need for policies, guidelines, and enhanced awareness of metadata and content taxonomies at the enterprise level. Simultaneously, the case highlights the challenge from the prevailing cultural norm of considering metadata as to belong in the domain of archivists only, and not as an ingredient in active content production and utilization in daily work. Hence, the data confirms the suggested importance of automated and dynamic metadata creation and taxonomy utilization in modern ECM solutions, supporting the recommendations to avoid manual practices for this whenever possible (Scott et al. 2004).

Concerning the technological infrastructure for ECM, Statoil has chosen to develop an enterprise-wide platform based on products acquired from well-established commercial vendors. In contrast, J.D. Edwards combined its in-house content publication system with evolving intranet and web content management solutions, gradually increasing the utilization of vendor-delivered software packages for more targeted purposes (Scott et al. 2004). We can thus identify at least two differing approaches to the development of ECM technology infrastructure: an evolutionary pattern through tactical improvements as in J.D. Edwards, or a strategic, holistic investment in technology platform as in the Statoil case. However, in both cases acquisitions of commercial software packages form the major part of the developments in technology platform. So far, the details of such commercial acquisition and development processes related to ECM technology have not been thoroughly researched

from the customer viewpoint, nor the corresponding development processes of open source ECM technologies.

Both the Statoil and the J.D. Edwards cases illustrate the importance of focusing on formalized administration and governance structures for content management issues, possibly renewing the existing administrative structures from the document management era (Smith and McKeen 2003a). In addition, awareness of the relevant routines among the employees emerged as a key issue in Statoil. Having many centralized routines was found to be of limited value, unless these routines were perceived necessary from the viewpoint of particular organizational domains and communicated clearly to these business areas.

The Statoil data supports previous indications about the importance of change management during ECM development (Scott et al. 2004; Smith and McKeen 2003a). Change management involves requirements for top management support, user motivation and training, new competence for ECM technology and development, continuous sponsoring and facilitation of corporate ECM services, and justification and evaluation of ECM initiatives. In Statoil, a team of people in Corporate IT was assigned to gain general-level competence on ECM and related technology, after which they presented the opportunities offered by this concept to the board of IT decision makers, including business unit managers. The report from the more focused and tactical projects in J.D. Edwards indicates that the ECM "evangelists" here worked on a more individual basis during the project initiation phases. In this sense, the strategic approach to ECM again seems to require more centralized change management efforts. Whereas J.D. Edwards focused on justifying and evaluating their targeted ECM initiatives through traditional cost-benefit measures applied to focused business cases (Scott et al. 2004), Statoil's comprehensive approach of considering the ECM platform as a whole before starting to pilot applications for particular business cases represents increasing challenges to the justification and evaluation of these initiatives. On the other hand, through this centralized decision-making process, Corporate IT in Statoil managed to obtain corporation-wide commitment to the ECM program.

5.2 Relating ECM to IRM, EDM, and KM

Most of the issues listed in Table 1 and discussed in the previous section clearly can be related to one or several of the following established research areas: information resource management (IRM), electronic document management (EDM), and knowledge management (KM). The following discussion is mainly based on reviews of research in these areas (Lewis et al. 1995; Sprague

1995; Alavi and Leidner 2001), as we believe that the established frameworks and constructs summarized in such reviews should inform also particular areas of ECM research in order to recognize the intellectual roots of this field. For example, the concept of EDM includes the field of office information/automation systems, which addressed varying applications for "document storage, retrieval, manipulation, and control" (Ellis and Nutt 1980, p. 27) from the 1970s to the early 1990s.

In this section, we present the argument that ECM, as framed by the case organization, represents a contemporary perspective to information management integrating the research traditions of IRM, EDM, and the repository model of KM. That is, ECM as a whole integrates a large number of previously separated research concerns which to some extent have been scattered across the disciplines of IRM, EDM, and KM, while none of these disciplines address the full set of contemporary issues relevant for an organization undertaking ECM practice as a whole. As the basis for this discussion, Tables 2 and 3 provide a comparative overview of the ECM issues identified in this study and the focal issues of the three abovementioned research areas.

	Information metaphor	*Scope*	*Life cycle*	*Metadata and taxonomy*
KM	Distinction between the "repository" and "network" models of KM (Alavi 2000), reflecting the focus on "explicit" and "tacit" knowledge (Nonaka 1991), respectively.	Evolving from KM applications for particular communities of practice or business units, towards enterprise-wide visions and programs (Smith and McKeen 2003b).	Knowledge life cycle typically focusing on acquisition/generation, codification, conversion, utilization and application, and protection from unauthorized use or theft (e.g., Alavi 2000; Gold et al. 2001).	The "repository model" (Alavi 2000) covers codified knowledge resources requiring metadata management. As well, the "network model" involves "corporate yellow pages", knowledge directories, and/or knowledge maps. Taxonomies and metadata brought up also in connection to document classification and portal systems, when regarded as part of the KM technology portfolio (Marwick 2001).

Table 2: Comparison of ECM with IRM, EDM and KM

	Information metaphor	*Scope*	*Life cycle*	*Metadata and taxonomy*
EDM	"Document" (Sprague 1995) or "file" (Bielawski and Boyle 1997) as the technical unit to be managed.	Enterprise-wide scope involving several business and support units (e.g., Sprague 1995).	Document life cycle: capture and creation, storage and organization (also compound documents/files in distributed storage), integration between documents and databases, retrieval, transmission and routing, printing and display, and retention (Sprague 1995).	Document metadata traditionally limited to reference information and indices of files. Limited research on organizational document metadata (Murphy 1998). Problems related to manual management of document metadata in organizations addressed (Murphy 2001, Päivärinta et al. 2002), as well as categorization challenges of documents under common taxonomies (Dourish et al. 1999).
IRM	Mainly "data", office automation (i.e., document-based information) occasionally mentioned (e.g., Lewis et al. 1995).	Coordinated, enterprise-level management of data, technology, planning, and development efforts (e.g., Lewis et al. 1995).	Focus on acquiring, storing, processing, and distributing data, mostly through well-structured databases and data warehouses.	Corporate data dictionaries and data architectures (Lewis et al. 1995), mainly for application development and planning purposes.
ECM	"Content" integrating utilization of heterogeneous data and document resources across their formats and production applications.	Evolving from group and unit level efforts towards integrated, strategic development programs across business processes, organizational units, and customers and partners.	Content life cycle: coordinated content capture, production, (dynamic) organization, workflow, access, search, retrieval, reuse, retention. Application-independent content formats and standards.	Guidelines for enterprise-wide utilization of metadata and taxonomies. Automated production and maintenance of metadata. Awareness of importance of metadata where it needs to be produced manually. Taxonomy as the organizing framework for content; also for access and personalization issues.

Table 2: Comparison of ECM with IRM, EDM and KM

	Technology infrastructure	*Administrative infrastructure*	*Change management*
KM	Marwick (2001) divides KM technology applications (and examples) according to the process types of knowledge transformation: tacit-tacit (e-meetings, chat), tacit-explicit (annotation, question-answering support), explicit-tacit (visualization, browsable video/audio presentations), explicit-explicit (text search, document categorization).	The role of the KM function and governance becoming more formalized and structured enterprise-wide, instead of early "distributed models" for particular communities of practice. The role of "chief knowledge officers" increasingly institutionalized (Smith and McKeen 2003b).	Need for people-centred technology, community building, knowledge-friendly managerial environment, and motivation of people to collaborate and share knowledge. Measurement of KM benefits remaining a problem since the 1990s (Alavi 2000; Smith and McKeen 2003b).
EDM	Technology infrastructure for EDM involves both basic infrastructure (workstations, storage, network, user interfaces, operating systems) and, ideally, support throughout document life cycle (Sprague 1995).	EDM requires reconsideration of the administrative roles among such traditional support units as IS department, records management, office management, library, reprographics and printing, and training and education (Sprague 1995).	Need for document management champions, executive support, and comprehensive training efforts in document management projects (Bielawski and Boyle 1997).
IRM	Technology integration a central issue to be coordinated at the enterprise level, including security of IT (Lewis et al. 1995).	Data ownership and administration, the role of chief information (technology) officer, comprehensive security programs (Lewis et al. 1995).	Central information systems planning process by advisory committees including both senior managers and users, based on business goals. "Mechanisms" for assessing the potential of new technologies by such committees (Lewis et al. 1995).
ECM	Integrated technology platform and applications throughout content life cycle. Tools should support standards for application-independent content formats. Information security issues.	Administrative routines for content ownership and governance. Information security issues. Awareness of meaningful and relevant routines. Support/service organization for ECM.	Top management support, user motivation and training, new competence development, continuous sponsoring and facilitation of corporate ECM services, and justification and evaluation of ECM initiatives. Challenges of justifying and evaluating infrastructural ECM investments.

Table 3: Comparison of ECM with IRM, EDM and KM

As shown in tables 2 and 3, the information concepts representing the form of information to be managed under each research area are varying. KM represents the most comprehensive concept, including both the repository model of codified knowledge that covers any information content stored outside the human brain, and the network model of knowledge referring to the situation in which tacit knowledge would be shared in human-to-human interaction networks (Alavi 2000). Related to the KM framework by Alavi and Leidner (2001), which divides KM into the processes of knowledge creation, storage/retrieval, transfer, and application, ECM mainly focuses on the knowledge storage/retrieval processes, with less attention to the human-centric processes of knowledge creation and application by human beings as such. Moreover, KM tends to highlight strategies for facilitating immediate utilization of knowledge, both tacit and codified, often targeted towards the purposes of innovation, development, and problem-solving, as reported from such business domains as consultation, high tech, and health care (Hansen et al. 1999). ECM, in turn, must also deal with other organizational information content that is perhaps less targeted to the core issues of KM, but which can plainly be needed for such purposes as: compliance to external documentation requirements, administrative routines and coordination, or informing about organizational actions and products towards customers and other stakeholders. In addition, some organizations may have digital products which may have little to do with organizational knowledge or information needs in the first place, but which still may pose a content management challenge, such as content targeted to entertain customers or other external parties. Hence, we argue that the scope of ECM development may sometimes reach beyond the strategies typical for KM (cf. Hansen et al. 1999; Earl 2001). However, whenever knowledge is transferred through and stored on digital media it becomes content which needs to be somehow managed, thus becoming a subject to ECM in the organizational context in question.

ECM thus covers all content that can be stored by using information technology, regardless of the data format (cf. Smith and McKeen 2003a). For centuries, the disciplines of archival science and records management have addressed the issues of document preservation and retention of archived records, which have been present in the early research within IRM and EDM as well (Lewis et al. 1995; Sprague 1995). Although these issues have been less highlighted in KM, robust records management and retention remain a non-trivial challenge, as highlighted by the external requirements identified in the Statoil case.

The actual rationale and scope for organizational initiatives may vary within each of these areas. Tables 2 and 3 thus only point to some general characteristics of scope, as identified in the literature. Whereas the enterprise-

wide scope of interest was central already in IRM (Lewis et al. 1995) and EDM (Sprague 1995), at least in larger corporations, the scope of both content management and KM initiatives is still evolving from single applications tailored for organizational groups and teams towards enterprise-wide programs (Alavi and Leidner 2001; Scott et al. 2004; Smith and McKeen 2003a, b). In this sense, our case study highlights this trend towards an integrative, enterprise-wide approach to manage the content assets.

ECM technologies are now increasingly being integrated with transactional databases, data warehouses, and file storages (Becker et al. 2003; Morrison et al. 2002). Web-based systems and related markup languages for semi-structured content (e.g., SGML, html, XML) have thus brought in new levels of content granularity, striking between well-structured relational databases and file systems. This has extended the idea of content management from the traditional, purely technology-based perspectives of managing either structured data or unstructured documents, to an increasing focus on how to access and utilize all content resources for organizational purposes despite the technical data models underlying particular domains of content. In this sense, ECM could integrate the traditional concepts of database management and administration (within IRM) and EDM, adding several semi-structured data formats of varying granularity in between, and providing an enterprise-wide perspective for the whole area.

ECM complements the (database-oriented) IRM and KM concepts through its comprehensive idea of stewarding content life cycles all the way from production/acquisition to retention/deletion, a scope clearly inherited from the focus on records management challenges in the EDM field. However, ECM extends EDM by covering all types of content, instead of only files or archival documents.

The concept of metadata originates in the field of IRM, where it first focused on the system integration problematics, corporate data dictionaries, and database architectures (Kerschberg et al. 1983). Whereas the academic EDM research never managed to develop a robust body of literature discussing organizational document metadata (Murphy 1998) or taxonomy beyond the challenges addressed in some case studies (Dourish et al. 1999; Päivärinta et al. 2002), ECM seems to have brought a renewed interest in the issue of metadata, now covering all possible content formats that need to be stored and retrieved. Especially, creating awareness of metadata importance among content producers may pose an organizational challenge, as evidenced in the Statoil case. Still, a solid theoretical ground for the area from the organizational viewpoint has not yet been laid. Likewise, research-based experience with tools for automating metadata and corporate taxonomy, such as Autonomy™ in the J.D. Edwards case (Scott et al. 2004), remains to be reported in depth.

Moreover, the idea of corporate taxonomy could also be enlarged to cover information about "who knows what", often referred to with the metaphor of corporate yellow pages, to guide with whom to communicate about particular areas of knowledge within the network model of KM. An integrated view to metadata of heterogeneous content resources and corporate taxonomy is furthermore needed to facilitate enterprise-wide information search and retrieval solutions, which were a central focus in Statoil.

Managing technological infrastructure, security, and business applications related to ECM provide few, if any, new conceptual issues compared to the traditional IRM idea of managing technology resources, applications, and integration at the enterprise level. However, similar to KM, the evolving enterprise-wide scope heightens the challenge to move towards a central model for developing the ECM platforms, away from group- or unit-based development initiatives that typically focus on one application at a time.

Administrative guidelines have been highlighted in all of the areas covered in our discussion. However, together with KM, ECM requires rethinking administrative structures and routines from the EDM and IRM eras. For example, the sheer amount of content to be archived in the digital world distributes information responsibilities throughout the enterprise. As illustrated through the Statoil case, another related key issue is thus the need for increased user awareness of meaningful content capture, production, editing, and publication routines for one's job. Alike KM, ECM will increase the users' responsibilities for disciplined knowledge work through a greater selection of applications.

With regard to change management, the enterprise-wide level of Statoil's program poses challenges in justifying and evaluating the large-scale investments in ECM platforms and development programs, e.g. in contrast to focused KM initiatives or centrally adopted databases in the IRM era. More focused and tactical content management projects of the nature reported in J.D. Edwards (Scott et al. 2004) are perhaps, as well, easier to justify and evaluate. Moreover, gaining access to the necessary competence on modern ECM technologies represents another challenge, as illustrated by Statoil's investments in developing ECM competence in-house as the basis for acquiring new technology. Otherwise, the more general change management issues of top management support, and user motivation and training, are shared across all four areas.

In summary, ECM represents integrated enterprise-wide management of the life cycles of all forms of recorded information content and their metadata, organized according to corporate taxonomies, and supported by appropriate technological and administrative infrastructures. ECM could thus subsume the concept of EDM, avoiding the pitfall of plainly file-level connotations of the concept of document, while still including all the basic issues of EDM. More-

over, the concept of ECM sets new challenges to content life cycle, metadata, and corporate taxonomy, beyond the database-centric IRM and file-based EDM, which now must be integrated and conceptualized together with modern (often Web-based) semi-structured solutions. The concept of ECM could cover all issues related to explicit information content in the field of KM. Especially, the ECM issues seem to correspond to the repository model of KM as such, with the corporate taxonomy including descriptions of both repository-based and network-based knowledge resources. The enterprise-wide scale and long-term management of content represent additional issues in the ECM concept to those most commonly identified with the KM field.

5.3 Research Implications

This exploratory study has identified a range of issues related to the ECM phenomenon. Yet, being based on a single ECM program (although comprehensive), the list of ECM issues needs to be expanded through further research, also providing more in-depth knowledge on each issue. Examples of potential areas include personalization issues, and the integration of ECM with other parts of the IS infrastructure, such as portal solutions, various e-collaboration solutions, other enterprise-scope applications and technologies, web services and service-oriented information systems architectures, and business intelligence. The issue of customization of commercial ECM packages for organizational processes, structures, and contemporary IT infrastructures represents another nearly unexplored area of research.

Two research issues stand out as particularly important to further develop ECM. First, the issue of utilizing content metadata and corporate taxonomy represents a big challenge in integrating the logical organization of the information resources, and their users and processes, regardless of the technological solutions for producing the content. Whereas technologies for automatic and semi-automatic creation and maintenance of content taxonomies evolve continuously (Lan and Al-Hawamdeh 2003), there is an important lack of evidence regarding whether and how these technologies are actually utilized in enterprise contexts. Work on metadata and taxonomies is also essential for reaching enterprise-wide information search and retrieval environments in organizations, an issue which has remained practically unresearched in organizations until lately (Freund et al. 2005).

Second, there is a need for justifying ECM investments and evaluating the impacts of comprehensive ECM programs like the one in Statoil, to legitimate the enterprise-wide approach in general (e.g., in contrast to the evolutionary and application-centric approach as recommended in Scott et al. 2004). The

Statoil case provided controversial data with regard to the evaluation and benefits realization issue. Although regarded as important from the beginning of the project, identifying the internal customer for this justification and evaluation of the ECM program was not clearcut. Especially, the challenge remains to establish effective, still efficient, justification and evaluation practices for ECM that would reach beyond "the overwhelming ROI calculations" of single applications which have gained visibility in the recent ECM literature (e.g., Scott et al. 2004). Most likely, whereas a single corporation lacks incentives to *develop* such measures or best practices for the evaluation processes alone, there could be a common interest in *using* such justification and evaluation methodologies and processes if commonly available. Developing such a common set of meaningful and effective evaluation measures and practices for ECM would thus require further research efforts, to be conducted independently from particular vendors, consultancies, or customers.

The integrated perspective of ECM also raises questions about how the different issues are interrelated. As the enterprise-wide program in Statoil is yet in an early stage, an in-depth analysis of the issues' relationships in the target organization and beyond remains on our future research agenda.

5.4 Implications for Practice

As one of the first empirical accounts of a strategic, enterprise-wide ECM program, the findings from the Statoil case and related discussion may contribute to increase the awareness of industry practitioners of the contemporary challenges involved in this form of organizational initiative. As illustrated by the list of issues in Table 1, these challenges are related both to the logical modelling of content resources, developing the necessary technological and administrative infrastructure for the ECM solutions, and initiating the needed change management activities. Of these, developing content and enterprise models, including content structures, metadata, corporate taxonomy, and the related models for roles, users and workflows, stands out as a more comprehensive challenge than focused in former information management approaches.

As part of our discussion, we have briefly pointed to the current strategy developed in Statoil for meeting these challenges, involving a common "knowledge reservoir", integration of collaborative tools and services, and extensive focus on training and facilitation for leveraging collaboration processes. Since this program is still in a relatively early stage, it is not yet possible to derive any best practice in this area. A key learning from the Statoil case is the need for building internal competence on ECM, to be able to develop the content models and related ownership, and address the challenges of making

qualified justifications and evaluations of such comprehensive ECM programs.

Further, the case also illustrates a need for establishing an administrative infrastructure, involving both new work roles for administering the content model and implementations, new administrative routines, and a service organization delivering training and support to the users. Typically, these new work roles will extend the current roles of information professionals such as archivists, librarians, database managers, and webmasters.

There is a challenge in specifying a set of administrative routines that is perceived meaningful for the users and thus will be followed in practice. As demonstrated in the Statoil case, an extensive set of procedures may result in "routine overload" for the users, with consequent lack of adherence to these routines. The implementation of these routines also needs to be supported by training and facilitation, and users may need to be persuaded of the need for replacing their familiar, localized information management practices with new, standard procedures.

6 Conclusion

This exploratory study has provided a holistic analysis of contemporary issues related to ECM, as viewed by an organization experiencing information management problems and challenges typical among organizations today. The analysis and categorization of these issues may contribute valuable learning for organizations that have not yet come this far in their analysis and awareness of these problems. By documenting issues and challenges from the enterprise-level perspective, as well as pointing to possible directions for addressing these, our exploratory study represents a contribution to the existing (scarce) body of IS literature on ECM.

Our second contribution lies in the preliminary assessment of ECM as a research area within the IS field. While most of the issues related to ECM initiatives can be traced back to established research areas when studied individually, the ECM concept integrates these issues in a new manner as described in this article. The rationale of ECM resides in the global collaboration needs of an organization's employees, customers, and partners through digital information content. To establish and maintain ECM in the world of ever-changing IT opportunities and business needs requires coordinated change management. Numerous IS practitioners, consultants, and IT vendors have already adopted the concept of ECM in their efforts of addressing these organizational needs. We encourage more academic inquiry into the ECM concept, to contribute to a

Published by AIS Electronic Library (AISeL), 2006

further understanding of the important issues facing contemporary organizations in their enterprise-wide management of digital assets.

Acknowledgement

The authors are grateful to Statoil for access to their ECM-related experiences. We especially would like to thank Anne Kleppe for her practical support in the empirical part of this study. The anonymous reviewers provided useful suggestions for the final version of the manuscript.

References

Alavi, M., "Managing Organizational Knowledge," in *Framing the Domains of IT Management Research: Projecting the Future…Through the Past*, R. W. Zmud (ed.), Pinnaflex Educational Resources, Cincinnati, OH, 2000, pp. 15-28

Alavi, M., and Leidner, D. E., "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly*, (25:1), 2001, pp. 107-136.

Balasubramanian, A., and Bashian, A., "Document Management and Web Technologies: Alice Marries the Mad Hatter, " *Communications of the ACM*, (41:7), 1998, pp. 107-115.

Becker, J., Knackstedt, R., and Serries, T., "Architectures for Enterprise Information Portals: An Approach to Integrate Data Warehousing and Content Management," in *Proceedings of the 11th European Conference on Information Systems*, C. Ciborra, R. Mercurio, M. De Marco, M. Martinez, and A. Carignani (eds.), Napes, Italy, 2003, [CD-ROM].

Bielawski, L., and Boyle, J., *Electronic Document Management Systems: A User Centered Approach for Creating, Distributing and Managing Online Publications*, Prentice Hall, Upper Saddle River, NJ, 1997.

Boiko, B., *Content Management Bible*, Hungry Minds, New York, 2002.

Dennis, A., "Lessons from Three Years of Web Development," *Communications of the ACM*, (41:7), 1998, pp. 112-113.

Dourish, P., Lamping, J., and Rodden, T., "Building Bridges: Customisation and Mutual Intelligibility in Shared Category Management," in *Proceedings of the ACM Conference on Supporting Group Work (GROUP'99)*, Phoenix AZ. ACM, New York, 1999.

Earl, M., "Knowledge Management Strategies: Toward a Taxonomy," *Journal of Management Information Systems*, (18:1), 2001, pp. 215-233.

Eisenhardt, K. M., "Building Theories from Case Study Research," *The Academy of Management Review*, (13:4), 1989, pp. 532-550.

Ellis, C. A., and Nutt G. J., "Office Information Systems and Computer Science," *ACM Computing Surveys*, (12:1), 1980, pp. 27-60.

Freund, L., Toms E. G., and Clarke C. L. A., "Modeling Task-Genre Relationships for IR in the Workplace," in *Proceedings of the Twenty-Eighth Annual International ACM SIGIR Conference on Research and Development in Information Retrieval,* G. Marchionini, A. Moffat, J. Tait, R. Baeza-Yates, and N. Ziviani (eds.), ACM, New York, 2005, pp. 441-448.

Gold, A. H., Malhotra, A., and Segars, A. H., "Knowledge Management: An Organizational Capabilities Perspective," *Journal of Management Information Systems*, (18:1), 2001, pp. 185-214.

Goodwin, S., and Vidgen, R., "Content, content everywhere... time to stop and think? The process of web content management," *Computing & Control Engineering Journal*, April 2002, pp. 66-70.

Hallikainen, P., Kivijärvi, H., and Nurmimäki, K., "Evaluating Strategic IT Investments: An Assessment of Investment Alternatives for a Web Content Management System," in *Proceedings of the 35th Hawaii International Conference on System Sciences*, R. H. Sprague Jr. (ed), CD-ROM, IEEE Computer Society, Los Alamitos CA, 2002.

Han, X., and Pape, U., "The Integration of Content Management System and Workflow Management System - A Conceptual Model," in *Proceedings of International Conference on e-Business (ICEB 2002)*, R. Gan, Y. Chen, and W. Huang (eds.), Beijing Institute of Technology Press, Beijing, 2002, pp. 213-218.

Hansen, M., Nohria, N., and Tierney, T., "What's Your Strategy for Managing Knowledge?" *Harvard Business Review,* March-April 1999, pp. 106-116.

Hu, Q., Päivärinta, T., Egenes, O. M., and Holte, C., "From Framework to Organization-Specific Process Model for IT Investment Justification and Evaluation: An Experience of Action Research," in *Proceedings of the Eighth Pacific-Asia Conference on Information Systems (PACIS 2004)*, Fudan University, Shanghai, 2004, pp. 350-362.

Kerer, C., Kirda, E., and Kurmanowytsch, R., "A generic content-management tool for Web databases," *IEEE Internet Computing*, (6:4), 2002, pp. 38-42.

Kerschberg, L., Marchand, D. and Sen, A., "Information System Integration: A Metadata Management Approach" in *Proceedings of the 4th International Conference on Information Systems (ICIS),* C. A. Ross and E. B. Swanson (eds), ICIS, 1983, pp. 223-239.

Kleppe, A., "Content management (CM) feasibility study. CM in Statoil's e-collaboration strategy. Scope and focus of CM case," *Presentation at Statoil*, Forus, October 16, 2002.

Lamming, M., Eldridge, M., Lynn, M., Jones, C., and Pendlebury, D., "Satchel: Providing Access to Any Document, Any Time, Anywhere," *ACM Transactions on Computer-Human Interaction*, (7:3), 2000, pp. 322-352.

Lan, S. C., and Al-Hawamdeh, S., "Taxonomy-Building Tools: An Investigative Study," *Journal of Information & Knowledge Management*, (2:1), 2003, pp. 63-77.

Lewis, B. R., Snyder, C. A., and Rainer, R. K. Jr., "An Empirical Assessment of the Information Resource Management Construct," *Journal of Management Information Systems*, (12:1), 1995, pp. 199-223.

Marwick, A. D., "Knowledge Management Technology," *IBM Systems Journal*, (40:4), 2001, pp. 814-830.

Miles, M. B., and Huberman, A. M., *Qualitative Data Analysis. An Expanded Sourcebook. Second Edition*, Sage Publications, Thousand Oaks, CA, 1994.

Morrison, M., Morrison, J., and Keys, A., "Integrating Web Sites and Databases," *Communications of the ACM*, (45:9), 2002, pp. 81-86.

Murphy, L. D., "Digital Document Metadata in Organizations: Roles, Analytical Approaches, and Future Research Directions," in *Proceedings of the 31th Hawaii International Conference on System Sciences*, R. H. Sprague Jr. (ed.), CD-ROM, IEEE Computer Society, Los Alamitos CA, 1998.

Murphy, L. D., "Addressing the Metadata Gap: Ad Hoc Digital Documents in Organizations," in *Text Databases & Document Management: Theory and Practice*, A. G. Chin (ed.), Idea Group Publishing, Hershey, PA, 2001, pp. 52-77.

Nakano, R., *Web Content Management: A Collaborative Approach*, Addison-Wesley, Boston, 2002.

Nonaka, I., "The Knowledge-Creating Company," *Harvard Business Review*, Nov.-Dec., 1991, pp. 96-104.

O'Callaghan, R., and Smits, M., "A Strategy Development Process for Enterprise Content Management," in *Proceedings of the 13th European Con-*

ference on Information Systems (ECIS), D. Bartmann, F. Rajola, J. Kallinikos, D. Avison, R. Winter, P. Ein-Dor, J. Becker, F. Bodendorf, and C. Weinhardt (eds.), CD-ROM, Regensburg, Germany, 2005.

Päivärinta, T., Tyrväinen, P., and Ylimäki, T., "Defining Organizational Document Metadata: A case beyond standards," in *Proceedings of the Xth European Conference on Information Systems (ECIS)*, S. Wrycza (ed.), Vol. 2, Gdansk: Uniwersytetu Gdanskiego, 2002, pp. 1154-1163.

Ross, J., "Creating a Strategic IT Architecture Competency: Learning in Stages," *MIS Quarterly Executive*, (2:1), 2003, pp. 31-43.

Scott, J., Globe, A., and Schiffner, J., "Jungles and Gardens: The Evolution of Knowledge Management at J.D. Edwards," *MIS Quarterly Executive*, (3:1), 2004, pp. 37-52.

Smith, H. A., and McKeen, J. D., "Developments in Practice VIII: Enterprise Content Management, " *Communications of the AIS*, (11:33), 2003a, pp. 647-659.

Smith, H. A., and McKeen, J. D., "Developments in Practice IX: The Evolution of the KM Function," *Communications of the AIS*, (12:4), 2003b, pp. 1-22.

Sprague, R. H. Jr., "Electronic document management: Challenges and opportunities for information systems managers," *MIS Quarterly* (19:1), 1995, pp. 29-50.

Strauss, A., and Corbin, J., *Basics of Qualitative Research: Grounded Theory, Procedures, and Techniques*, Sage Publications, Newbury Park, CA, 1990.

Surjanto, B., Ritter, N., and Loeser, H., "XML content management based on object-relational database technology," in *Proceedings of the First International Conference on Web Information Systems Engineering*, Vol. 1, IEEE, Los Alamitos, CA, 2000.

Surmacz, J., "Corralling Content. *CIO Magazine*," December 31, 2003, Available online: http://www2.cio.com/metrics/2003/metric647.html [Accessed March 10, 2004].

Tyrväinen, P., Salminen, A., and Päivärinta, T., "Introduction to the Enterprise Content Management Minitrack," in *Proceedings of the 36th Hawaii International Conference on System Sciences*, R. H. Sprague Jr. (ed.), CD-ROM, IEEE Computer Society, Los Alamitos CA, 2003.

Walsham G., "Interpretive case studies in IS research: nature and method," *European Journal of Information Systems*, (4:2), 1995, pp. 74-81.

Weiseth, P. E., Olsen, H. H., Tvedte, B., and Kleppe, A., "*eCollaboration Strategy 2002-2004"*, Statoil, Trondheim/Stavanger, 2002.

Weitzman, L., Dean, S. E., Meliksetian, D., Gupta, K., Zhou, N., and Wu, J., "Transforming the content management process at IBM.com, " *Case studies of the CHI2002/AIGA Experience Design Forum,* ACM Press, New York, 2002, pp. 1-15.

Yin, R. K., *Case Study Research - Design and Methods (2nd edition)*, Sage Publications, Newbury Park, CA, 1989.

Zack, M. H., "Managing codified knowledge," *Sloan Management Review*, Summer 1999, pp. 45-57.