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The implementation of enterprise content management systems in SMEs

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Abstract

Purpose – A literature review revealed that none of the few longitudinal studies of enterprise content management (ECM) implementations focus on small and medium-sized enterprises (SMEs). To contribute to this area, the purpose of this paper is to generate insights in relation to how SMEs can successfully promote implementation of ECM solutions.

Design/methodology/approach – The paper presents and analyses a longitudinal study of an ECM project.

Findings – The findings of the paper include a definition of a process model for ECM implementation in SMEs, identification of ten success factors related to ECM system implementation, and a definition of a new pattern for ECM technology development, compared to existing case studies.

Research limitations/implications – Since it appears to be the first detailed study of ECM system implementation in SMEs, this paper provides a point of departure for future research in the use of ECM technology in SMEs.

Practical implications – Practitioners in SMEs preparing to engage in ECM projects may utilize the findings of the paper in relation to managing the implementation process and understanding various benefits that ECM systems can produce.

Originality/value – The paper represents a contribution to the sparse literature on ECM implementation. In fact, the case seems to be the first longitudinal study of ECM implementation in SMEs.

Keywords Knowledge management, Small to medium-sized enterprises, Enterprise content management, Enterprise system, Electronic document management, Project management

Paper type Research paper

1. Introduction

In recent years, documents in paper form have been increasingly replaced by electronic documents in most types of organizations. The use of electronic documents provides an obvious advantage over physical documents, in particular due to easier and more efficient retrieval of information. A company's information can be divided into structured information (typically stored in databases) and unstructured information (stored in file systems, content management systems, e-mail servers, and so on). In most companies, the majority of information is unstructured (Bandorf *et al.*, 2004; Robb, 2004). Enterprise content management (ECM) systems represent a technology that addresses information management tasks, including the need for integration of unstructured information with structured information.

The innovations in network technologies in the 1990s created a basis for new ways of storing, organizing, and sharing information. The field of web content management emerged in the mid-1990s to meet the challenges of managing corporate web pages, which had increased in complexity and size (Boiko, 2002; Nakano, 2002). However, web content management should not be confused with ECM, which is a concept with a different and even more complex focus. ECM systems can be traced back to

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information systems (IS) concepts, such as information resource management, knowledge management, and electronic document management (EDM) (Päivärinta and Munkvold, 2005). While EDM traditionally addresses the management of files (Sprague, 1995; Sandhu and Ajmal, 2012), ECM goes beyond the idea of a file as an object to be managed by addressing other technical and organizational challenges related to managing content in the context of its organizational production and use (Päivärinta and Munkvold, 2005).

According to Brocke *et al.* (2010a), there seems to be a consensus among researchers that ECM is not only a set of technologies but also an "organizational concept that covers multi-faceted business issues". Thus, implementing ECM solutions in organizations may require many changes related to production strategy, business processes, and work practices (Salminen *et al.*, 2006). In order to understand how to implement such changes, there is a need for experience from organizational ECM implementations and methods for achieving success with such projects.

Not much ECM research exists (as shown in the following section), and the few existing case studies focus on large companies. However, there seems to be a general consensus in the literature that SMEs differ from large companies in that they have fewer financial resources, less IT expertise, and rely more on external expertise (e.g. Utomo and Dodgson, 2001; Rantapuska and Ihanainen, 2008; Alonso-Mendo *et al.*, 2009; Sharma, 2009; Cragg *et al.*, 2011). Based on such reasons, some literature suggests that IS theories and practices aimed at large companies may not be suitable for smaller ones (Lee and Runge, 2001; Premkumar, 2003; Gäre and Melin, 2011). This indicates a need for studying ECM implementations from an SME perspective. For example, less in-house IT expertise may imply that SMEs are much more dependent on external partners and the fewer users of the ECM system may imply that other types of technological solutions may be different. Taking these observations into account, this paper investigates how SMEs can successfully promote ECM system implementation by investigating three questions:

(1) How can ECM systems be successfully implemented by SMEs?

(2) What are the most important success factors for ECM implementation in SMEs?

(3) In which aspects do ECM projects in SMEs differ from projects in larger companies?

To address these questions, the paper presents and analyses a longitudinal case study of a successful ECM system implementation project in an SME.

The remainder of the paper is structured as follows. Section 2 reviews ECM literature. Section 3 provides an overview of the case in focus and Section 4 describes the research method. Section 5 discusses the case study of the ECM project in focus, while Section 6 provides answers to the research questions by synthesizing lessons learned from the study. Section 7 presents conclusions.

2. ECM literature

This section discusses the status of ECM research, reviews studies of ECM implementations, and explores ECM implementation success factors.

2.1 The status of ECM research

According to Päivärinta and Munkvold (2005), there are hundreds of software vendors on the immature ECM market, along with several books and forums. This may be seen

as a result of the challenges practitioners face when implementing ECM solutions. On the other hand, from the viewpoint of the enterprise, researchers still have not provided much support for practitioners (Päivärinta and Munkvold, 2005; Tyrväinen *et al.*, 2006; Nordheim and Päivärinta, 2006). In fact, Munkvold *et al.* (2006) searched in major academic outlets and databases and concluded that the papers found that explicitly address "content management" mainly report on the particular technical functionality of content management software or provide purely conceptual suggestions. In spite of their extensive search for ECM research, Munkvold *et al.* were able to find only three papers "speaking of content management as an enterprise-wide initiative" (besides their own study). The first is by Smith and McKeen (2003), who provide an introduction to the ECM concept and, based on input from a focus group of industry knowledge managers, discuss key issues related to ECM deployment and governance. The next is by Scott *et al.* (2004), who describe three content management-related projects in J.D. Edwards (however, using the term "knowledge management"). Finally, O'Callaghan and Smits (2005) propose a content portfolio framework for defining the specific content to manage in an enterprise. To the knowledge of Nordheim and Päivärinta (2006), the J.D. Edwards case (Scott *et al.*, 2004) represents the first longitudinally reported ECM case in the IS literature, and their study of the ECM development programme at Statoil, a Norwegian-based oil company, is the second. The state of ECM research is described by Smith and McKeen (2003) who state ".[…] there is no clear definition what it [ECM] means, how it should be done, and who should do it".

The author of this paper was not able to identify ECM implementation studies more recent than those mentioned. In addition, not much academic literature on ECM systems has been produced in recent years, which is underlined by a search for ISI indexed journal papers on the topic of ECM systems in June 2011 that returned only eight papers. On the other hand, if the focus is broadened to include conference papers, several conceptual papers can be identified (e.g. Usman *et al.*, 2009; Brocke *et al.*, 2010a, b). However, in relation to the focus of this paper (i.e. exploring ECM system implementation), these papers were not found to be of any use.

2.2 Empirical studies

The identified empirical-based studies on ECM are shown in Table I and is briefly described.

Smith and McKeen (2003) focus on how organizations develop and implement ECM to manage and use their information assets better. The aim of their paper is "not to provide definitive answers to the challenges of ECM but to establish the scope of the issue and the questions that need to be asked in organizations if the vision of ECM is going to be realized". To produce such insight, they convened a focus group of practicing knowledge managers from a variety of industries. Based on this, they examined the scope of the challenge that the companies face, discussed the reasons why organizations feel it is becoming important to have an ECM strategy, looked at the variety of activities involved in effective content stewardship, and defined which key governance issues must be resolved. They concluded that "as organizations become more and more knowledge-based in their endeavors, it is likely that their ECM capabilities will become a significant differentiating factor between those that succeed and those that fail".

Scott *et al.* (2004) describe three content management-related projects at J.D. Edwards. However, it should be noted that Scott *et al.* state that their paper represents

Source	Empirical basis	Main contribution
Smith and McKeen (2003)	Focus group of practicing knowledge managers	Clarification of which challenges companies face in relation to ECM
Scott *et al.* (2004)	Longitudinal study at J.D. Edwards	Guidelines for conducting ECM projects
Päivärinta and Munkvold (2005)	56 publicly available case narratives of ECM projects	Guidelines for ECM development from the viewpoint of the enterprise
Munkvold *et al.* (2006)	Longitudinal study of the ECM programme at Statoil	Identification of issues related to the management of content, infrastructure and change
Tyrväinen *et al.* (2006)	Analyses of case studies in literature	A framework to stimulate and guide future ECM research
Nordheim and Päivärinta (2006)	Longitudinal study of the ECM programme at Statoil	Insights in relation to different motors of organizational change in ECM implementations
Miller (2007)	A number of interviews (the number is not mentioned)	A collection of tips in relation to ECM system implementation
Brocke *et al.* (2011)	Two case studies	Identification and discussion of the business challenges that drive ECM adoption

Table I.
Empirical ECM studies

an "evolution of knowledge management at J.D. Edwards" although the focus of the case is mainly content management. Based on their longitudinal study and Damsgaard and Scheepers' (2000) "four-stage interpretation of the model for the evolution of intranets", Scott *et al.* define four stages of content management evolution and the lessons associated with these steps:

(1) initiation: gain executive support and reuse content;

(2) contagion: establish content ownership early, align each technical initiative to revenue-generating business processes, and establish and leverage standards;

(3) control: persevere to keep resources available, replace outgrown technology, and replace outgrown governance; and

(4) integration: develop and operationalize an enterprise vision, reuse and extend organizational knowledge, replace static metadata with dynamic metadata, certify authors, and formalize job descriptions.

Scott *et al.* also provide ROI figures for two of the three content management applications: one delivered an ROI of 270 per cent the first year, and the other performed at 1,811 per cent over three years. Furthermore, the case study describes how three relatively separate content management applications evolved into becoming one integrated content management platform.

Päivärinta and Munkvold (2005) analyse 58 case narratives (mainly practitioner oriented) of ECM projects in order to identify a framework of major issues that require managerial attention in organizations. The main areas that this framework covers are "objectives/impacts sought with ECM, enterprise model to be supported by ECM, content model, technological infrastructure, administrative resources and practices, and change management issues". Päivärinta and Munkvold recommend that IS research should further explore the field of ECM from the point of view of the

enterprise, and that more holistic and systematic means to manage the complex ECM solutions should be found.

Munkvold *et al.* (2006) present a longitudinal study of the enterprise-wide ECM programme at Statoil. They argue that the ECM perspective integrates and extends the existing research areas of information resource management, document management, and knowledge management. According to Munkvold *et al.*, the Statoil case study provides an example of a strategic and corporate-wide ECM approach which includes the following: first, confirmation of the importance of a holistic focus on content life cycle as a core characteristic of ECM; second, illustration of the challenges related to management of voluminous and heterogeneous content resources that have evolved over time; third, illustration of the challenge from perceiving metadata as belonging to the domain of archivists only instead of as a part of daily content production and utilization in all areas; fourth, confirmation of the importance of automated and dynamic metadata creation and taxonomy utilization in modern ECM solutions; fifth, illustration of the importance of focusing on formalized administration and governance structures for content management issues, and finally, indications that it is of limited value to have many centralized routines unless such routines are found necessary by relevant organizational domains and communicated clearly to these business areas.

Tyrväinen *et al.* (2006) provide a framework to stimulate and guide future research, and they outline research issues relevant specifically to the field of ECM. The framework includes three views: users, information, and systems. The views are divided into two dimensions, with the first dimension separating processes into development and deployment and the second dividing technology into hardware, software, standards, and so on. The fields produced by the intersecting dimensions should include the content perspective. Tyrväinen *et al.* argue that their framework emphasizes the multi-dimensionality of ECM as a research phenomenon.

Nordheim and Päivärinta (2006) study the ECM development programme in the Statoil case. They apply the perspective of implementation processes of enterprise systems by Van de Ven and Poole (1995) who summarize the literature under four meta-theoretical motors of development and change: the teleological motor, the evolutionary motor, the life-cycle motor, and the dialectical motor. In this light, they argue that the Statoil case represents a hybrid development approach to ECM in contrast to the evolutionary development motor, which has prevailed in the hitherto reported content management research. They argue that research and practice on large-scale ECM implementations should acknowledge all four motors of change.

Miller (2007) investigates ECM project experiences to determine criteria for success in such projects. According to Miller, moving from conception to implementation of ECM systems is not an easy task, which is illustrated by the failure of many ECM projects due to budget cuts, business swings, management changes, or institutional inertia. They further argue that, even if an ECM project avoids such pitfalls and an ECM system is ready to be put into use, the project still has to be accepted by the end users, which is often not a straightforward task.

Brocke *et al.* (2011) present and discuss 21 contemporary ECM challenges that drive ECM adoption based on two case studies and a literature review. The aims of defining these drivers are to contribute to further theorizing about ECM adoption and to support practitioners in determining the scope and objectives of their own ECM initiatives.

2.3 ECM implementation success factors

In the literature, only one list of criteria for success in ECM projects was identified, specifically in the paper by Miller (2007). Miller collects a set of success criteria in ECM projects in the form of 31 quotes from industrial experts, grouped under the following topics: selling the ECM project to executives, overcoming political obstacles, selecting a vendor, implementation and installation, administration, training, and getting those involved to use the system. These 31 quotes are not very concise and do not all seem to be essential in relation to achieving ECM success. Thus, more general literature on IS implementation may provide better insight into the main success factors in ECM system implementation projects.

In general literature on IS implementation, a number of factors have been defined in relation to the success or failure of an IS project (e.g. Somers and Nelson, 2001; Burke *et al.*, 2001; Poon and Wagner, 2001; Umble *et al.*, 2003; Kanter and Walsh, 2004; Doom *et al.*, 2010). Having analysed such factor sets with the nature of ECM systems in mind, the ten implementation-success factors related to executive information systems (EIS) defined by Poon and Wagner (2001) seem to be the most useful. Although ECM systems and EIS systems differ in a number of aspects, they also have some similarities in that they both deal with complex information and data manipulation functionalities. These ten EIS success factors are committed and informed executive sponsor, operating sponsor, appropriate IS staff, appropriate technology, management of data, clear link to business objectives, management of organizational resistance, management of system evolution and spread, evolutionary development methodology, and carefully defined information and system requirements.

3. Case overview

The ECM project in focus for this paper was carried out at Altan.dk. Altan.dk is a contracting company that produces customized balcony solutions for existing buildings. The main office of Altan.dk is located in Sorø, Denmark and has approximately 100 employees, of which a third works in administration and two-thirds work at construction sites. The turnover in 2007 was approximately 115 million DKK, which corresponds to approximately 15 million euros. Altan.dk typically has approximately 100 ongoing balcony projects (i.e. where a quote has been accepted and the balcony project has not yet been delivered). Furthermore, Altan.dk typically has several hundred open quotes which are closed only if the potential customer chooses another contractor.

The implementation of the ECM system at Altan.dk was an offspring of another project, "The User Configured Balcony". This project was carried out from 2005 to 2007 with the intention of creating a software-based product configurator (a type of software-based expert system that supports the creation of product specifications) for the configuration of balconies at Altan.dk. The purpose of the configurator was mainly to support the quotation phase and secondarily to support activities relating to engineering design. Based on individual customer requirements, the configurator was designed to generate three dimensional balcony drawings, calculate sales price, create bills of materials, etc.

The need for an ECM system was discovered at the beginning of the configurator project, when Altan.dk's and major supplier's business processes were mapped in flowcharts and analysed. This analysis showed that there were many problems related to management and sharing of documents, mailings, drawings, and other content that an ECM project could address. On this basis, the managing director of Altan.dk

promised the IT manager the necessary funding to carry out such a project. The final decision to invest in an ECM solution was made in mid-2006 and, soon after, ECM vendors were approached. An important part of the basis for the ECM project at Altan.dk was an earlier attempt by the IT manager to implement an MS Excel-based document management system. This system, however, had failed to gain widespread use in the organization because many employees found the system tedious to use and prone to errors.

4. Research method

4.1 Research process overview

The research strategy employed to investigate the ECM project at Altan.dk was an action research approach (2005-2007) followed by a non-participatory phase (2008-2010).

The term "action research" was introduced by Kurt Lewin (1946) who characterizes it as research oriented towards bringing about change with the researchers actively involved in the situation or phenomenon being studied. Thus, action research implies two roles for the researcher, namely as a participant in the change process and as an observer who reports from the study. The action research approach has been adapted by many researchers from various fields with different perceptions of what action research actually is and how it should be executed (Waterman *et al.*, 2001). An often-cited definition of action research is provided by Reason and Bradbury (2001): "[Action research] seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people and more generally the flourishing of individual persons and their communities".

The employment of an action research approach allowed the researcher to guide the project in directions which made it possible to investigate the research questions of the paper. In the action research phase, the double role as researcher and consultant was clear from the beginning, since Altan.dk received financial support from a national foundation with the aim of promoting and learning new ways of working in the building industry. The participation in the ECM project involved several activities for the researcher, including facilitation of workshops to map business processes; analysis of business processes; presentation and discussion of possible process improvement initiatives; conduction of individual and group interviews to define ECM system requirements; design of ECM system user interfaces and definition of overall requirements; identification of possible ECM vendors; participation in meetings with possible vendors; and elaboration of detailed specifications together with Altan.dk and the selected vendor. All the activities involving the researcher were registered and notes about events were taken during the entire action project.

After putting the ECM system into operation in January 2007, the role as a consultant ended for the researcher, and the case was studied in a non-participatory manner in the form of a qualitative case study. A qualitative case study can provide a holistic investigation of a contemporary phenomenon within its real-life context (Yin, 1989). Furthermore, the revelatory nature of the investigation can be argued to justify the single-case study design (Yin, 1989). This part of the research was carried out as six semi-structured interviews and three thorough demonstrations of the system. In January 2007, the first ECM system demonstration was given, and interviews with the IT manager and sales manager were conducted. In August 2008, the second ECM system demonstration was given and an interview with the IT

manager was conducted. In May 2010, the third ECM system demonstration was given and, this time, interviews with the IT manager as well as the balcony project manager and the civil engineer were conducted. The interviews lasted 30-60 minutes and were recorded. The interviews focused on: first, experienced benefits and problems as a result of the ECM system; second, experiences in relation to participating in the ECM project; and third, needs and ideas for the further development of the ECM system. The demonstrations of the ECM system lasted one to two hours and the researcher was given screen dumps as desired. Besides the interviews and demonstrations a number of informal phone interviews were conducted with the purpose of clarifying certain issues. These interviews were not documented.

The entire research process is charted in Figure 1.

4.2 Discussion of the research approach

The participatory aspect of action research is in great contrast to the positivistic scientific tradition in which researchers attempt to disengage themselves from their study subjects. The challenge of distinguishing between the two roles of an action researcher has caused some parts of academia to criticize action research as being unscientific. On the other hand, since the areas typically investigated by using action research (complex social systems) often are blurred, the intimacy of action research may be seen as a means of promoting appropriate change and understanding of practice (Waterman *et al.*, 2001).

In the case study of Altan.dk, the "action project" was to implement an ECM system into Altan.dk's daily operations, while the main purpose of the "research project" was to learn about the ECM implementation. In some action research studies, it can be difficult to evaluate the outcome of a change project, but in this particular project, the implementation of an ECM system (or a similar software system) was a necessary means by which to achieve the outcomes that Altan.dk experienced. Furthermore, the role of the action researcher (as an external advisor hired to ensure that the ECM system corresponded to user expectations) implies that it is highly unlikely that crucial problems would have been hidden from the action researcher.

Conversely, it may be difficult to claim that the implementation project's success (with success defined as the system's acceptance without much need for training and without resistance against the system) can be attributed to the particular manner in which the project was carried out. In this context, there is risk of the researcher being biased towards showing the quality of the project management, thereby being likely to ignore other significant factors. To minimize such possible sources of errors, the author took notes during the entire project, and in order to get other perspectives on the quality of the ECM system, a number of informal interviews with the ECM system

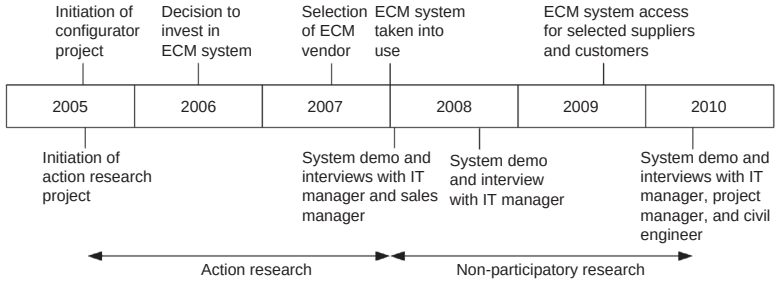

Figure 1.
Research process

users were carried out during the project. Crosschecks of the data acquired from the interviews showed no inconsistencies.

In the non-participatory research phase, the ECM demonstrations showed that the ECM system was, in fact, in full use at Altan.dk and that all types of users were actually using the system in full scale.

5. The case study at Altan.dk

5.1 Project plan

As mentioned, the need for an ECM system was realized during the end of 2005, and the decision to invest in an ECM solution was made in mid-2006. Based on the experience from other projects and existing software development models (e.g. structured analysis and structured design, e.g. Andersen, 1996) and the Unified Process (e.g. Arlow and Neustadt, 2005), plans for the ECM project at Altan.dk were defined in an informal manner in the form of the phases, process analysis, process redesign, software analysis, software design, software selection, and implementation.

5.2 Business process analysis and redesign

To begin, the scope of the ECM project needed to be defined. Most projects at Altan.dk were carried out with an overall project organization, as described in Figure 2. In the remainder of the cases, one of the two main component suppliers delivered both the balconies and the balcony fastening systems.

As part of the mentioned configurator project, the business processes of all four main companies in connection with a customer order were described in detail and subsequently analysed. Part of this investigation included collecting requests for a future process from the balcony suppliers, the balcony fastening system suppliers, and the engineering consultancy. These requests for the future process were divided into two parts: requests enabled by configurator technology and requests enabled by an ECM system. Table II shows the suppliers requests related to ECM system functionality.

The analysis of the existing processes at Altan.dk indicated great possibilities for improving certain areas by the use of an ECM system. Table III highlights these areas and relevant ECM system functionality.

Based on the process analyses, a future business process with the support of an ECM system was defined by focusing on specific sub-processes, one at a time. This process redesign was represented in flowcharts for each sub-process. Table IV shows the defined sub-processes and how the ECM system should support these.

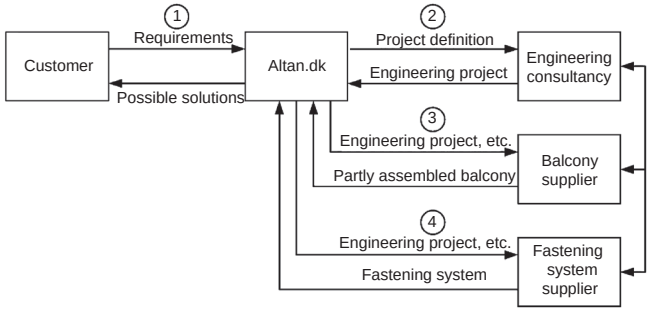

Figure 2.
The overall project organization

Supplier requests	Enabling ECM functionality
More uniform specifications	Use of document templates
Earlier reception of product specifications	Faster creation and distribution of specifications
More uniform product solutions	Better possibilities of reusing solutions (easier to find existing solutions and increased use of specification templates)
Specifications in electronic form	Handling of electronic documents
Better sharing of specifications	Version control, digitalization of specifications, e-mail integration, etc.
Fewer incomplete specifications	Use of templates to ensure complete specifications
Fewer errors in specifications	Higher uniformity of specifications, the use of templates, better sharing of information, etc.
More uniform order procedures	Workflow management
Better naming consistency in specifications	Templates and metadata
Better coordination with other suppliers	Use of electronic documents, forced use of document templates, sharing information across companies, etc.

Table II.
Possible benefits of an ECM system for the suppliers

Altan.dk problems	Enabling ECM functionality
Much time is spent on managing documents	Electronic document management, e-mail functionality, revision control, etc.
Difficult to know the stage of each specific project	Workflow management
Misunderstandings between employees occur during information exchange	Workflow management, document templates, and centralization of information
Misunderstandings with suppliers occur during information exchange	Workflow management, document templates, centralization of information, and sharing of documents
Difficult to overview project documentation	Centralization of information and documents
Assembly personnel need more uniform instructions	Specification templates
Information disappears	Centralization of all (electronic) documents
Little uniformity of product solutions	Existing project data in electronic form that can be accessed from a central point (i.e. better possibilities for reuse of solutions)
Difficult to find information	Centralized access to documents for all users
Incomplete specifications	The use of templates to ensure complete specifications
Errors in specifications	Higher uniformity of specifications, the use of templates, better sharing of information, etc.
Inconsistency of naming in specifications	Templates and metadata
Little uniformity of procedures	Workflow management

Table III.
Possible benefits of an ECM system for Altan.dk

Another important part of the business process redesign was that Altan.dk decided that all documents related to a project should be entered in electronic form in the ECM system. Furthermore, later in the process it was decided that suppliers should be able to access project information through the ECM system (sub-process 5 of Table IV) and

No.	Sub-process	ECM system support
1	Creation of a new project	Handling of project identification and metadata
2	Creation of a quote letter (with/without configurator support)	Ensure that correct templates and price lists are used
3	Quote letter handling	Manage all documents related to a quote (quote letter, drawings, conditions, etc.), including revision control and e-mail-based distribution
4	Engineering project (with/without configurator support)	Enable sharing of documentation between Altan.dk and the engineering consultancy
5	Supplier handling processes	Manage relevant documents that are exchanged between Altan.dk and the suppliers, including positioning of orders at sub-suppliers by e-mail
6	Data exchange with IT systems	Export data from ECM system to the enterprise resource management (ERP) system and customer relationship management (CRM) system of Altan.dk
7	Assembly process	Provide assembly personnel with relevant information (sites, time-plans, project specifications, etc.) and handle delivery documents
8	Service period	Handle documents related to the one- and five-year inspections

Table IV.
Definition of the future business process

that the ECM system should include customer relationship management (CRM) functionality to replace the existing CRM system (sub-process 6 of Table IV).

5.3 Software requirements analysis and software design

Having clearly defined how the ECM system was to be used in Altan.dk's business processes, the next step was to define user interaction with the ECM system. In this context, it was found to be of utmost importance that the user interfaces were intuitive to use and required a minimum of training, since the majority of the users had very limited IT competences. The requirements for the appearance of the ECM system were defined by designs of the main user interfaces, interaction diagrams, and lists of required functionality. The requirement specifications were based on the five basic usability characteristics described by Nielsen (1992) which, according to Holzinger (2005), are generally accepted as part of any software project: learnability (how quickly users can be working with the system), efficiency (enabling those who have learned the system to attain high productivity), (3) memorability (allowing casual users to return to the system after periods of non-use), (4) error recoverability (ease of correcting user error), and (5) satisfaction (how pleasant the system is to use).

To ensure high usability of the ECM system, it was decided that the user interfaces should show, to the greatest extent possible, only the relevant functionality for ordinary users. On the other hand, advanced functionality should be placed in menus accessible only to advanced users (i.e. users with some IT competencies and administrative tasks in relation to the ECM system). In addition, it was decided that the language of the interfaces should be Danish, since many of the employees of Altan.dk did not possess high-level English fluency. Figure 3 shows the design of the project overview. From the project overview window, users could create new projects, navigate to specific projects, filter the projects shown (e.g. by status), conduct various searches, and open the project configurator to create a quote.

The other main window of the ECM system includes information about a particular project. It was decided that, during a project, the ECM system should show the status of a given project and ensure that the right documents are created in different sub-processes. This was solved by the design of the top of the "project window", which includes a visualization of a project's current stage. At the end of each stage, a checkbox representing a milestone is shown. When a phase is completed, a milestone is checked and the next phase is highlighted. Below the project progress visualization, metadata fields are organized in different categories. These include customer data, project data, contact persons, overall product information, and notes/letters. The data from these fields would automatically be inserted into various documents (e.g. the customer data inserted into a quote letter). On the left side of the screen, various functions were defined, such as assignment of rights to a particular project (or part of a project), person responsible at the particular stage of the project, additional templates, statistical reports, e-mails associated with a project, and so on. Figure 4 shows the design of the project window.

In addition to the described windows, several project-related windows were defined together with windows for managing general information such as instructions, training material, marketing material, etc.

5.4 Software selection

Having established a clear vision of how an ECM system for Altan.dk should appear and behave, the next step was to investigate possible ECM system vendors. First, materials about different ECM systems were gathered. From this, Altan.dk chose specific vendors by evaluating the price, functionality, and ability to customize the user interfaces according to Altan.dk's specifications. From mid-2006 to mid-2007, meetings were held with six different ECM system vendors. Two of these vendors were eliminated after only one meeting, while three others were asked to provide additional details about how their system would match Altan.dk's requirements, to define how

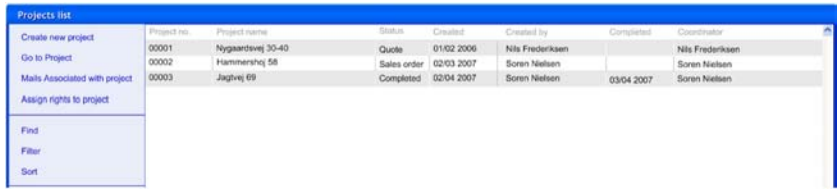

Figure 3.
Design of project overview window (translated into English)

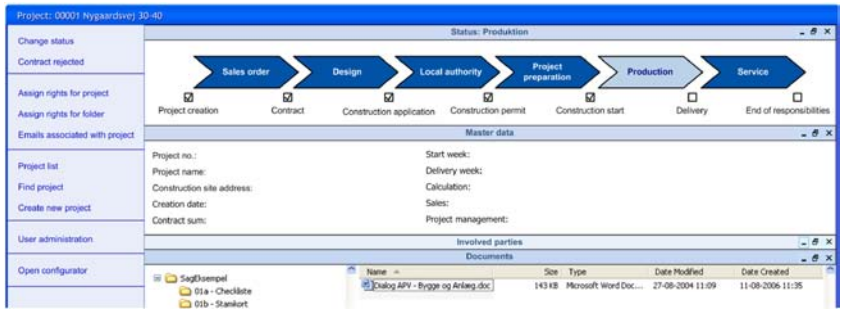

Figure 4.
Design of the project window (translated into English)

their system could be customized to Altan.dk's requirements, and to create more detailed offers, etc. After further meetings, these three were also eliminated. The first five vendors were rejected because their solutions required Altan.dk to accept many compromises in relation to the defined requirements. The shortcomings included features such as no capability for Danish language interfaces, lack of e-mail integration functionality, problems in providing a folder structure for documents, inability to include the project stage visualization, inability to exclude unnecessary functionality (buttons and links) from user interfaces, limitations in the project overview provided, handling of user access, and limitations of web access functionality, among others. The sixth possible ECM system vendor, which was ultimately chosen, is a smaller consultancy and software developer that was already providing Altan.dk with IT-related services. This company was in the process of developing an ECM system and was willing to go to great lengths in order to support the functionality and user interfaces requested by Altan.dk. After initial meetings, the vendor gave a proposal to Altan.dk in July 2007, which was accepted shortly thereafter. The exact cost of the software chosen is confidential, but the price corresponds to the investigated types of ECM software in the lowest-priced segment.

5.5 Implementation and use

Having made an agreement with the software vendor based on the initial system specification, the vendor began development. Meanwhile, Altan.dk defined more detailed specifications of data fields and functionality. The IT manager held meetings with all users (grouped by departments) to develop these detailed design specifications. All requests for terms used, data fields, and functionality were collected, and most of these requirements were translated into design specifications for the software vendor. Thus, almost all Altan.dk employees were involved in the process of defining the particular user interfaces that they were to work with, in particular in relation to defining field/function names and types of data fields.

The ECM software, customized to Altan.dk's requirements, was delivered and tested during December 2007. Altan.dk put the ECM system into use on 1 January 2008, from which date all new projects could be created only through the system. Previously, this had been done through the CRM system, but since the ECM system included the necessary CRM functionality, the existing CRM system was phased out from that date. More or less from day 1, sales and planning employees began to use the system without training but with some support when needed. Later, balcony project managers began to use the system. The balcony project managers with few IT skills received some training. During March and April 2008, use of the ECM system from construction site huts was initiated. From the first implementations, the employees at the construction sites were very willing to use the ECM system and were able to save time from its use. These time savings were a result of the employees' ability to access all project information from the construction site via the internet and to print out various notice documents at the construction site (e.g. noise warnings, use of cranes, construction sites, etc.), compared to the previous process where they had to pick up such documents or have them sent from the main office.

The final design of the ECM system reflects the daily, ongoing needs of the users at Altan.dk. This means, for example, that there are only a few unfamiliar terms in the user interfaces, and that more complex functions are hidden from standard users. This may explain in part why there was hardly any resistance to the system. As stated by the IT manager, "There have been no problems in making the users to use the system.

The system is designed with very simple interfaces in which only unambiguous terms are found. If we discover that something in the user interfaces is not unambiguous, we then change such terms". The IT manager also reported that the organization has fully embraced the ECM system and explained, "I recently asked a couple of users what we did before [using the ECM system] and they could not tell me". The interviewed project manager of balcony projects shared this impression stating, "There have not been any real problems that I am aware of. The only problem I can think of was that in the beginning the system was a little slow, but that was quickly fixed". The interviewed engineer (who was appointed at Altan.dk after the launch of the ECM system) had not experienced any real problems with the system either, but after some consideration mentioned that, "On extremely rare occasions the system has crashed, which meant that everybody just had to wait for the system to run again".

The ECM system at Altan.dk is not perceived as a final solution but is continuously being refined. For instance in 2009, selected suppliers and customers (i.e. the building owners, apartment owners, and tenants) of Altan.dk also gained access to parts of the ECM system through an extranet solution. As stated by the IT manager: "New requirements emerge regularly from the organization in relation to changes and improvements. Thus, the system is constantly improved. It is a continuous user-oriented development process".

5.6 Project results

Currently, all projects in progress as well as all the information associated with these projects are found in the ECM system. The only exception is large drawings received in physical format only. Altan.dk, however, makes efforts to receive such drawings in digital format. In addition to the more than 100 files in the form of documents, drawings, pictures, and e-mails that are typically attached to an individual balcony project, a number of general files are also managed by the ECM system. This includes documents, pictures, and videos related to safety and health, instructions, customer evaluations, component types, solution principles, and the like. Compared to previous processes when all project material was placed in ring binders, the use of an ECM system to manage documents digitally produces some major benefits. The project managers of balcony projects are some of the users at Altan.dk who depend most on such information. The interviewed balcony project manager at Altan.dk noted that "the [ECM] system provides a fantastic overview of all the ongoing projects, and it provides many great reports. […] the [ECM] system makes it much easier to inform customers about the status of their project. […] before [the ECM system] I had to leaf through ring binders to provide customers with answers to their questions". Similarly, the interviewed engineer stated that the greatest benefit of the ECM system is "that everybody has access to all information and [they] do not have to leaf through ring binders to find relevant information".

Table V shows how the ECM system has been able to address the problems found at Altan.dk so far (i.e. the problems listed in Table III).

6. Research synthesis

This section addresses the three research questions, stated in the introduction, by synthesizing the lessons learned from the project. This is done in three steps:

(1) defining a process model for ECM system implementation in SMEs;

(2) deriving success factors for ECM implementation in SMEs; and

(3) discussion of ECM implementation in SMEs compared to larger companies.

Possible improvement areas	Results of using the ECM system
Much time is spent on managing documents	The percentage of project documents found in electronic form has been increased from around 25 per cent to almost 100 per cent. The time used for finding documents has been significantly reduced
Difficult to know the stage of each specific project	The process progress indicator of the ECM system now shows the status of all projects
Employee misunderstandings occur during information exchange	Before, information was spread across physical documents and in the minds of employees, but now almost all information can be retrieved from the ECM system
Supplier misunderstandings occur during information exchange	Before, information was spread across physical documents and in the minds of employees, but now all information can be retrieved from the ECM system. Now, significantly fewer misunderstandings with suppliers occur
Difficult to overview project documentation	The ECM system provides an overview of all documents associated with a project
Assembly personnel need more uniform instructions	Templates for the creation of assembly instructions are placed in the ECM system and are now used in all cases
Information disappears	All information is placed in the ECM system or in documents controlled by the ECM system. Now, information very rarely disappears during a project
Little uniformity of product solutions	Now there are better possibilities of reuse, since all existing project data are stored in electronic form and can be accessed through the ECM system
Difficult to find information	All project information is placed in the ECM system or in documents controlled by the ECM system
Incomplete specifications	The ECM system provides templates for most specifications so that it is clear which information to register
Errors in specifications	The ECM system provides easy access to all relevant information so that the number of errors in specifications has been reduced
Inconsistency of naming in specifications	The ECM system provides templates and centralizes metadata, which has resulted in more consistent naming
Little uniformity of procedures	The project process is controlled by the ECM system, which has significantly increased process uniformity

Table V.
Effects of the ECM system implementation

6.1 A process model for ECM system implementation in SMEs

As mentioned, the plan for the course of the ECM project was based on general IS implementation literature. However, because of the nature of ECM solutions, certain aspects were of particular importance compared to guidelines in the general literature. The phases and the most important tasks within these phases in the project at Altan.dk project are outlined in the process model in Figure 5.

6.2 Success factors for ECM implementation in SMEs

Table VI summarizes how Altan.dk addressed the ten success factors described in Section 2.3. Subsequently, the appropriateness of these factors is discussed.

The fulfilment of all ten factors, to varying degrees, seems to have been essential for the success of the project at Altan.dk. The only slight exception may be that Altan.dk, instead of splitting project management into an executive function and an operation function, decided to let its IT manager take both roles while being advised by an external consultant. This can be seen as choosing a vertical instead of a horizontal

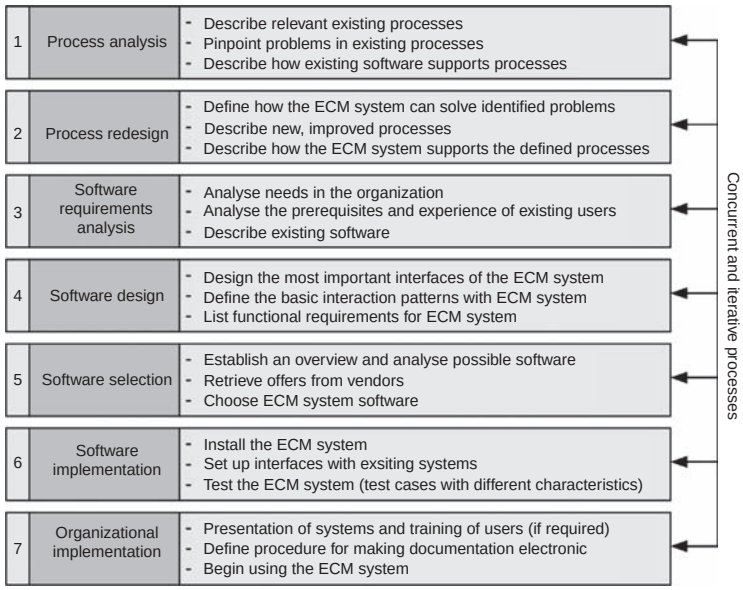

Figure 5.
A process model of the implementation of the ECM system at Altan.dk

division of the project management. The essentiality of the factors in the current case study may indicate that these also apply to ECM system implementation. However, more case studies are needed for confirmation of this.

The appropriateness of the ECM solution that Altan.dk acquired is also, in addition to being a success factor, a result of other success factors such as appropriate IT staff, clear links to business objectives, and carefully defined information and system requirements. A key aspect to consider is that, while large companies in some cases have the resources to develop their own ECM solution, SMEs are normally much more dependent on using standard software since they have only limited in-house IT expertise. In the case of Altan.dk, all vendors that were approached offered standard solutions with various possibilities of adaption to Altan.dk's needs. As described, Altan.dk displayed a rather uncompromising approach to the involved software vendors, which resulted in finding a vendor willing to go to great lengths to satisfy the company's requirements. Figure 6 summarizes the approach of Altan.dk compared to a traditional approach in the acquisition of enterprise software in SMEs. As seen, Altan.dk's approach implies that the users were presented to a system that was very much in accordance with their prerequisites and terminology rather than being introduced to an ECM system that required learning new terms and routines. Thus, the Altan.dk approach promoted greater initial user acceptance.

6.3 ECM implementation in SMEs compared to larger companies

As shown in the review of existing literature, the case studied in this paper seems to be the only longitudinal study of an ECM project at an SME. Thus, a comparison of the Altan.dk case with projects in similar types of companies is not possible. However, two studies of ECM implementations in larger companies exist, namely the study of the enterprise-wide ECM programme in the Norway-based oil company Statoil (Munkvold *et al.*, 2006; Nordheim and Päivärinta, 2006) and the case study report from

Success factor	Actions
Committed and informed executive sponsor	The executive sponsor in the project of Altan.dk can be seen as the project manager. This person was extremely committed to the project and was able to dedicate most of his time to the ECM project. An external consultant was used to advise the project manager in relation to the project
Operating sponsor	In the case of Altan.dk, the executive and operating sponsor can be seen as the same person, namely the project manager. The use of a consultant may have been the factor that enabled the project manager at Altan.dk to function both as executive sponsor and operating sponsor
Appropriate IS staff	A consultant was hired to assist in the definition of software requirements, while the ECM system vendor handled the software development
Appropriate technology	The applied technology was tailored to the needs of Altan.dk
Management of data	To ensure all relevant data were accessible in the ECM system, Altan.dk decided that all documents should be found in digital form
Clear link to business objectives	The project was strongly linked to business objectives as a result of originating from an extensive business process analysis of Altan.dk and its main suppliers
Management of organizational resistance	To avoid organizational resistance, Altan.dk presented the project to the employees with a focus on how the ECM system could eliminate daily problems, and Altan.dk was not willing to compromise on the defined requirements for the ECM system, and the future users were very much involved in the project (e.g. in the defining of the ECM solution)
Management of system evolution and spread	After the system was put into operation, new elements were continuously added. The Altan.dk IT manager, who was able to devote much time to such tasks, governed the process
Evolutionary development methodology	By continuous further development of the ECM system, Altan.dk ensured that the system did not become obsolete and that users felt their requests for the system were heard
Carefully defined information and system requirements	The main interfaces and user interaction patterns were described in great detail before talking to vendors of ECM solutions

Table VI.
Application of the ten success factors

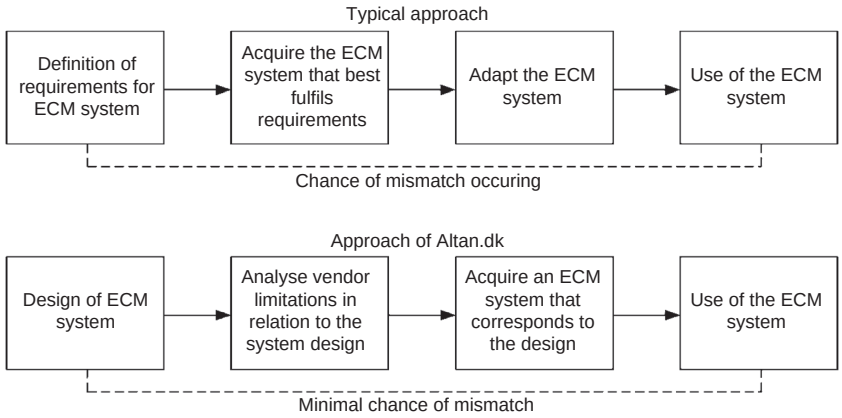

Figure 6.
The ECM approach at Altan.dk

J.D. Edwards (a global software and service provider in the field of enterprise systems) (Scott *et al.*, 2004). Obviously, having only one study of an SME and two studies of larger companies makes it hard to generalize about the differences between ECM implementation in SMEs compared to larger companies. However, it may be reasonable to assume that in spite of the few cases, some major differences may be identified which can be attributed to the difference in company size.

While referring to the Statoil and the J.D. Edwards cases, Munkvold *et al.* (2006) point out that at least two different approaches to the development of ECM technology infrastructure can be identified. In the case of Statoil, an enterprise-wide platform based on products acquired from well-established commercial vendors was developed. In the J.D. Edwards case, an in-house content publication system was combined with evolving intranet and web content management solutions. These represent an evolutionary pattern through tactical improvements (at J.D. Edwards) and a strategic, holistic investment in a technological platform (in the Statoil case), respectively (Munkvold *et al.*, 2006). As is the case with many SMEs, Altan.dk differs from large companies such as J.D. Edwards and Statoil by not having in-house IT development competences. Thus, developing an ECM platform internally was not a possibility, and a "ready-to-use" application had to be acquired instead. In the case of Altan.dk, software was purchased from a vendor that was in the process of developing a standard ECM solution. The software vendor made many adjustments and added supplemental features to the software in order to meet the requirements of Altan.dk. Thus, Altan.dk outsourced the needed IT development competence to the vendor. The prime focus, which directed the development of the ECM software at Altan.dk, was to create a solution that allowed the diverse set of future users to easily put the software into use, while strategic or technical aspects were given far less attention. Thus, in many ways this case represents yet another form of development of ECM technology, which could be described as a "user-oriented development process".

In the Statoil case, awareness of the employees' relevant routines was a key issue, while having centralized routines was found to be of limited value unless these routines were perceived as necessary from the viewpoint of particular organizational domains. A similar conclusion was made in the case of Altan.dk (i.e. if all people within relevant domains were not using the system, then the solution would not have the intended value). To achieve this, Altan.dk made the management decision that all documents should be available in electronic form and that projects could be created only through the ECM system. It was possible to implement this strategy with little disruption because of the relatively small size of the company and frequent interaction between the IT manager and the ECM system users. This aspect illustrates the point that development and adaption of ECM systems will typically be a simpler task in an SME, since fewer user requirements and routines will need to be considered.

In literature, arguments have been made for the importance of change management during ECM development (Smith and McKeen, 2003; Munkvold *et al.*, 2006; Scott *et al.*, 2004). In the case of Statoil, this was done by assigning an internal corporate IT team to gain general level competence on ECM and related technology. This team was to present the opportunities offered to the board of IT decision makers. Also, Statoil's approach included considering the ECM platform as a whole before starting to pilot applications for particular business cases. According to Munkvold *et al.* (2006), corporate IT in Statoil managed to obtain corporation-wide commitment to the ECM programme through a centralized decision-making process. The report from the projects in J.D. Edwards, conversely, describes ECM endorsers working primarily on an

individual basis during the project initiation phases. Also in the J.D. Edwards case, the focus was mainly on justifying and evaluating their ECM initiatives through traditional cost-benefit measures applied to focused business cases (Scott *et al.*, 2004). The IT manager in the Altan.dk project had the full support of the managing director and mainly handled the change management process at Altan.dk. An external consultant with insights into the business process of Altan.dk and experience from similar projects also advised the IT manager. Having this consultant available to give advice during the whole process was a minor part of the total cost of the project (<10 per cent).

Another important aspect in relation to ensuring success at Altan.dk was that the ECM project manager started many initiatives to ensure organizational support. First, the project was presented to the employees with a focus on problems frequently arising in existing work routines, and how an ECM system could eliminate such problems was highlighted. Second, a clear vision and well-defined set of requirements for an ECM solution were formulated before approaching possible vendors. The learning from the case was that having clear definitions of basic user interfaces and interaction patterns provides a solid basis for discussions with possible ECM system vendors. Furthermore, in negotiations with possible software vendors, Altan.dk was not willing to compromise on most of the defined requirements for the ECM system, which resulted in Altan.dk acquiring an ECM system that appears to fit extraordinarily well with employee needs. Third, the future users were very much involved in the project; more specifically, meetings were held with the different departments to define requirements for the parts of the system that they were to use. During these meetings, future users were involved in the outlining of specifications for user interfaces and functionality. In fact, to a great extent the users were the designers, since they decided which data to include and the names of fields and functionalities. In the end, this approach resulted in minimal resistance to the project and use of the ECM system, despite the low level of IT knowledge, in general, at Altan.dk. Having failed in previous attempts to implement EDM systems at Altan.dk, the unproblematic organizational implementation process of the ECM system illustrates the importance of being well prepared before engaging in an ECM implementation to ensure user acceptance. Other SMEs may learn from this in relation to IT implementation. As shown, only when Altan.dk acquired the necessary expertise (in the form of an external advisor) were they able to successfully implement an ECM solution.

The main differences between Altan.dk and the cases at Statoil and J.D. Edwards are summarized in Table VII.

7. Conclusions

A literature review revealed that only two existing longitudinal studies of ECM implementations appear to exist and that these do not focus on SMEs. Thus, this paper investigates how SMEs can successfully promote ECM system implementation by answering three questions. The questions were addressed by presenting a case study of the ECM project at a Danish balcony contractor and, on this basis, by analysing the case and connecting it to existing literature.

In relation to the first question, "How can ECM systems successfully be implemented by SMEs?", the lessons learned from the project at Altan.dk were converted into a process model with 21 tasks grouped under the seven phases: process analysis, process redesign, software requirements analysis, software design, software selection, software implementation, and organizational implementation. This process

Table VII.
Main differences compared to existing cases

Dimension	J.D. Edwards	Statoil	Altan.dk
Project initiation	ECM "evangelists" on a more individual basis during the project initiation phases	A team of people in corporate IT was to present and define concept to the board of decision makers	The IT manager was given relative freedom to complete the project, without a clear business case or solution definition
Software development approach	In-house development combined with vendor-delivered software packages	In-house development based on commercial software products	Ready-to-use (customized) ECM system was acquired based on design specifications
Development pattern of ECM infrastructure	Evolutionary pattern through tactical improvements	Holistic investment in technology platform	User-oriented development process
Justification and evaluation of ECM solution(s)	Cost-benefit measures applied to focused business cases	Consideration of the entire ECM platform before specific piloting and business cases	Funding for the entire project was given based on one loosely defined business case
User involvement in ECM design	Seems to be limited	Seems to be limited	Almost all future end-users to some degree involved
Resistance to the ECM project	Some resistance	Some resistance	No significant resistance

model represents the main elements of the ECM project at Altan.dk, but it obviously cannot be generalized to other cases without reservations. However, although, the characteristics of other SMEs may promote slightly different procedures, the defined process model may be a useful basis in most cases of ECM implementation in SMEs. To provide further insights into this matter, more ECM implementation studies are needed.

To address the second question, "What are the most important success factors for ECM implementation in SMEs?", the case of Altan.dk was analysed in relation to the ten success factors for EIS implementation defined by Poon and Wagner (2001). The case showed that these success factors also seem to apply in the context of ECM systems. The only major deviance was that Altan.dk succeeded in its project despite not dividing the project management into executive and operational levels but, instead, combined these two and sought external support from a consultant (i.e. a vertical instead of a horizontal division). Thus, the case of Altan.dk indicates that these success factors may provide a useful guideline for future ECM projects in SMEs.

If one of the success factors should be highlighted, it may be the uncompromising manner in which Altan.dk insisted on not changing its well-defined system requirements when discussing possible solutions with different software vendors. More specifically, Altan.dk rejected the ECM software from five vendors before finally choosing a software vendor that was in the process of creating ECM software and that was willing to make this software almost exactly as defined by Altan.dk in cooperation with their external consultant. This issue illustrates a common problem for SMEs, namely that it often can be hard to find off-the-shelf software which suits the specific needs of the particular company. Altan.dk managed to do so because of their patience, uncompromising attitude, and willingness to pay for the right solution.

For the third question, "In which aspects do ECM projects in SMEs differ from projects in larger companies?", the paper compares the Altan.dk case to two ECM project studies described in existing literature. Although the Altan.dk project involved considerably fewer actors and employed a much less extensive technological solution, many of the lessons learned were similar (i.e. awareness of the relevant employee routines, considering the system as a whole before initiating the project, the importance of change management, etc.). On the other hand, some major differences were also identified. In the context of developing an ECM platform, the case of Altan.dk illustrates that SMEs often differ from larger companies in that they do not have in-house IT development competences. In the cases of J.D. Edwards and Statoil, to a large extent the ECM solutions were developed in-house, implying that a solution could be continuously adapted to fit the requirements of the organization. On the other hand, a lack of in-house software development competences (as in the case of Altan.dk) requires that a more or less ready-to-use application be acquired. To avoid acquiring ECM software that would later turn out to not fit the organizational needs, Altan.dk put much effort into investigating user requirements and making rather specific requirements for the ECM system. Additionally, compared to the two existing cases, Altan.dk also seems to have included the users in the system specification to an even greater extent. This may be one reason why serious problems related to the use of the ECM system did not emerge. Finally, compared to the existing cases, the Altan.dk case represents another pattern for ECM technology development, namely what can be described as a "user-oriented development process".

In addition to providing answers to the three research questions, the case also demonstrated many of the benefits to be achieved from ECM systems in SMEs, which

typically handle large amounts of unstructured information. At Altan.dk, the result of the introduction of the ECM system was that almost all documents associated with a specific project are now managed by and can be accessed through the ECM system. The benefits include, among others, more efficient document retrieval, improved project process control, easier document creation through use of templates, more document uniformity, and fewer incidents of information loss. Also, the case shows how ECM can facilitate stronger ties with suppliers (i.e. ensure better and timelier information). Although ECM solutions may appear to be mostly aimed at large companies, the case study showed that SMEs can also achieve great benefits from using such technology.

Overall, this paper represents a contribution to the sparse research on organizational implementations of ECM. Thus, practitioners in SMEs who plan to engage in ECM projects may utilize the experience from this project. From a research perspective, the paper provides a point of departure for future research in the use of ECM technology in SMEs. Given the great variety in the few case studies of ECM projects, more studies are needed in order to better understand what ECM is, how it is implemented, and what its effects are.

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