Customization of Enterprise Content Management Systems: An Exploratory Case Study

Stig Nordheim, Tero Päivärinta
Agder University College, Dept. of Information Systems
PO Box 422, 4604 Kristiansand, Norway
Phone +47 3814 1610, +47 3814 1662
Stig.Nordheim@hia.no, Tero.Paivarinta@hia.no

Abstract

Enterprise Content Management (ECM) systems are mostly implemented in organizations by acquiring commercial software packages and customizing them to meet the organizational requirements. The customization aspect of ECM systems lacks empirical research. This paper explores the concepts of ECM customization and issues identified with ECM customization. The data are based on an in-depth case study from the oil industry and complemented with a secondary analysis of 60 vendor-reported cases of ECM implementations. The results show considerable customization challenges related to ECM, especially concerning integration, usability and functional adaptation. A resulting framework of customization concepts in ECM is suggested and discussed, along with issues for further research.

1. Introduction

Enterprise Content Management (ECM) is an integrated approach to managing all of an organization's information: including strategies, processes, skills, and tools [1]. ECM "integrates the management of structured, semi-structured, and unstructured information – and embedded pieces of software code – throughout the entire content life-cycle in the organizational contexts of content production and utilization" [2]. The ECM market consists of a plethora of vendors, including IBM, Microsoft, Documentum, Hummingbird and Vignette. They all provide software products with varying functionality under the concept of content management [3, 4]. In addition to the software vendors, a larger practitioner-oriented community focusing on ECM has emerged. There exists professional associations and communities, such as AIIM (www.aiim.org), a cluster of consultancy companies, and several practitioner-targeted books summing up the authors' consulting experiences [5-7]. Consulting institutions such as METAGroup, expect "the content management market" to exceed $10 billion per year in 2004 [8].

Beyond the hype facilitated by the consultancies and vendors, ECM represents a significant challenge from the viewpoint of organizations truly aiming at implementations of corporate-wide and integrated content resources. Problem areas include knowledge management, document management, web content management, and structured databases [2]. However, as noted by Munkvold et al. [2], research has so far nearly ignored the organizational viewpoint of content management, focusing on either constructive studies promoting and analyzing particular technical functionalities in software related to ECM [9-13] or purely conceptual ideas and frameworks to think about the issue in organizations [14, 15].

After the era of the "web content management pioneers" and in-house solutions of the mid-1990s [6, 16], commercial software packages nowadays play the central role in most ECM implementations. This "market-based perspective" [17] on developing information systems based on commercial software, may quite often require customization of the original products for the information processing needs of the customer organization.

The issue of software customization is at least as old as the EMACS editor [18]. More recently, it has been an issue in the field of enterprise resource planning (ERP) systems, where minimal customization has been considered a critical success factor for organizational implementations [19]. As with the ERP efforts, we have indications that customization of ECM software may involve considerable costs. For example, a market study among manufacturing enterprises Daratech [20] reports that for each $1 of expenditure on software licenses, the customization expenditure can range from an additional $1 to $10. However, a

dearth of empirical studies on customization in the field of ECM systems remains.

This paper explores the concept of customization related to ECM systems. It is based on a case study of a customer organization that has run a corporation-wide development program for 18 months. The viewpoint of this in-depth case study resides in the customization needs of ECM software anticipated by the ECM champions and IT experts of the target organization. The data are complemented by a secondary analysis of 60 case texts of ECM implementations provided by "the ECM association", AIIM (www.aiim.org).

The paper contributes by grounding the concept of customization in ECM systems and its role in the requirements definition phase of such development initiatives. After declaring the general-level working concepts of customization reviewed from the literature in the next section, section three describes an exploratory case study [21] about anticipated customization needs in a large-scale ECM initiative. Section four complements the results of that in-depth study with a secondary analysis of 60 vendor stories of ECM implementations. Section five discusses the resulting observations of the concept of customization in ECM systems and its role in the requirements definition process. Section six concludes with suggestions for further research.

2. Customization

Since definitions of customization vary, this section builds up our working definition. According to Merriam-Webster's dictionary [22], to customize generally means: "to build, fit, or alter according to individual specifications". In this context we do not mean "to build" from scratch, nor to "alter" an artefact. Rather, the concept refers to "fit" an existing software package into a customer's environment. We propose the following working definition:

Customization is a socio-technical activity of modifying the properties of packaged software, so that the resulting information system converges with the requirements of the target organization.

A number of candidate concepts to describe the customization of software exist. *Modification* and *adaptation* could be used. *Configuration* is another term that carries a more technical or architectural meaning, and we understand configuration as a subset of customization. We also regard the *integration* of software to the customer organization's existing infrastructure as a subset of customization.

We use customization in the sense of largely non-users modifying software before use. A rival concept for customization could be *tailoring*, which we have chosen to avoid here as some connotations of tailoring imply a modification of the software while it is already in use [23]. By including "socio-technical activity" in our definition, we also emphasize the interaction of the individual and the group in the process of planning for and implementing customized systems. Finally we limit our definition to packaged software, as opposed to software made-to-order.

The following options to modify software, which are here included in our concept of customization, have been identified in the tailoring literature [24]:

- Choosing between alternative anticipated behaviors
- Constructing new behaviors from existing pieces and components
- Altering the packaged software artifact

Customization does not necessarily imply total adaptation of software to organizational needs. In some cases, the target organization may need to adapt itself to software. In ERP implementations, this is a well-known phenomenon [25], referred to as "mutual adaptation" [26]. To take this phenomenon into account, our definition states that the resulting information system, as a result of customization, "converges with the requirements of the target organization". Let us next examine the concept further in relation to ECM.

3. A case of anticipated customization needs for ECM

Statoil is a Norwegian oil corporation, having approximately 16,600 employees (all potential users of ECM) in 25 countries. Statoil IT (Information Technology) employs 700 people at all major sites, and carries the central responsibility for IT services in the company. This includes the maintenance of a large portfolio of applications. The total ambition of Statoil's planned ECM-initiatives goes beyond alleviating single problems and limitations, to also provide a corporate-wide foundation for IT-supported collaborative work practices. However, this vision implies several challenges. Statoil has therefore chosen a step-wise approach comprising more than 50 preliminary development initiatives spanning a two-year period (2002-04). Since 2001, several persons in Statoil IT have focused on gaining ECM competence and scrutinizing the potential solution scenarios in relation to the enterprise's contemporary objectives and challenges. To scrutinize customization needs for ECM, Statoil thus represents an interesting case of a competent customer, unlike several companies who

need to rely on the vendors and external consultants in their requirements definition phase for ECM.

The ECM planning process in Statoil has so far consisted of the following phases:

- Strategy development (Q[uarter]1-Q2, 2002)
- Feasibility study (Q3-Q4, 2002)
- Solution scenarios (Q1, 2003)

A possible decision to purchase a commercial ECM package will lead to specification and acquisition in Q3, 2003.

This paper draws on experiences from the feasibility study, elicited by open interviews with four key project personnel – hereafter referred to as informant one, two, three, and four – after their completion of the solution scenarios. The research was conducted as an interpretive case study. The informants have been involved in the feasibility study, and each was interviewed for about 40 minutes, at the company site. Two of the interviews were conducted through telephone. The interviews were tape-recorded and transcribed. The interviews were carried out towards the end of the project planning phase in May 2003. ECM-related project documents were also analyzed. Data analysis has been following a grounded approach.

Statoil's feasibility study was based on a case which they presented to two major ECM vendors, who spent a week each providing their solutions according to the Statoil case. The vendors offered solutions based on two ECM packages characterized as "two extreme points": a comprehensive "all-in-one package" solution versus a component-based framework enabling context-specific configurations of modular ECM technology components. Statoil's customization needs anticipated by the informants are largely based on the enlightenment provided by these thoroughly scrutinized and demonstrated solution scenarios. Turning to the data, Statoil's use of different concepts related to customization are presented in the next section. Then the challenges of customization are presented.

3.1. The concept of ECM customization in Statoil

ECM in Statoil is understood as "management of content through the entire collaboration process, and through the entire life cycle of the content object". Commenting on customization needs and challenges in Statoil, informant one referred to the following strategic statement: "What is good enough for others, will be good enough for Statoil". (The quotes from the informants are translated from Norwegian to English by the authors). This implies the generic tendency to avoid extensive customization efforts, whenever possible.

Customization was related to three organizational levels in Statoil:

- Organizational level
- Group level
- Individual level

The levels were prioritized in that order, and customization was anticipated to occur in that order. Customization at the organizational level emerged as a comprehensive technical issue, group level customization was somewhat less explicitly articulated, and individual customization was barely mentioned. Hence, the current focus of customization in ECM systems in this case seemed to be on the organizational and infrastructural level, rather than focusing on group-level, let alone individually customized, ECM solutions.

'Customization' was hardly used as a concept by the informants inside Statoil. They perceived it as a commercial concept, describing the vendors' actions to develop their products according to their experience from the previous customers. Since the informants were inside the company, they used mainly the following concepts instead of customization:

- Adaptation
- Integration
- Configuration
- Migration

3.1.1. Functional customization. In general the customization of ECM functionality was referred to as *adaptation* of the package in connection to its organizational implementation, including three main areas:

- Content model management (functionality for structuring of content, metadata model, taxonomy, templates).
- Content storage and delivery management (functionality for managing user roles, access and security, versioning, transformation, classification, distribution, retention, tracking).
- Process support and automation (workflows).

The functionality customization of ECM was considered extensive: "I consider that there is a need for adaptation of most of the functions, indeed, that [the "all-in-one" solution] offers" (Informant four).

Speaking of the limits of functionality customization, informant four continued: "For example, when a vendor offers templates … or content models, we can rarely use them as-is. Usually we have to carry out that … customization ourselves then."

A few supplementary functions to the future ECM package then may be needed. However, the main objective of functional customization in Statoil

appeared to be *simplification*. A lot of functionality had been included in the two ECM packages under scrutiny, coinciding with Statoil's needs. "What often is a problem, at least in my experience with products, is that they can be functionally quite good, that is, comprehensive, rich… So what we have a need for is merely to simplify… So the purpose of adaptation to a large extent becomes simplification, simply, because these products are often too complex and functionally too comprehensive, so one has to simplify it quite drastically" (Informant four). Speaking of the existing functionality of the two packages in question, informant two said: "As I perceive such a system, it implies a fairly rigid structure, which makes it [customization] a type of simplification that most will bid welcome. In a way, that will perhaps overshadow slightly more individual characteristics." The last mention indicates that Statoil might also need to adapt to the software, instead of plainly adapting the software to Statoil. However, this approach was not mentioned by the other informants.

In addition to the simplifications due to the seemingly rigid structures of the software products, workflows customized for different user groups are expected to imply considerable costs.

3.1.2. Non-functional customization. Three non-functional aspects of customization were referred to with the concepts of integration, configuration, and migration. *Integration* is largely used in a technological sense, and integration of an ECM solution with the existing applications and infrastructure, e.g. for enabling remote offices and mobile users, is expected to be one of the major efforts ahead. In Statoil, ECM software will have to be integrated with:

- Web publication tools
- MS Office
- Collaboration suite
- Search and content classification / taxonomy tools of the future

Other architectural-level integration challenges were also mentioned, such as global network topology, enterprise portal, enterprise application integration, role based access, public key infrastructure, external access and offline access. These represent more generic challenges which an ECM solution will have to deal with. Integration is sometimes also used by informants to describe the customization of work processes, or workflow integration between applications.

Configuration was another term used for the non-functional customization of the ECM software. The focus here resides especially in the customization of user interfaces to achieve required usability. Users' positive experiences with the new system rely on skilful configurations, e.g. ECM transparency when the user is working with E-mail or MS Office connected to ECM.

Migration from old to new system for ECM can be regarded as an area tangential to customization, especially adaptation. Migration is an important activity to preserve the existing information resources. Preparation for migration can include some customization.

Table 1 summarizes the concepts related to the customization observed in the Statoil data. These concepts are partially overlapping, e.g. integration may be achieved by some adaptation of interfaces, and some adaptation may be achieved by configuration. Table 1 thus reflects tendencies in the understanding of concepts, rather than disjoint categories.

3.2. Expected customization challenges

Customization was seen as a tremendous challenge in Statoil. All customization efforts of ECM will be implemented by Statoil's internal IT service, which makes this case a bit exceptional if compared to cases

Table 1. ECM customization concepts used in Statoil

Time	Before delivery	Early preparation	Before roll-out
Level	Organization	Organization	Group
Focus	Largely technical	Technical	Business
Aspects changed	Non-functional and functional	Non-functional and functional	Functional
Concepts used	Customization	Migration (preparation) Configuration Integration Adaptation	Adaptation
Who	Vendor (and partner)	Statoil IT	Statoil IT
Expected effort	Limited	Large	Large

in which external consultants and vendors would play a major role in the organizational implementation. The major reasons for this approach reside in the cost efficiency over time and strategic competence development. An ECM solution is expected to last for many years, with an increasing functionality evolving over the years. In the long run, the in-house customizations and the competence gained to do those are considered to represent a profitable approach over time. Rather than a long term relationships with a consulting company, they want to develop the internal service provider's customization competence. This will probably be done in cooperation with selected implementation / integration partners.

The greatest uncertainty is expressed over the possibilities of *integration* with other tools and systems. "The main uncertainty is after all in relation to what we can achieve related to surrounding tools. The other tools, such as e-mail, the search and classification tools and other functional modules … uncertainty because the vendor does not deliver finished products. They supply components, but these need to be adapted, in the solution" (Informant four).

Another important aspect resides in the customization challenge of *user interfaces*. Commenting on the two candidate solutions presented during the feasibility study, informant one stated: "none of this can be presented to our users … [A] total collaboration solution should be as transparent for the user as possible, with a lot of automated processes, running in the background". Hence, a considerable configuration and adaptation effort is expected, to achieve the required usability.

In conclusion, the anticipated customization needs greatly exceed what was contemporarily offered as standard software by the vendors and implementation partners. The gap will have to be mapped by a comprehensive requirements analysis, expressed in this way by informant one: "as we now are about to begin specifying requirements for this solution, it will be a formidable task".

4. Customization issues in 60 texts of ECM implementations

To complement the study of Statoil, we conducted a secondary analysis of AIIM's 60 case descriptions of ECM solutions (www.aiim.org/all_cs.asp) in May 2003. The reason for choosing this data source was AIIM's espoused independence of any particular kind of ECM product or vendor. The cases thus represent already implemented ECM solutions for a variety of organizations from a variety of vendors.

60% (n=36) of the cases mentioned customization-related issues. Only 8% (n=5) explicitly stated that no customization was needed. The remaining 32% texts (n=19) made no reference to customization, leaving the status of customization in these cases unclear. The few cases highlighting no needs for customization concerned content management solutions for a focused, rather than an enterprise-wide scope.

Of the 60% texts describing some form of customization, the following types of customization challenges were found:

- Integration 38% (n=23)
- User interface 13% (n=8), simplification in one case
- Functionality 10% (n=6)
- Organizational adaptation to the system 7% (n=4)
- Customization of the software product conducted by the vendor according to the requirements of the customer 7% (n=4)

Looking more closely at integration, we found that in 25% of the cases mentioning integration (n=6) the vendor provided predefined solutions included in the ECM package for integrating ECM software with other packages such as application programming interfaces (APIs). In almost 50% of the integration cases (n=10) integration was provided by other software components to be purchased in addition to the core ECM package. Integration issues of ECM were mentioned e.g. in relation to ERP, database APIs, other off-the-shelf components, scanning systems, PDM (product data management), GIS (Geographical Information Systems), XML (eXtensible Markup Language) applications, portal integration, and (in-house developed) legacy systems.

User interface customization was related to issues such as customized applications, user-friendliness of front-ends, support for browsing and printing large drawings, forms processing for handheld devices, manufacturing process mimicking, and simplification of scanning solutions. Functionality customization was related to the functionality of billing systems, new applications built on the ECM core, producing ERP output through ECM, and real-time collaboration solutions connected to content management.

Although four cases mentioned organizational adaptation to the ECM system, organizational adaptation did not emerge as a big issue in general.

The major focus on integration in these cases fits well with our observations from Statoil. So does the mention of user interfaces, although Statoil appeared to emphasize usability more than what was reflected in the AIIM cases. Of course one must be careful not to jump to conclusions based on silence in these case descriptions, as there is a lot of unknown material behind them. Our observations are based on what is

explicitly stated and mentioned in the texts describing these cases.

Only four cases highlighted the vendor's capability and readiness to update the ECM software as an artifact based on the customer's needs. In the majority of the AIIM cases, the customization challenge thus rarely concerned the software package as such.

5. Discussion

Our working definition of customization appeared to fit rather well with the anticipated challenges in the Statoil ECM case. The anticipated technical activities in Statoil's case were mainly related to fitting the ECM software with the existing infrastructure, described with such subconcepts as integration, migration, and configuration. The socio-technical activities in Statoil's case were mainly related to defining and implementing work processes utilizing ECM at corporate and group levels. They were described in Statoil by the term adaptation. The adaptation of ECM requires both social and technical understanding to fit the organization and technology with each other. Hence, the customization of ECM systems highlights the socio-technical nature of the issue perhaps more than the previous literature. Especially, the ECM customization seems to highlight the issues of integration, configuration, and functional adaptation of the systems, whereas the customization of the software product as such by the vendor was not often mentioned as a significant issue. Together with the small number of organizational adaptations to ECM packages, this implies that ECM software by nature is mostly meant to provide a flexible platform for further customizing by the implementing organization.

The customization of ECM software was perceived mainly from two perspectives. Let us call them the technical/architectural and the business perspectives. From both perspectives, the main focus resides in the challenges of adaptation. In addition, integration represents another major challenge from the technical/ architectural perspective. Configuration and migration need as well to be considered from the technical viewpoint.

Figure 1 summarizes the customization issues observed from the case study data. The solid arrows describe the issues mentioned in the data which relate directly to the customization: the technically implemented ECM system might need adaptation to the needs of specific user groups and business processes (from the business perspective). The technical implementation of the ECM system may require adaptation, configuration, migration, and integration; and sometimes (although rarely) the vendor may customize the actual software artifact

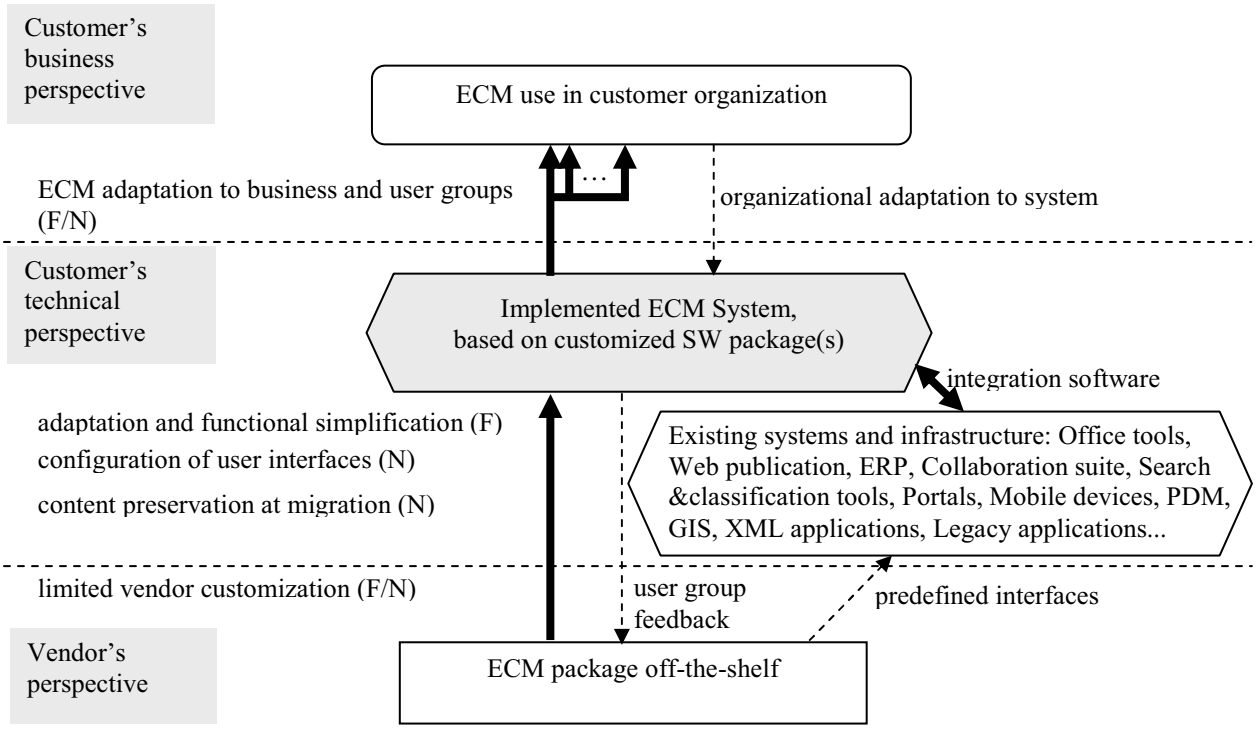

Fig 1. A framework for customization concepts related to ECM (F=Functional, N=non-functional)

based on the feedback from a particular customer. The dashed arrows describe issues which may affect the customization issues as they were mentioned in the data: the organization may still need to adapt to the existing ECM system from the business viewpoint, the pre-defined technical interfaces may significantly help the integration of the ECM software with the others, and in some cases feedback from a particular customer organization affects the product (and its further customizability) through the vendor's customization efforts.

The Statoil case, however, highlighted that the customization needs may significantly exceed the standard offers from the vendor and implementation partners. Statoil strives for filling this gap by its internal IT services, after initial collaboration with carefully selected implementation partners. In fact, this issue was seen as a central area of developing strategic competence. In this respect Statoil may be different from many companies, who would rely on implementation partners and vendors for organizational implementation.

The user interface represented an important area of non-functional customization, to accomplish integration between ECM and e-mail and search & classification tools. These issues require considerable configuration and adaptation efforts to reach the required usability. On the other hand, ECM should be maximally transparent and simplified for its users, allowing requirements for functional customization as well. A generic ECM software package may be so comprehensive that even a sophisticated customer typically needs only a subset of its functionality in a particular context. Whereas these issues were strongly highlighted in Statoil, simplification was mentioned only in one of the AIIM cases, and only 5% (n=3) of those vendor cases mentioned addition of functionality. Hence, our data highlights the need for vendor-independent research on the customization: the vendor reports seem not to highlight the challenges related to the organizational implementations of particular products after their acquisition.

At this early stage our informants in Statoil could only anticipate how customization will be performed. Following Henderson and Kyng's [24] levels of modification, we may after Statoil's feasibility study anticipate the following:

- *Choosing between alternative anticipated behaviors* will constitute the major effort in ECM. This seems to represent the main problem area of customization.
- *Constructing new behaviors from existing pieces* appears to be the main area of concern for achieving technical integration with ECM and the existing solutions.
- *Altering the artefact* by the software vendor is not an expected activity in general.

Unlike in the majority of current ERP systems, organizational adaptation to fit plainly into the capabilities provided by the software package in question did not emerge as an extremely visible issue, neither in Statoil nor in the AIIM cases. Hence, we assert that ECM and ERP systems clearly represent two different approaches to such issues as workflow and data management. ECM products provide platforms for flexible organizational implementations of content management and workflow. This includes rich possibilities to customize the organization-specific solutions for heterogeneous contexts of knowledge work and business processes with heterogeneous content. ERP products, on the other hand, rely mainly on the benchmarked and readily built-in process models for highly standardizable business processes and general solutions for their transaction processing and data management.

6. Conclusion and future research

This paper has explored the concept of customization related to ECM systems and software, resulting in a framework for the related issues. Our framework highlights a few important issues to be considered in the customers' requirements analysis processes for ECM systems.

Firstly, the Statoil case highlights the need for scrutinizing the customization issues carefully before a selection of a complex ECM product – and the need for preparing oneself for customization efforts for functionality simplification and user interface customization in this area.

Secondly, the major vendors seldom conduct the customization of ECM packages as such. ECM customization consists mainly of adaptation, configuration, integration, and migration. These efforts are typically conducted by the customer organization or their selected technical implementation consultants to fit the product onto the existing infrastructure.

Organizational implementation and cultivation of ECM may appear as a continual challenge, requiring the customer organizations to acquire such competence inside the organization instead of relying too much on external vendors and consultants in the long run. This applies especially to the more challenging and integrated ECM solution scenarios. These issues are rarely highlighted by the vendor or consulting-oriented literature, and the need for empirical and neutral research efforts on organizational implementations can

be clearly seen from our in-depth case study. If the customer organization does not possess shared in-depth knowledge of their existing business, organization and IT infrastructure, or remains unable to connect this knowledge to the opportunities offered by the ECM market, corporation-wide ECM initiatives beyond targeted niche applications can appear to be surprisingly laborious after the initial acquisition of a software package.

The major customization needs for ECM systems include:

- Non-functional integration between an ECM software and existing software tools and infrastructure.
- Non-functional configuration and simplification of user interfaces.
- Functional adaptation and simplification of the ECM package in relation to the enterprise's content model, storage management and delivery requirements, and workflows.

A longitudinal study following the actual realization of the anticipated customization issues in the Statoil case would shed additional light on challenges to the requirements analysis and organizational implementation of ECM. Such empirical research would complement the contemporary vendor and consultancy-biased literature, as well as the technical reports describing ECM software functionality as such. This could help organizations to anticipate the customization challenges for their future ECM solutions.

7. References

[1] Smith, H.A. and McKeen, J.D., *Developments in Practice VIII: Enterprise content management.* Communications of AIS, 2003. **11**(33): p. 1-26.

[2] Munkvold, B.E., Päivärinta, T., Hodne, A.K., and Stangeland, E. *Contemporary Issues of Enterprise Content Management: The Case of Statoil*. in *Proceedings of the 11th European Conference of Information Systems (ECIS 2003)*. 2003. Naples, Italy.

[3] Clyman, J., *Content Management Systems at a Glance*, in *PC Magazine*. 2002.

[4] Doculabs, *Special Report on Content Management Products*. 2000, Doculabs: Chicago, IL.

[5] Asprey, L. and Middleton, M., *Integrative Document and Content Management: Strategies for Exploiting Enterprise Knowledge*. 2003, Hershey: Idea Group.

[6] Boiko, B., *Content Management Bible*. 2002, New York: Hungry Minds.

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

[8] METAGroup, *Web Content Management Market to Reach $10 Billion by 2004, Says META Group*. 2002.

[9] Balasubramanian, V. and Bashian, A., *Document management and Web technologies: Alice marries the Mad Hatter.* Communications of the ACM, 1998. **41**(7): p. 107-115.

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

[11] Mack, R., Ravin, Y., and Byrd, R.J., *Knowledge portals and the emerging digital knowledge workplace.* IBM Systems Journal, 2001. **40**(4): p. 925-955.

[12] Rein, G.L., McCue, D.L., and Slein, J.A., *A Case for Document Management Functions on the Web.* Communications of the ACM, 1997. **40**(9): p. 81-89.

[13] 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*. 2000, IEEE: Los Alamitos. p. 70-79.

[14] Goodwin, S. and Vigden, R., *Content, content everywhere... time to stop and think? The process of web content management.* Computing & Control Engineering Journal, 2002. **13**(3): p. 66-70.

[15] 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)*. 2002. Beijing.

[16] Lau, T., *Revamping a Corporate Web Site: Strategies and Implementation*, in *Proceedings of the International Professional Communication Conference (IPCC'96)*. 1996, IEEE: Los Alamitos.

[17] Sawyer, S., *A Market-based Perspective on Information Systems Development.* Communications of the ACM, 2001. **44**(11): p. 97-102.

[18] Stallman, R., *EMACS: The Extensible, Customizable, Self-Documenting Display Editor*, in *Proceedings of ACM SIGPLAN SIGOA*. 1981, Massachusetts Institute of Technology. p. 301-323.

[19] Somers, T.M. and Nelson, K. *The impact of critical success factors across the stages of enterprise resource planning implementations*. in *Proceedings of the 34th Hawaii International Conference on Systems Sciences (HICSS-34), January 3-6, Maui, Hawaii*. 2001. Los Alamitos CA: IEEE.

[20] Daratech, *The Changing Role of IT in Manufacturing: Document/Content Management vs PDM - How Buyers Choose*. 2001, Daratech.com.

[21] Yin, R.K., *Case Study Research - Design and Methods*. 2nd ed. 1989, Newbury Park: Sage.

[22] *Merriam-Webster's collegiate dictionary*. 10th ed. 1996: Merriam-Webster, Springfield.
[23] Kahler, H., *Supporting Collaborative Tailoring*. 2001, Roskilde University: Roskilde.
[24] Henderson, A. and Kyng, M., *There's No Place Like Home: Continuing Design in Use*, in *Design at Work - Cooperative Design of Computer Systems*, J., G. and M., K., Editors. 1991, Lawrence Erlbaum, Hillsdale NJ. p. 219-240.
[25] Davenport, T.H., *Putting the Enterprise into the Enteprise System.* Harvard Business Review, 1998. **76**(4): p. 122-131.
[26] Soffer, P., *Aligning an Enterprise System With Enterprise Requirements: An Iterative Process*, in *Proceedings of the Fifth International Conference on Enterprise Information Systems (ICEIS), April 23-26, Angers, France*. 2003. p. 147-155.