ECM SYSTEMS ANALYSIS AND SPECIFICATION
Towards a Framework for Business Process Re-Engineering

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Keywords: Analysis, Business Processes, Business Process Management (BPM), Business Process Re-Engineering, Content, Enterprise Content Management (ECM), Framework, Information Systems (IS), Specification.

Abstract: In today's working life, the management of content represents one of the most critical success factors. Quick access to required information considerably enhances business process efficiency as well as effectiveness. Enterprise Content Management (ECM)—a presently emerging field in Information Systems (IS) research—aims at providing concepts on how to best administer an organization's individual content situation. Nevertheless, due to the novelty of the topic, there is still a lack of methodical support for ECM systems (ECMS) analysis and specification. A further drawback to a frictionless implementation of ECM results from the negligence of re-engineering affected business processes. With this paper, we present an integrated framework for ECM adoption and business process re-engineering, reverting to established methods in the field of Business Process Management (BPM) and IS analysis and specification techniques.

1 INTRODUCTION

In the course of daily business, enterprises create enormous amounts of digital content. Hence, organizing, resourcing and directing this information flood represents a huge business challenge. All employees need to be provided with the correct content, at the right time, of good quality, and preferably in a cost-conscious manner. Enabling and supporting these tasks with both adequate management concepts and suitable Information Technologies (IT) has become one major topic in Information Systems (IS) research.

Enterprise Content Management (ECM) comprises means and technologies to efficiently capture, manage, store, preserve, and deliver content (www.aiim.org). However, the academic work carried out so far is lacking guidelines on how to realize the named potentials. Methods for analyzing and specifying ECM systems (ECMS) can rarely be found within prevailing ECM literature.

With this paper, we aim to diminish the depicted grievance by introducing an integrated framework for ECM adoption. Reverting to the idea of business process re-engineering (cf. van der Aalst and Hee, 1995), the framework provides methodical support for embedding ECM reference processes into an organization's business process structure. Therefore, at first, business processes and potential ECMS functionalities and systems are analyzed and specified in order to then re-organize the business process structure in a way that best fulfils the company's organizational as well as content-related requirements. The realizable optimization potentials are finally quantified by means of profitability analysis on the basis of personnel costs.

The remainder of this article is structured as follows: in the next chapter we examine latest academic literature on ECM and then introduce an established framework for ECM research (section 3). The framework serves as a theoretical foundation for our approach that is introduced in the subsequent section (section 4). In accordance with the design science research paradigm (Simon, 1996; Hevner et al., 2004), we then present first results of its application within a real life business project (section 5).

vom Brocke J., Simons A. and Cleven A. (2008).
ECM SYSTEMS ANALYSIS AND SPECIFICATION - Towards a Framework for Business Process Re-Engineering.
In *Proceedings of the Tenth International Conference on Enterprise Information Systems - ISAS*, pages 345-350
DOI: 10.5220/0001710303450350

We finally conclude with a short summary and give an outlook on future research (section 6).

2 RELATED WORK

ECM comprehends "strategies, tools, processes, and skills an organization needs to manage its information assets over their life cycle" (Smith and McKeen, 2003). Adopting ECMS may significantly enhance both, efficiency (e. g. costs) and effectiveness (e. g. compliance) of business processes (Reimer, 2002; O'Callaghan and Smits, 2005). However, despite the estimated benefits ECM offers (c. f. Rockley et al., 2003), ECM research still exhibits major deficits regarding implementation methods (Tyrväinen et al., 2006). Far too often, the concept is falsely limited to technological solutions for the management of enterprise content (c. f. the ECM definition of the ECM Association; www.aiim.org) and the necessity of analyzing and especially re-engineering business processes according to ECM strategies is neglected. An effective ECMS adoption requires an in-depth assessment of an organization's individual business process structure including a rigorous examination of managerial requirements on an organizational and technological level (vom Brocke, Simons, Cleven, 2008). Nevertheless, methods on how to in fact analyze and specify ECMS can rarely be found within the latest academic reports (cf. Figure 1 in the following).

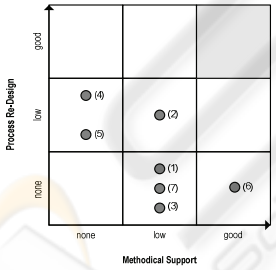

Figure 1: ECM literature review results.

Nordheim and Päivärinta (2004) present a case study on ECMS customization and thereon identify common issues for its implementation (1). In their later work (2006), they include a process-based view, but solely focus on ERP systems (2). Methodical support is only provided to a small degree. Päivärinta and Munkvold (2005) introduce a content model for ECM implementation (3). The approach primarily focuses on the content structure and life cycles but neglects the relevance of the business process perspective.

Concentrating on technological aspects of ECM solutions, Reimer (2002) primarily describes the functions and structure of ECM systems (4). The business process perspective is solely referred to in order to estimate the impact of an ECM implementation on business process efficiency. Smith and McKeen (2003) focus on defining related terms and concepts (5). Methods for ECMS analysis and specification are not presented. Rockley et al. (2003) provide an overall guideline for ECMS adoption, but mainly address aspects of collaboration and strategy development, whilst also neglecting a business process perspective (6). O'Callaghan and Smits (2005) introduce ECM strategies, but do not consider business processes as well (7).

In summary, a lack of methodical guidelines for ECMS analysis and specification in the present ECM literature can be constituted. Especially the business process perspective (symbolized by the shaded field in Figure 1) is widely neglected. Hence, our aim is to provide methodical support by presenting an integrated framework for ECM adoption and business process re-engineering. Firstly however, an established framework for ECM research needs to be introduced to serve as a theoretical base.

3 THEORETICAL FOUNDATION

In accordance with the results of our literature review, Tyrväinen et al. (2006) state that ECM has received far too little attention within the IS research community until now. Thus, they introduce a framework systemizing four different perspectives on ECM research: content, technology, processes and enterprise (cf. Figure 2 and Tyrväinen et al., 2006 in the following).

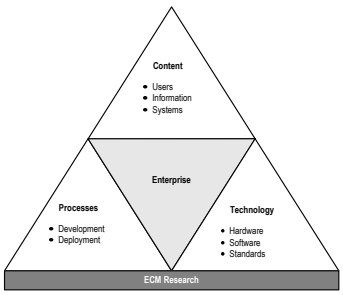

Figure 2: ECM research framework.

The content perspective comprehends an information view (primarily structure information), a user view (users and user-content-relations) and a system view (content storage and access). The technology

perspective comprises software and hardware aspects as well as respective standards. It shows the necessity for an intense consideration of different ECM systems and functionalities within ECM research (subsumed under the term technology). The process perspective, which gains special attention in this paper, contains the conceptual development of processes as well as their deployment within the organizational infrastructure. Finally, the enterprise perspective connects and determines all of the other perspectives and is therefore arranged in the centre of Figure 2.

We are of the opinion that a successful implementation of ECMS requires the integral consideration of all the four research perspectives. Hence, our framework integrates all of them into a holistic framework for ECMS adoption. Making use of established Business Process Management (BPM) methods, the framework offers methodical support for a circumspect process-driven ECM implementation.

4 A FRAMEWORK FOR ECM ADOPTION

Our framework for ECM adoption is displayed in the following Figure 3. It consists of five consecutive phases (visualized by the light-colored fields), results (visualized by the dark-colored fields), and methods (being applied within the different phases).

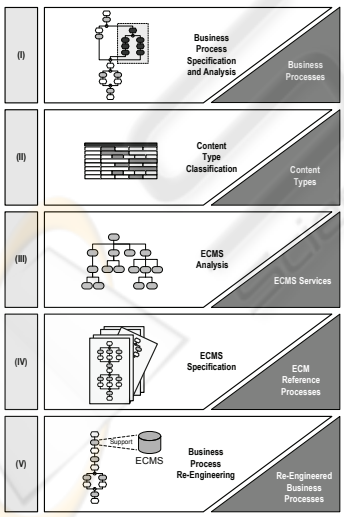

Figure 3: A framework for ECM adoption.

The first phase aims at analyzing an organization's existing business process landscape by means of business process modeling. Examining the prevailing process structure in detail on the one hand serves the purpose of identifying the relevant content entities for each business process. On the other hand it facilitates the detection of those (parts of) processes that offer a high optimization potential when re-engineered through ECM adoption (symbolized by the dark-colored process elements). Methodical support for the first phase lies in the use of Event-driven Process Chains (EPC). Within the second phase, those content entities that require the same ECMS support are subsequently aggregated to content types. Content types are specified by content attributes (relevant for all content entities) and respective attribute values (describing the content character). They are represented by the means of morphological boxes.

Phase III serves the analysis of available ECMS with regard to their support functionalities considering business processes as well as different content types. ECMS functionalities, herein combined to ECMS services, that are required for the rationing of different content types within a specified organizational context are arranged in Functional Decomposition Diagrams (FDD). Within the subsequent phase IV, reference processes for ECM are adapted with regard to an organization's individual content and process situation. These reference processes serve as guidelines for an ECM realization and are therewith part of the ECMS specification. Finally, in the phase of business process re-engineering, the ECM reference processes are embedded into the organization's business process structure. Those process parts offering a high potential for optimization through ECM support (identified within phase I) are now fostered by the ECMS (symbolized by the re-engineered process chain that does no longer contain any dark-colored process elements). Realized benefits are estimated by means of profitability analysis based on personnel cost reductions.

Subsequently, first results of an application within a real life industry project are presented. Please note that the documentation has been slightly simplified to ensure a clear presentation of the framework.

5 APPLICATION OF THE FRAMEWORK

The application of the framework starts with a conceptual specification of a company's processes by means of business process modeling. Specifying business processes using the EPC technique allows for the identification of different content assets, content users, and systems in which content assets re-

side. Thus, the first phase particularly refers to the user and to the system view of the research ECM framework. Moreover it serves as a basis for business process analysis.

Below, an exemplary (part of a) process chain is presented which has been specified (and simplified) on the basis of the results that had been gained during our project work. Within this process—an application process—two content assets are captured: an application document and a contract of employment (cf. Figure 4 in the following). Exemplary average lead times for capturing the two content assets are also specified within the figure (symbolized by the clock symbols). We will refer to these lead times in more detail when presenting the re-engineered business process by referencing to the capturing of the contract (as symbolized by the refinement symbol).

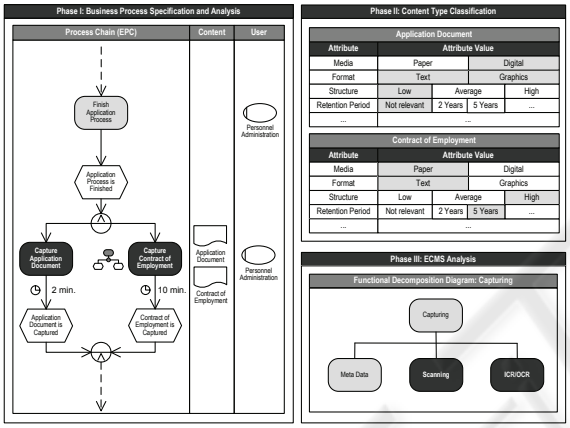

Figure 4: Exemplary application (I).

Within the second phase, those content entities identified in the first phase are classified. Accordingly, this phase refers to the information view of the ECM research framework. The second phase aims at combining the identified content objects to common content types which require the same ECMS support.

Firstly, a set of content attributes relevant to all content entities is developed. Secondly, attribute values are elaborated characterizing the different content entities. Finally, those content entities exhibiting the same attribute values are combined to unitary content types. This phase points out the necessity of taking the organizational context into account (e. g. in terms of compliance/archiving times).

Business process models provide a suitable basis for assessing the organizational requirements of certain content assets. Referring to our example, there are two content assets that need to be captured within the business process: the application document and the contract of employment. Exemplary attributes and attribute values for both content assets are arranged in Figure 4 on the basis of morphological boxes (Knackstedt and Klose, 2005). Whereas the application document is usually submitted digitally (e. g. pdf), the contract of employment is signed on physical paper. Furthermore, the application document may contain the applicant's photo as graphical element—in contrast to the contract that usually only contains text elements. Within this context, the structure of the two content assets also differs. Applications are usually created by external persons using different styles and presentations, whereas the contract is created on the basis of a given template. Finally, the contract has to be archived for a certain period of time due to legal restrictions in contrast to the application document (retention period).

All attribute values of the two considered content types differ. Hence, an aggregation into one content type is not possible. The deviant attribute values indicate the necessity for a diverging content rationing of the two content entities. Consequently, different technological support is required. For example, content assets that have to be archived in the long run due to legal restrictions, often may not be edited during that time. Thus, they particularly require adequate ECMS functionalities, for example access protection or security of storage. Accordingly, in the next step, ECMS functionalities are analyzed on that basis.

Phase III of the framework comprises a detailed analysis of ECMS available and thereby addresses the technology perspective of the ECM research framework. A wide variety of different ECM solutions (e. g. OpenText; www.opentext.com or EMC2; www.emc.com) and mainly practical-oriented reports (e. g. Browning and Lowndes, 2001; www.aiim.org) can be found on the market. However, the challenge is to identify those systems and functionalities supporting a company's organizational situation best, on both the content level and the process level. In order to arrange the manifold of ECMS functionalities available and to provide a systematic overview, ECMS functionalities can be combined to ECMS services. Within our framework, we arranged ECMS services on the basis of functional decomposition diagrams. An exemplary functional decomposition diagram referring to our example is also displayed in Figure 4.

This diagram refers to the two functions *Capture Application Document* and *Capture Contract of Employment* of the introduced EPC. According to these functions, an exemplary ECMS service *Capture* may comprise three functionalities: the definition of *Meta*

Data, *Scanning*, and *Intelligent Character Recognition (ICR)* respectively *Optical Character Recognition (OCR)*. The definition of *Meta Data* is an essential functionality allowing for searching or archiving nearly all types of content assets and may be applied automatically or manually. In contrast, the functionalities *Scanning* and *ICR/OCR* are not necessarily required for the management of all content assets (as symbolized by their dark color). Referring to our example, this is determined by the media and the structure of the two content assets (as organizational requirements). As the application document is already submitted digitally (media), it does not need to be scanned (in contrast to the contract). Furthermore, ICR/OCR may serve as a means for automatically defining meta data for the contract (as the contract is highly structured compared to the application document). Concluding, phase III refers to the identification of ECMS functionalities (and systems) (not) being required for managing a company's organizational content situation.

Phase IV of the ECM framework refers to the adaptation of ECM reference processes and therewith to the specification of ECMS. Within our project work, we are currently developing such reference processes that describe how to capture, manage or archive content, for example. Therewith, phase IV corresponds to the process development view of the ECM research framework. However, as content management is a highly specific task, the reference processes have to be customized concerning an organization's individual content situation. For that purpose, design principles of reference modeling, for example, configuration (Becker et al., 2004), specialization, instantiation, aggregation, or analogy may be used (vom Brocke, 2007).

A reference process applicable for our example is displayed in Figure 5. It represents a guideline on how to implement content capturing and corresponds to the ECMS functionalities that have been specified within phase III: The functionality *Scanning* refers to the EPC function *Scan Content Asset*. In spite of that, the (automatic or manual) definition of meta data corresponds to the same named functionality and ICR/OCR (as symbolized by the shaded fields).

The reference process is implicitly adapted by means of configurative reference modeling (Rosemann and van der Aalst, 2003). Attribute values that have been specified within phase II are used as configuration parameters: Within the example, the attribute *Media* particularly determines whether or not functions, referring to the automatic definition of meta data or scanning of the content assets, are required for capturing. Accordingly, the shaded areas within Figure 5 depict that ICR/OCR and scanning are not necessary for the application document.

Finally, within phase V of the framework, the reference processes are embedded into an organization's business process structure. Hence, this phase refers to business process re-engineering and the process deployment perspective of the ECM research framework. In Figure 5, phase V is demonstrated in more detail as to the refinement of the function *Capture Contract of Employment*.

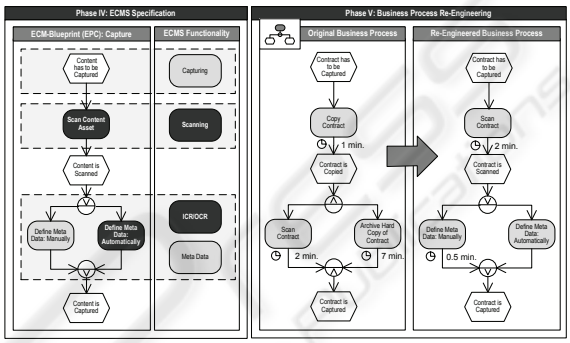

Figure 5: Exemplary application (II).

The support process displayed in the figure shows that the function *Copy Contract* takes 1 minute on average, whereas the average lead time of scanning the contract is 2 minutes. Archiving of the copy takes a further 7 minutes on average, as it has to be stored both physically and digitally. Hence, this function especially shows high optimization potentials through business process re-engineering.

Within the re-designed process—containing the ECM reference process—the personnel administration no longer has to archive the contract manually, but only needs to scan it and to manually apply suitable meta data (further information may be gained automatically by ICR/OCR, cf. above). The average lead time of the re-engineered business process counts for only 2.5 minutes. Taking into account these time savings and the average application frequency of each function, personnel cost reductions can directly be estimated. Summing up the cost reductions for all re-engineered business processes may serve as a means for comparing the benefits of ECM adoption and its implementation costs (e. g. investment or maintenance costs).

6 SUMMARY AND OUTLOOK

With this paper, we introduced a framework for ECM adoption and business process re-engineering.

Therewith, we intend to contribute to a newly emerging field in IS research. On basis of a literature review, we pointed out that methodical support for specifying and analyzing ECMS—especially with regard to business processes—has received far too little attention within the related research communities. Hence, our framework for ECM adoption is primarily based on ECMS analysis and specification, by particularly taking business processes into account. A theoretical background for our approach was given by presenting an established framework for ECM research. The four research perspectives of the framework (content, processes, technology, and enterprise) implicitly structure our implementation framework. Finally, we presented first application results that have been taken from a real life business project. The exemplary application shows that our framework may serve as a means for analyzing content-related as well as organizational requirements in order to support content management best by making use of the most appropriate ECMS.

The framework will be applied to additional industry projects. Therewith, we intend to further elaborate it and to gain a deeper insight into its applicability and profitability. Currently, we are working on the development of further reference processes for ECM, a framework for digital content analysis, and a modeling technique for specifying an organization's individual content situation.

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