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Enterprise Content Management Systems as a Knowledge Infrastructure:
The Knowledge-Based Content Management Framework

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ABSTRACT

The rise of the knowledge-based economy has significantly transformed the economies of developed countries from managed economies into entrepreneurial economies, which deal with knowledge as both input and output. Consequently, knowledge has become a key asset for organizations and knowledge management is one of the driving forces of business success. One of the most important challenges faced by enterprises today is to manage both knowledge assets and the e-collaboration process between knowledge workers. Critical business knowledge and information is often contained in mostly unstructured documents in content management systems. Therefore, content management based on knowledge perspectives is crucial for organizations, especially knowledge-intensive organizations. Enterprise Content Management has evolved as an integrated approach to managing documents and content on an enterprise-wide scale. This approach must be enhanced in order to build a robust foundation to support knowledge development and the collaboration process. This paper presents the KBCM (Knowledge-Based Content Management) framework for constructing a knowledge infrastructure based on the perspective of knowledge components that could help enterprises create more business value by classifying content formally and enabling its transformation into valuable knowledge assets.

Keywords: *Design Science Research, Enterprise Content Management, Information Management, Knowledge Management, Knowledge-Based Content Management Framework*

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INTRODUCTION

The rise of a knowledge-based economy has significantly transformed the economies of developed countries from managed economies into entrepreneurial economies that rely heavily on the production, distribution, and use of knowledge (Beijerse, 1999). Knowledge thus becomes an asset of the organization and knowledge management (KM) becomes a critical factor in the success of a business. Organizational knowledge that is created and held by individuals is integrated within an organization through collaboration (Grant, 1996). E-collaboration is defined as the collaboration among individuals engaged in a common task using electronic technologies (Kock, 2005). With e-collaboration, a change-oriented capability, companies are able to identify, integrate, and apply their knowledge assets in order to meet competitive demands (Fink, 2007). Recent studies show that e-collaboration technologies directly influence innovation (Fedorowicz et al., 2008; Meroño-Cerdán et al., 2008). Especially in knowledge-intensive enterprises, information is a driver of business in general and innovation in particular. Companies want to make use of business-critical knowledge and information, which is existent and used in collaboration processes, that is contained in mostly unstructured documents. This enterprise content is often scattered across several repositories and systems and makes up 80% of a company's total data (O'Callaghan & Smits, 2005). Huge amounts of content are produced every year and this content needs to be captured, managed, stored, preserved, and delivered efficiently on an enterprise-wide scale (AIIM, 2014). However, content is not just a means to an end; it could help enterprises to create more business value since it contains useful information.

To manage content on an enterprise-wide scale, Enterprise Content Management (ECM) has evolved as an integrated approach to Information Management (IM) (Päivärinta & Munkvold, 2005). More and more companies adopt commercial ECM solutions that are becoming more developed and sophisticated. While ECM received a lot of attention from practitioners (Wiltzius et al., 2011), it has been neglected by academic research (Rickenberg et al., 2012a). Since ECM is still an emerging field in Information Systems (IS) research, more research needs to be conducted in order to add more value to this approach (Wiltzius et al., 2011). While there is little literature about the reconciliation of ECM and KM, integration of the two areas is crucial, especially for knowledge-intensive organizations. Effective knowledge flows and KM can drive innovation; therefore, managing knowledge inside ECM systems, both within and among enterprises, has become vital. Accordingly, this paper seeks to answer the following research question:

How can enterprise content management systems be enhanced to implement a knowledge infrastructure in knowledge-intensive organizations?

In order to respond to this question, this paper presents a Knowledge-Based Content Management (KBCM) framework that proposes a new facet for ECM systems to support knowledge development and the collaboration process. One of our previous papers, which was presented at the HICSS'14 conference, proposed a knowledge-based framework for ECM. This paper extends and formalizes this framework in order to transform ECM systems into a knowledge infrastructure. Enterprises can use the framework to classify content formally and to transform it first into information assets and then into organizational knowledge. Following the guidelines of design science research (Hevner et al., 2004), the next section of this paper presents a literature review and the research design. Next, the KBCM framework for enhancing ECM systems to implement a knowledge infrastructure based on knowledge components is presented. Within a real-world example, the applicability of the framework is then checked and demonstrated. After a discussion on limitations and implications, the paper ends with conclusions and outlook.

REVIEW OF THE LITERATURE

The real value of organizations today is more dependent on ideas, insights, and information. According to Landry et al. (2006), knowledge is the result of a series of three successive transformations: i) from reality to data, to capture and store discrete facts about reality; ii) from data to information, to process and organize data in order to create useful business information; and iii) from information to knowledge, to interpret information in order to derive an action. This section explains the key ECM aspects related to these transformations, outlines the general relationship and interaction between ECM, IM, and KM, and reveals the research gap that the paper is addressing.

The theoretical foundation of our research is based on elements gathered from the resource-based view and the knowledge-based view. The resource-based view (Barney, 1991) states that resources, such as knowledge, can lead to the creation of competitive advantage. The knowledge-based view (Grant, 1996) builds upon and extends the resource-based view and emphasizes the importance of knowledge as a strategically significant resource toward achieving a competitive advantage. As KM involves the learning process of individual and collective members of an organization or of a network of organizations (Nonaka et al., 2005), it needs to promote intellectual capital, which refers to the knowledge and knowledge processes of a social entity (Subramaniam & Youndt, 2005). Knowledge is integrated into an organization through the coordination mechanisms based on organizational practices and on the collaboration process (Grant, 1996). In the Internet age, e-collaboration is one solution for obtaining strategic value of organizational knowledge, especially for supporting group coordination mechanism (Fink, 2007). E-collaboration facilitates the transformation from tacit knowledge into explicit knowledge and vice versa (Nonaka & Takeuchi, 1995). Tacit knowledge is an unspoken, unwritten knowledge residing in an individual's intellectual competencies, while explicit knowledge is a documented and formalized knowledge in ECM systems. A new facet of ECM systems will need to support different knowledge conversion activities to transform knowledge from one form to another, such as combination, internalization, externalization, and socialization (Nonaka & Takeuchi, 1995). This is especially important for knowledge-intensive organizations which, as opposed to labor-intensive or capital-intensive organizations, supply the market with the use of fairly sophisticated knowledge or knowledge-based products and services (OCDE, 2007).

While IM and KM are well-studied topics in IS literature, ECM has received little attention from scholars yet (Vom Brocke et al., 2008) and limited academic research has been conducted. Concerning the importance of ECM for IS research, Tyrväinen et al. (2006) emphasized that ECM represents an important and complex subfield of Information Systems. Since the introduction of the concept around the turn of the millennium, what lies beneath ECM has not been perfectly clear (Smith & McKeen, 2003). From a practical point of view, ECM is defined as strategies, methods, and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes (AIIM, 2014). From an academic viewpoint, ECM can be summed up as an integrated approach to IM (Päivärinta & Munkvold, 2005).

As a multifaceted topic, ECM emerged from several related preceding approaches and disciplines. While in the past, several concepts simultaneously coexisted within the company's IS infrastructure, ECM integrates these concepts on an enterprise-wide scale and helps eliminate content silos. Web content, documents, records, and digital asset management can be consolidated into a homogeneous ECM architecture (AIIM, 2014). However, ECM providers largely focused on the technology perspective, which addressed technological issues, rather than the content perspective or organizational context of technology utilization (Tyrväinen et al., 2006). Within ECM literature, there are some efforts being made to add value to ECM systems by integrating enterprise content into information

or process management. For example, there is a paper that aims at applying a business process perspective to ECM and to study experiences with these initiatives (Vom Brocke et al., 2008). There is also an ontology approach that supports collaborative work in the different domains (Elgh & Sunnersjo, 2007). Another perspective considers enterprise aspects, such as organizational, social and business issues, within the context of content management (Tyrväinen & Päivärinta, 1999).

All three approaches (enterprise content, information, and knowledge management) deal with the management of mostly intangible textual items and assets on different levels of abstraction and value. ECM, IM, and KM overlap because all three approaches focus on data and information. Particularly, ECM focuses on enterprise content, a typical type of mostly unstructured data. IM focuses on information that is inferred from data that can be found in ECM, as well as from other enterprise systems. KM focuses on the transformation of information into organizational knowledge. In this context, ECM approaches still focus on IM on a somewhat technological level.

Nowadays, the boom of content in companies and in networks (e.g., big data) poses a challenge of business decision-making that requires the right information at the right time (Hayes-Roth, 2005), while the lack of capacity of effective KM in ECM systems in general is still an important issue for companies. They need to know where information and valuable knowledge is located in order to make use of it efficiently. Content needs to be assessed in a structured way, classified, and finally transformed into organizational knowledge. Therefore, the reconciliation of KM and ECM is vitally important to improve decision-making, promoting knowledge development and e-collaboration. However, little research has been conducted in this direction, especially concerning a theoretical foundation for content classification based on organizational knowledge (Rickenberg et al., 2012b). While the top-down vision for ECM initiatives includes better use of valuable information, improvement of decision-making, and creation of competitive advantage, most ECM initiatives take a bottom-up approach that focuses on delivering immediate benefits such as enterprise portals, information sharing, and web content management (Smith & McKeen, 2003). Accordingly, this issue must be addressed by developing a knowledge-based framework for enhancing ECM systems to implement a knowledge infrastructure based on the perspective of knowledge components.

RESEARCH DESIGN

This paper presents the KBCM framework, which proposes a new facet for ECM architecture to support knowledge development and the collaboration process. The underlying research design consists of two phases: i) the construction of the research artefacts and ii) a subsequent evaluation and applicability check of these artefacts.

Within the first phase, the actual construction of the artefacts was the focal point. To ensure rigor within the research process, relevant thematic and methodological literature was reviewed. ECM literature has set the theoretical basis for the management of content like granular data, documents, and information. Building upon this basis, we drew upon KM literature in order to provide a conceptual foundation for the management of knowledge assets and organizational knowledge. Concerning the research process and methodology, we chose the design science research (DSR) approach to explore our research question. DSR is particularly useful for creating and evaluating IT-related artefacts that intend to solve identified organizational problems (Hevner et al., 2004). Key recommendations (March & Smith, 1995) and guidelines (Hevner et al., 2004) for this research method were used in this context for determining our artefacts. As part of a rapid interaction of building and evaluating cycles, we constructed and refined our artefacts cyclically and created the KBCM framework. The framework consists of several categories of artefacts, including a set of constructs, a model, a method, and a set

of instantiations (March & Smith, 1995). The constructs are different types of concepts related to content and knowledge produced and used in ECM systems. The model is a set of statements expressing the relationships between content and knowledge concepts. The method is a set of activities that support the process of content management and knowledge development. The instantiations are best practices related to the operationalization of the framework.

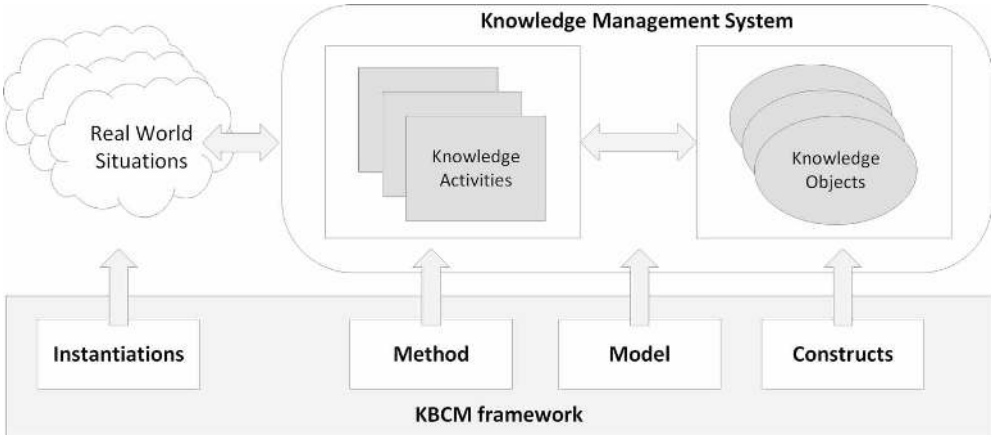
The second phase of our research design was the evaluation of the artefacts. To examine the static qualities of the artefacts and to build arguments to describe their utility, we used the analytical and descriptive evaluation methods (Hevner et al., 2004). Using the analytical method, we examined the structure of the artefacts to identify static qualities and explained how the proposed artefacts could be used. We also used an architecture analysis to study how the artefacts could be integrated into an IS architecture, e.g., with an open-source ECM system. Using the descriptive method, we built detailed scenarios around the artefacts to demonstrate their utility. Therefore, an illustrative but realistic example was constructed and evaluated. After this primary evaluation, we checked the practical applicability of our research artefacts. To do so, we used the widely recommended applicability check designed by Rosemann and Vessey (2008) as the underlying method. An IT service company in Vietnam served as a case company for the phase of empirical investigation. As a provider of outsourcing services for foreign customers, the company makes use of two general types of knowledge-intensive services: business and IT services. The empirical investigation was conducted in two sub-phases. The first sub-phase identified knowledge gaps, while the second sub-phase suggested ECM-based solutions to fill these gaps. Two focus groups of five and six members respectively were established. They included researchers, IT professionals, and managers. One of the authors of this paper served as moderator for the two groups. Interviews and surveys were used during the first sub-phase, which took place in 2012. During the second sub-phase in 2013, interviews were used to confirm the key constructs and the semantic contexts, and also to determine the required information products. The focus groups were interested in how knowledge needs were identified, how knowledge gaps were determined, and how the constructs, model and method were established. All those involved in these two cases (including researchers, managers, project leaders, and business customers) were interviewed at least twice during the process. Each interview was between 30 and 45 minutes long. After all the empirical data was gathered, an aggregated overall analysis of the sources concluded the phase.

KNOWLEDGE-BASED CONTENT MANAGEMENT FRAMEWORK

Knowledge management can be defined as the "KM is the art of performing knowledge actions such as organizing, blocking, filtering, storing, gathering, sharing, disseminating, and using knowledge objects such as data, information, experiences, evaluations, insights, wisdom, and initiatives" (Sivan, 2000, p.6). To this end, the artefacts proposed by the KBCM framework include a set of constructs, a model, a method, and a set of instantiations (Vaishnavi & Kuechler, 2011), which will be presented later in this section. In general, the framework covers two facets: the traditional IM facet and a new KM facet. Some concepts of the KBCM framework were extended based on industrial standards for ECM architecture such as OASIS DITA (Harrison, 2005) and TOGAF (Haren, 2011) in order to support the IM facet. Other concepts were adapted from Le Dinh et al. (2013) to support the perspective of knowledge components for KM in ECM systems.

As presented in Figure 1, the constructs represent the knowledge objects; the method represents the knowledge activities; the model represents the relationship between the constructs and the method, and finally; the instantiations represent the lessons learned

Figure 1. Components of the KBCM framework



and extracted from a real-world application of the framework.

Constructs of the KBCM Framework

The constructs of the KBCM framework are different types of concepts that represent knowledge objects that are related to IM and KM facets. In our approach, a knowledge object (KO) is a highly structured interrelated set of data, information, knowledge, and wisdom concerning an organizational situation (Bellenger, 2004). In order to provide a viable approach for dealing with this situation, each knowledge object has its own goal and a set of interrelated content objects as supporting material. Depending on organizational strategies of innovation, knowledge objects could be a product, a process, or a market. According to the literature, the objective of ECM systems is to support and manage content objects that can be assembled into different information products of knowledge objects (Harrison, 2005; Haren, 2011).

The content of business objects that resides in ECM systems can be addressed from different points of view: the information view, the user view, and the system view (Tyrväinen et al., 2006). These perspectives can be defined as follows: i) the information view uses content semantics to promote the transformation from data into information; ii) the user view focuses on the interaction between the user and the system to promote the transformation from information into knowledge, including the creation, use, and management of content; and iii) the system view provides the container in which content resides to promote the transformation from knowledge into understanding within the organization. In addition, the KBCM framework suggests a new point of view: the network view, which represents a way of collaborating in a network to promote the transformation from knowledge into understanding between organizations. We use the term *understanding* instead of *wisdom* (Rowley, 2007) because our research focuses on the first level of knowledge: understanding. In summary, the information view gathers content objects (data) of knowledge objects, the user view connects content objects (information) of a knowledge object, the system view forms a knowledge object as a whole (knowledge), and the network view forms a network of knowledge objects by joining wholes (understanding). In the following part of this paper, the constructs of the framework are presented according to these views of the content:

Information View

The information view deals with the semantics of the content of a knowledge object and covers three aspects of informa-

tion: the static, the dynamic and the rule aspects (Le Dinh, 2006). The static aspect of information concerns the structure of information, meanwhile the dynamic aspect of information focuses on the transition of information. The rule aspect is on the meta-level of the two previous concepts that concerns the coherence of information structure and information processing (Le Dinh et al., 2013).

Accordingly, the following constructs are related to the information view: *content object*, *knowledge component*, *know-what*, *know-how*, and *know-why*. Information resources are created by authors and are stored as content objects in ECM systems that can be classified according to their corresponding knowledge components.

A knowledge component is defined as a form of knowledge (Garud, 1997), including:

- Know-what is often generated through "learning-by-using" and describes knowledge artefacts that are known and related to a phenomenon of interest (Garud, 1997). In an organization or in a social network, know-what often refers to products, services, and other organizational properties;
- Know-how is generated through "learning-by-doing" and describes the understanding of the generative processes constituting phenomena (Garud, 1997). Know-how knowledge components in ECM systems are usually related to business processes that are performed to achieve organizational goals;
- Know-why is obtained through "learning-by-studying" and describes the understanding of principles of the underlying phenomena (Garud, 1997). In ECM systems, a know-why knowledge component often refers to business rules that are put in place to help an enterprise achieve its business goals and comply with laws and regulations. Rules can apply to subsets of constructs related to know-what or know-how.

User View

The user view aims at supporting the interaction between the user and the knowledge object. The constructs related to the user view are: *know-who*, *semantic unit of information*, and *zone of responsibilities* (ZoR).

Know-who refers to individuals, groups, or organizations that may provide or consult the content objects within a knowledge object (Le Dinh et al., 2013). A semantic unit of information depicts a semantic context corresponding to a particular situation of an application of knowledge. A semantic unit of information is defined as a coherent representation of the whole structure, transition, and coherence of information. In other words, a semantic unit of information includes a set of interconnected know-what, a set of know-how that uses methods belonging to these know-what, and a set of rules whose scope is defined within these know-what and know-how. Each know-who may assure a zone of responsibilities (ZoR) that determines the relationships between know-who and other knowledge components. For instance, a ZoR may determine who-know-what, who-know-how and who-know-why.

System View

The system view deals with the containers in which content objects reside. The constructs related to the system view are: *information product*, *know-where* and *know-when*.

An information product assembles different content objects to be delivered to target audiences (O'Callaghan & Smits, 2005). For example, reports, brochures, press releases and presentations are popular information products found in business. In order to identify and locate information products throughout an organization, information about how an enterprise organizes and handles its content is needed, and this information is represented by know-where and know-when knowledge components. Know-where indicates the information product's locations in various systems

and networks. Know-when indicates the right time for finding an information product. Know-where and know-when help people find the right information in the right place at the right time.

Network View

The network view concerns the way an organization and its partners collaborate in a network via their knowledge objects. The constructs related to the network view are: *know-with*, *shared object*, *coordination situation*, and *coordination protocol*.

Know-with is knowledge about the way of collaboration with partners in a network environment. Know-with is defined based on a shared object, an overlap situation, and an overlap protocol. A shared object is an information product of a knowledge object that is intended to be shared between members of a network. In the context of knowledge sharing across professional and organizational boundaries, shared objects are indeed boundary objects, which are defined as artefacts that link different sets of various interests (Carlile, 2002). A coordination situation occurs when there is at least one shared object that is common to different zones of responsibilities (Le Dinh et al., 2013). A coordination protocol can be used to handle coordination situations. Depending on the characteristics of shared objects and the complexity of coordination situations, there are three coordination protocols (Carlile, 2002): i) syntactic coordination including the activity of representing, ii) semantic coordination including the activities of representing and learning, and iii) pragmatic coordination including the activities of representing, learning, and transforming.

Model of the KBCM Framework

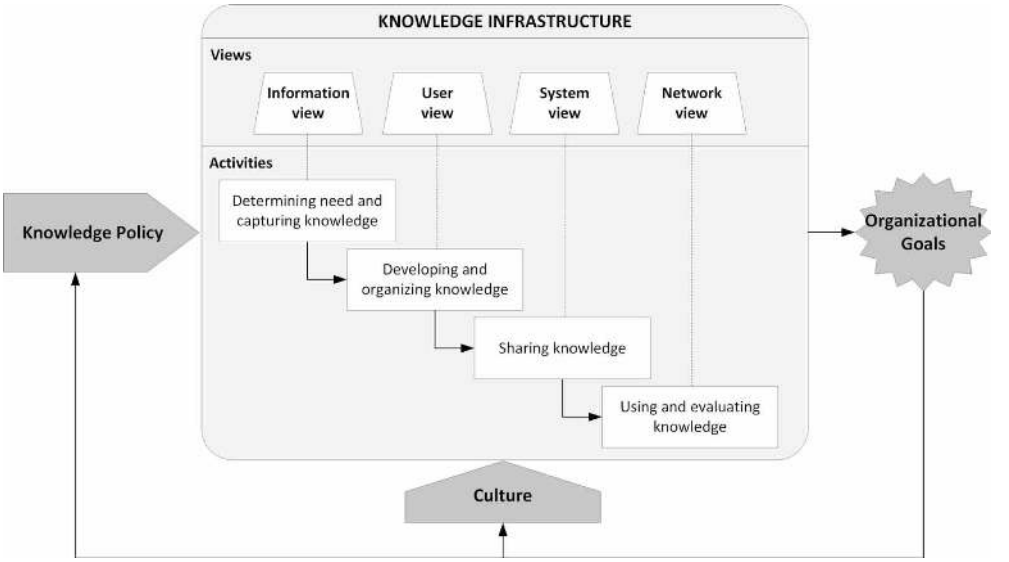
The objective of the KBCM framework model is to express the relationship between knowledge activities and knowledge objects of the knowledge infrastructure, as well as the relationship between the concepts related to the IM and the KM facets of ECM systems.

In our approach, we consider that the new KM facet of ECM systems needs to take into account the duality of knowledge in order to enhance from IM to KM (Kimble, 2002). Indeed, recent research shows that certain knowledge cannot easily be captured. Therefore, KM must provide a knowledge infrastructure that supports already captured knowledge, as well as new knowledge that is created through interaction between people, as well as between people and KM systems.

The concept of ZoR in our approach represents the context of knowledge creation, which provides a basis for interpreting and transforming information into knowledge. Each ZoR corresponds to a virtual and/or a real-world environment for knowledge creation at a specific time and space. The concept of ZoR is somewhat similar to the concepts of "ba" (Nonaka et al., 2005) and "community of practice" (Kimble, 2002). The main difference between ZoR and other approaches is that ZoR corresponds to an integrated living and virtual space, while its boundary is evolutionary, and is defined by a set of responsibilities, classes, processes, and rules (Le Dinh et al., 2013).

Figure 2 presents a knowledge infrastructure that enables an organization to learn in a natural and optimal way in order to reach its goals. The knowledge infrastructure is being fed by the knowledge policy and the culture (Beijerse, 1999). The knowledge policy determines *what* will be learned, *where and when* it will take place, and *who* will learn. The culture of the organization determines the answers to the above questions and also *how* learning will take place. Inside the knowledge infrastructure, there are different views of knowledge objects and knowledge activities. The information view corresponds to the activity of determining the knowledge gap and capturing required knowledge objects inside ECM systems. The user view provides knowledge objects for the activity of developing and organizing knowledge. Finally, the system view concerns the activity of sharing knowledge within the organization, and the network view concerns the activity of

Figure 2. The knowledge infrastructure



using and evaluating knowledge within and between organizations.

Figure 3 presents the KBCM framework model using simplified Unified Modeling Language (UML) notation (Rumbaugh et al., 1999). Basic ideas and concepts of this meta-model are built on Le Dinh et al. (2013) and were further enhanced for our purposes. The framework is arranged and presented according to different knowledge activities later in the paper.

Capturing Knowledge

In an ECM system, an information product contains a subset of content objects within a knowledge object. Each content object relates to one or more knowledge components. As stated before, there are three types of knowledge components: know-what, know-how and know-why.

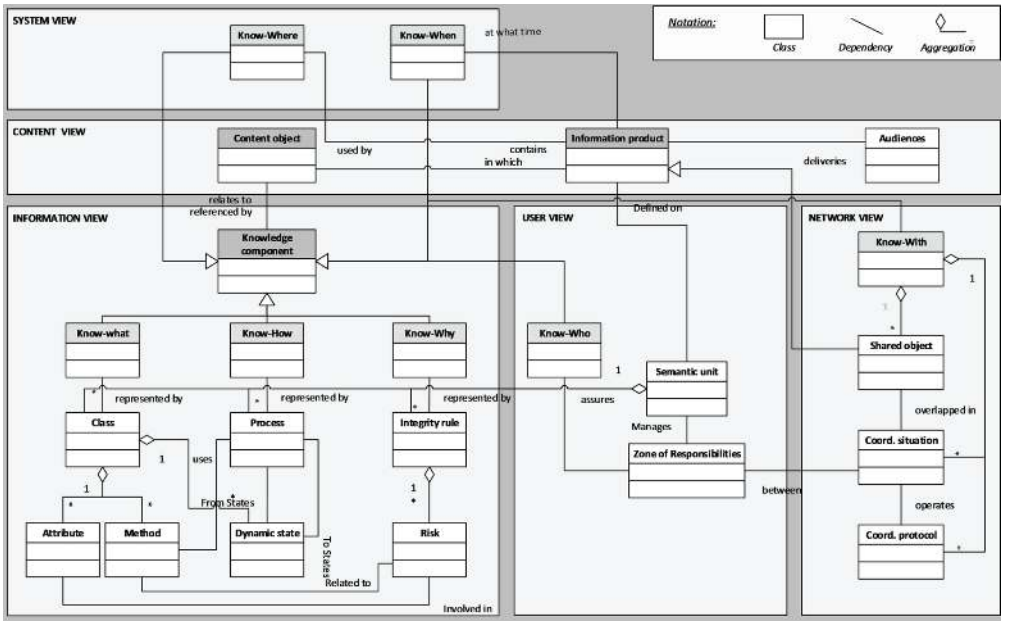
A know-what deals with the structure of information that is represented by a class. A class has certain attributes, methods, and dynamic states (Le Dinh, 2006). Dynamic states of the class depict the levels of achievement of the associated work package. Methods are often used to transition from one level to another level of achievement. A know-how concerns the transition of information that is represented by a process. A process in turn invokes a set of methods and changes a set of dynamic states of classes. Finally, know-why concerns the coherence of information that is represented by an integrity rule, which manages a set of risks. Each risk is related to certain methods and is involved in some attributes of classes.

Organizing Knowledge

An information product is created based on a semantic unit of information of a knowledge object. A semantic unit of information depicts a context of knowledge application in a specific situation.

A semantic unit of information includes a set of processes that use methods belonging to these classes, a set of interconnected classes, and a set of rules whose risks are defined within the classes. A ZoR is a part of an organization that assumes responsibility for information inside a semantic unit. The know-who is a knowledge component that refers to either groups or individuals who assume a ZoR.

Figure 3. The model of the KBCM framework



Sharing Knowledge

At this level, there are two new knowledge components: know-where and know-when. Each information product is organized and used based on its relevant know-where and know-when knowledge components. Know-where is the knowledge for navigating and finding the right information product. Know-when is knowledge about the timing of events related to information products.

Using Knowledge

Know-with is a knowledge component that represents the way collaboration occurs among members of a network. A know-with is defined by a shared object, an overlap situation representing the information dependencies between ZoRs, and an overlap protocol that operates the overlap situation. An information product assembled by several shared objects can use different delivery methods to reach its audiences.

Method of the KBCM Framework

The method of the KBCM concerns activities related to the knowledge value chain that supports the objectives of e-collaboration, such as coordination, learning, and innovation (Fink, 2007). First, depending on the organization's goals, strategic knowledge needs are determined and knowledge gaps narrowed down by developing, buying, or improving knowledge. Second, available knowledge is organized according to different ZoRs to serve knowledge workers. Finally, organized knowledge is shared, used, and evaluated within and among organizations, taking different coordination protocols such as syntactic coordination, semantic coordination, and pragmatic coordination into account. Each activity in the knowledge value chain accesses and produces different content objects of knowledge objects.

Accordingly, the method of the KBCM framework focuses on the set of activities that supports both the process of content manage-

ment (Gupta et al., 2002) and that of knowledge development (Le Dinh et al., 2013). The process of content management includes the following key activities: assessment, organization, sharing, and use (Gupta et al., 2002). Meanwhile, the process of knowledge development includes knowledge creation, knowledge organization, knowledge transfer, and knowledge application activities (Le Dinh et al., 2013). Since our objective is to propose a new facet for ECM systems, we adopted the process of content management into our framework method and integrated it with the process of knowledge development (Figure 4).

This approach focuses on enterprise content, a typical type of mostly unstructured data. Information is data that is processed so that it becomes useful and that provides answers to what, who, when, and where questions. Knowledge is the application of data and information and provides answers to how questions. Understanding is an acquaintance, which can be evaluated based on KM metrics, and provides answers to why questions.

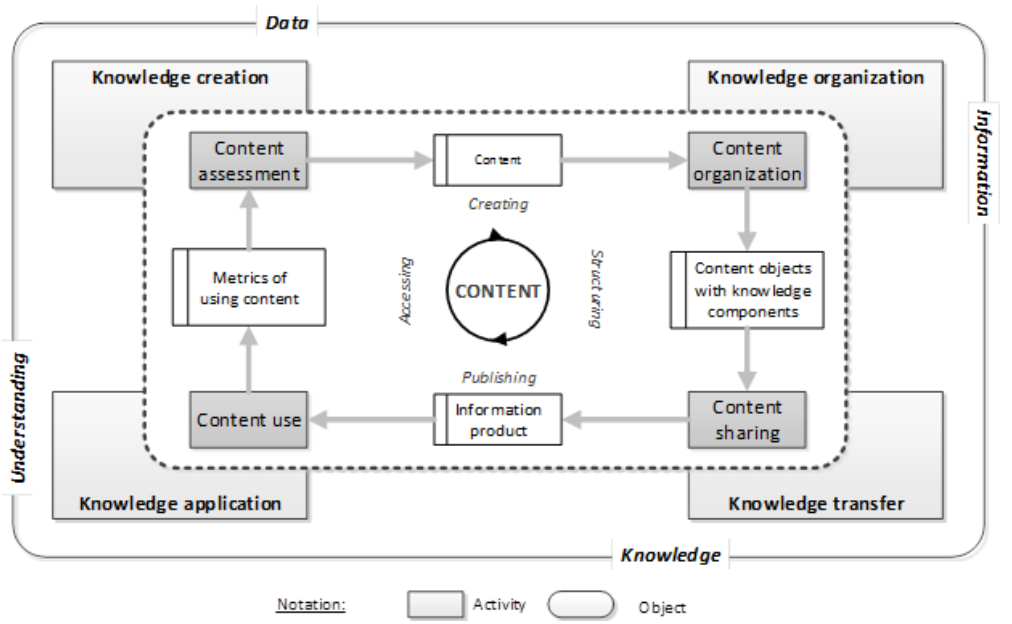
Content Assessment

The objective of the content assessment activity is to develop new content or to improve existing content within the organization's body of knowledge. This activity creates or acquires valuable content from different sources inside and outside ECM systems. Content from outside of ECM systems is transferred into ECM systems so that it can be reorganized.

Content Organization

The content organization activity gathers enterprise content in order to transform them into useful information. This activity structures content by editing and transferring it into content objects and adding semantics by means of metadata about relevant knowledge components (know-what, know-how and know-why). Content objects are organized according to their semantics (semantic unit of information) and corresponding sources (i.e., ZoR).

Figure 4. Activities in the method of the KBCM framework



Content Sharing

The content sharing activity occurs at different levels: individual, organizational, and social levels. This activity extracts content objects from ECM systems, assembles them into information products, and transforms those products into targeted publications using different delivery methods (web site, email, digital documents, etc.). Information products could be shared within and among ZoRs. Knowledge components related to information products, such as know-where and know-when, also need to be indicated in order to identify and locate those information products in ECM systems. Information products then become organizational knowledge, which enables organizational learning and promotes the development of intellectual capital (Nemetz, 2006).

Content Use

The objective of the content use activity is to apply organizational knowledge to a special use or purpose. This activity identifies how collaboration occurs with regard to business content within and among organizations. It determines what content needs to be shared (shared objects), the business context or situation (coordination situation), the involved audiences (know-with) and the way of working (coordination protocol). In order to transform knowledge into understanding, it is important to consider primary mechanisms for knowledge application such as directives, organizational routines, and self-contained task teams (Le Dinh et al., 2013).

REAL-WORLD EXAMPLE AND APPLICABILITY CHECK

To evaluate the KBCM framework as part of an applicability check, we used an IT service company as the case company (hereafter called the ITS company) for the design and testing of ECM-based KM solutions. In this way, we were able to demonstrate and evaluate how the framework could be used to analyze ECM and KM activities in the enterprise and to create improvements based on identified deficiencies.

The objective of the example is to propose a framework for building a knowledge infrastructure based on ECM systems for the ITS company, hereafter called the ITS framework. Since the business priority of this company is to provide better customized IT outsourcing services, it focuses on managing knowledge about its services, service processes, and business environment. Therefore, there are three types of knowledge objects in the company's knowledge management solution: *Project*, *Core competence* and *Customer*. Since each service provided is indeed a project, the company is a project-based organization. Managing knowledge related to projects helps the company to improve the quality of its services. In addition, the company itself is an SME (small and medium-sized enterprise); therefore, it is always challenged with providing training and skills development. Managing knowledge related to core competences helps the company perform skill-gap analysis and succession planning when an employee quits, to create and manage a sustainable learning environment for employees, and to track the learning process. Finally, working with foreign partners is a real challenge for an SME in a developing country; therefore, managing knowledge related to customers and their business environment helps the company to improve customer satisfaction and to increase market share.

Our example focuses on the management of knowledge related to projects, represented by *Project* KO, one of the top business priorities of the company for the time being. As a matter of fact, some key customers require the company to improve its project management (PM) practice by using the guidelines proposed in PMBoK (2013).

The framework created within the case company, including the constructs, the model, and the method, are described in the following.

Constructs of the ITS Framework

In order to become a highly project-oriented organization, the ITS company is currently working toward the Level 3 of the Project Management Maturity Model, whose focus is the management of formal PM data, the definition of formal PM processes, and the identification of formal PM problems [PMBoK, 2013]. Consequently, the company is concentrating on the following PM knowledge areas: project scope, project time, project cost, project risk and project human resource management.

At the beginning, the company needs to determine the key knowledge components that help it in achieving its business priorities, their corresponding artefacts, and the methods and tools for specifying those knowledge components and their artefacts. Table 1 presents the key knowledge components of the proposed framework for the ITS company that aims at capturing and managing knowledge about project deliverables as know-what, project, project activities as know-how, project risks as know-why and project roles as know-who.

Information View

The information view concerns the adaptation of the constructs to related static, dynamic, and rule aspects of knowledge according to the organizational structure and specific requirements of the company. Each construct can be modified or evolved into a subset of constructs to represent correspondingly the knowledge structure.

In a project-based organization, know-how may correspond to the procedural knowledge exercised in the performance of a project activity. For instance, a know-why may be associates with the priority of the project priority matrix, which describes the relative importance of criteria related to cost, time, and performance parameters. A rule is defined and enforced to ensure that priority.

Table 2 presents the proposed constructs for the ITS company. The class construct was developed to meet the specific requirements of a project-oriented SME. A class is now associated with a subset of project deliverables, sub-deliverables and work packages. A project deliverable might be composed of a set of sub-deliverables. A sub-deliverable then can be composed of a set of work packages that can be assigned to a specific role for execution. In the same way, a risk is associated with a structure including a risk handling, a response strategy and a risk action (Tah & Carr, 2000).

User View

In a project-based organization such as the ITS company, a ZoR can be associated with a working space of a project team. This ZoR is defined by a set of responsibilities assumed by the project team according to the organization-breakdown structure, by a set of classes representing the deliverables defined in the work-breakdown structure, by a set of activities and their interdependences as specified in the project network, and by a set of risk controls corresponding

Table 1. Key knowledge components of the ITS framework

Knowledge Component	Artefacts	PM Knowledge Areas	PM Tools
Know-what	Project deliverables	Project Scope Management	Work Breakdown Structure (WBS)
Know-how	Project activities	Project Time and Cost Management	Network diagram and Earned Value Management System
Know-why	Project risks	Project Risk Management	Risk Breakdown Structure (RBS)
Know-who	Project roles	Project Human Resource Management	Organization Breakdown Structure (OBS)

Table 2. Key constructs of the ITS framework

Knowledge Component	Generic Construct	Proposed Construct
Know-what	Class	Project deliverable, sub-deliverable and work package
	Attribute	Project property
	Method	Project task
Know-how	Process	Project activity
	Dynamic state	Project stage
Know-why	Integrity rule	Risk control
	Risk	Risk handling, risk response strategy and risk action
Know-who	Know-who	Project sponsor, project manager, team members and stakeholders
	Zone of responsibilities	Project team
	Semantic unit	Project portal

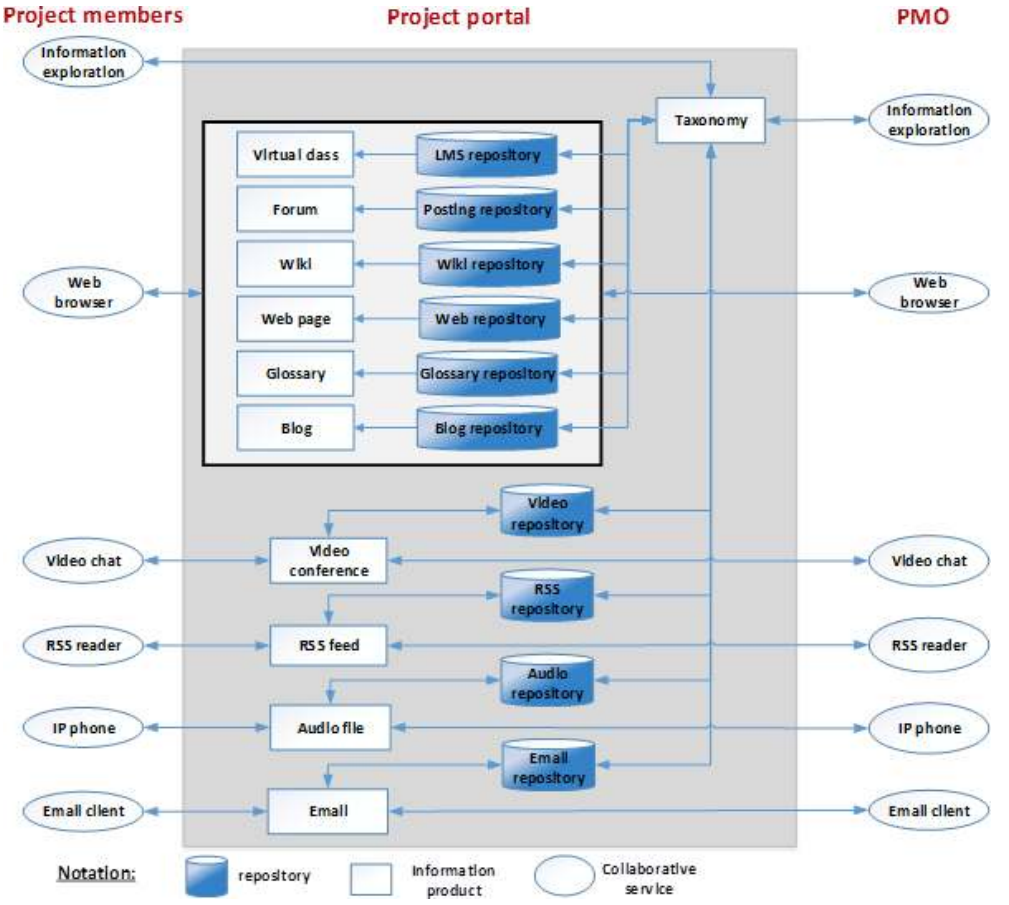
to the project definition and prioritization. In Table 2, the Know-who construct has been developed into a composition of different project roles, such as project sponsors, project managers, team members, and stakeholders. Stakeholders (such as customers, suppliers or partners), as guest users of the ECM system, are consulted about certain information products. Project members, as authorized users, work on information products. Project managers, as moderators, manage information products and related activities. Finally, project sponsors, as super users, can appoint moderators.

A semantic unit of information that corresponds to a specific project portal in the ECM system is defined for each project team. The project manager affected by this project plays the role of a moderator and manages the information products that belong to his or her ZoR.

System View

The ITS company chose a popular content management platform to carry out its knowledge management initiative (Devarakonda & Shanafield, 2011). This platform is an open-source solution that allows an organization to easily publish, manage, organize, and customize a wide variety of types of content. At the beginning, the company has chosen the following types of content: Web page, forum, wiki, glossary, email, IP phone, videoconference, virtual class, RSS feed, and blog (Figure 5). The database structure of the platform is extended so that each type of content has an additional attribute to indicate the corresponding knowledge components. At the time being, users can use the tag cloud or QBE query to explore contents according to knowledge components and their interrelations. Information products are built based on content objects of one or several types of content. For instance, the company generally uses the glossary function to represent the know-what, the web pages for the know-how, and the discussion forum for the know-why. Two information products relate to the glossary: an online version, and a paper version that is used to train new employees at the beginning of each year. There are three information products related to web pages: a web site of the enterprise, a web page on Facebook, and a web page on LinkedIn. There is also a special information product in form of wiki pages that summarize knowledge of what, how, and why. Concerning know-when and know-where, each page of the wiki has information about the date and the location of the latest update and the application scopes.

Figure 5. Excerpt of the ECM system for ITS company



Network View

There are three types of collaboration in the ECM system: collaboration within a project team, collaboration between project teams, and collaboration between the company and organizations. Based on the KM directives of the company and communication plan of projects, project managers decide what information products can become shared objects and what their target audiences are. Team members who are custodians of shared objects determine the access rights for those objects. For example, the wiki pages can be shared with clients, suppliers, and partners, who can visit these pages but cannot modify the content. The coordination protocol was based on the syntactic coordination.

Model of the ITS Framework

For the model of the KBCM framework, zones of responsibilities were considered to be virtual working spaces for projects since the IT services company was organized by projects. Accordingly, content objects were managed on three levels: individual, project, and organizational levels. Subsequently, the paper goes into detail about some exemplary instances of knowledge components that are captured and used inside the enterprise.

Knowledge Capturing

Certain instances of the know-what knowledge component are in glossary form. Those know-what components concern project deliverables such as a Gantt diagram, a PERT diagram, a status report, a project definition, and lessons learned. Each know-what has its own structure. For instance, the class representing the project definition includes the following attributes: project ID, project scope, project priorities, and WBS (work breakdown structure). Other instances of the know-how knowledge component are in the form of web pages about project activities such as project definition, project planning, project execution, and project closing. The process related to project defining uses the following methods of the project definition class: defining project scope, determining project priorities, defining WBS, integrating WBS into the organization diagram, and coding WBS (Gray & Larson, 2006). Finally, there are some instances of the know-why knowledge component that relate to legal obligations of IT when outsourcing projects. For example, there is a know-why related to the quality of projects that states, "the working hours of each member of projects should not be beyond the weekly maximum."

Knowledge Organizing, Sharing, and Using

Each project has its own semantic unit that covers all knowledge related to its project deliverables, processes, and rules. The manager of the project is responsible for all the information products related to his or her semantic unit. The wiki as an information product was created in order to share knowledge with and among members of projects. Project managers also use the wiki to share their knowledge with partners, clients, and suppliers. Some partners are able to consult the wiki pages and submit change requests.

Method and Instantiations of the ITS Framework

The method of the ITS framework allows ECM activities to be aligned with the process of knowledge development and collaboration of the company. In the following, some main functions of the KBCM-based system for the ITS company are illustrated.

Content Assessment

The company tried to capture and store important content related to daily activities such as email, shared documents, IP phone calls, instant messages, video conferences, and discussions. In addition, the PMO also uses certain awareness tools such as RSS or data mining to capture the current knowledge and information related to their services, technologies used, and the business environment.

Content Organization

The PMO suggests a taxonomy system, including vocabulary and terms. Vocabulary has been organized according to knowledge components such as know-what, know-how and know-why. Under a specific vocabulary, one can start adding some terms to break the content down into more specific classifications. For example, under know-what one might have Gantt diagram, Status report, PERT diagram, and so on.

Content Sharing

Each semantic unit has its own space for sharing and creating knowledge that can have functions such as blogs, discussion forums, events, work trackers, notifications, video conferences, and document collaboration and co-authoring.

Content Use

In relation to directives, wiki pages were built to help employees find knowledge based on types of knowledge components and semantic relations among them. With regard to organi-

zational routines, the workflow function was used to enable or disable specific subsets of knowledge related to certain activities of the project management process.

Concerning the instantiations, the company initially focused on best practices related to its core business for two types of projects: software development and BPO (business processing outsourcing). The company hired a KM advisor, who provided support to achieve the goals and follow the KM directives for those two types of projects. This person acted as a change agent to foster leadership and incite employees to implement and utilize functions of the knowledge infrastructure.

Evaluation

On the basis of the implementation discussed above, we checked to what extent the practical relevance and applicability of the KBCM framework can be assumed. Therefore, we used the three dimensions of the applicability check as proposed by Rosemann and Vessey (2008) during our empirical investigation. During the focus groups and the interviews, we showed and explained our artefacts, namely the KBCM framework, to the practitioners. With regard to importance, the participants mainly argued that the reconciliation of content, document, e-collaboration, and knowledge management is highly relevant for both the practical applications within the specific case company, but also in general. The participants argued that they are too often victims of information overload; thus it is not that there is too little content and information about a certain topic, but rather too much. Especially for knowledge-intensive services and content-intensive processes, the participants felt overwhelmed by the amount of data and information available. Our framework was considered a useful approach to assessing, classifying, organizing, sharing, and using content based on knowledge perspectives. In particular, the classifying and organizing abilities included in the framework and their combination with KM aspects were considered to be very important by the participants. Therefore, our artefacts address a problem that is important for practice and that can act as a basis for a possible solution.

The dimension of accessibility encompasses whether or not the presentation of the research artefact is understandable for practitioners and whether it focuses on results rather than on the research process (Rosemann & Vessey, 2008). The use of scientific terms or theoretical descriptions can be a barrier to accessibility. To create a better understanding of the KBCM framework, we used several clearly arranged and consistent figures and examples as mentioned above. Thus, we could make this rather complex topic more understandable, which helped to improve participants' understanding immensely. Participants were discussing where, how, and why the framework could be applied in the case company, rather than wondering about the meaning of the artefacts.

The third dimension of the applicability check encompasses whether the problem solving needs of the practice are met (Rosemann & Vessey, 2008). As stated above, the investigated area of combining ECM and KM was rated as being highly relevant by the participants. Due to the constant lack of time in practice and in the field, the participants stated that a pragmatic solution was required, especially at initial phases of the implementation, which can be fine-tuned afterwards. Our artefacts were rated as being suitable for this purpose. Initially, only dedicated parts of the enterprise (specific processes, departments, or branches) can be modeled, but they can be extended and integrated into an overarching system later.

Within this context and as an overall result of applicability check, we were able to show the applicability of the artefacts. Some limitations and recommendations were identified for practical application. The participants estimated that a high effort is needed to create an all-encompassing implementation of the framework. Further, the lack of a KM and ECM strategy within the company might prevent a successful implementation and adoption of the KBCM framework.

DISCUSSION

The KBCM framework proposes a new facet of KM for ECM systems based on the perspective of knowledge components. This perspective provides an environment conducive to different types of innovation in organizations. With regard to our research question about how ECM systems can become a knowledge infrastructure, our approach represents a starting point to reconciling ECM and KM, to effectively support e-collaboration process, and to generate additional value. We first tested the KBCM framework with analytical and descriptive evaluation methods (Hevner et al., 2004). Then we conducted an applicability check in which we were able to further evaluate and show the applicability and usefulness of the artefacts. The KBCM framework was able to help the case enterprises with the complex tasks of assessing, organizing, sharing, and using content based on knowledge perspectives.

To enable a holistic approach for the reconciliation of KM and ECM, our framework addresses KM in ECM systems in a coherent level and in a global manner. In the context of a business organization, knowledge can be classified according to its level: individual knowledge, organizational knowledge, and collective knowledge. Accordingly, KM approaches can manifest themselves as intellectual capital in the following forms – human, organizational, and social capital (Subramaniam & Youndt, 2005) – which cover the knowledge of individuals, of an organization, or of a network of organizations. In the KBCM framework, the different views of knowledge components represent the different types of knowledge in an organization. In contrast, other approaches have chosen the process-oriented perspective (e.g., Vom Brocke et al., 2008) that focuses mostly on the know-how knowledge component and could be well suitable for a type of innovation that is related to processes.

Innovations can be classified based on technological, market, and administrative characteristics (Afuah, 2003). We believe that those types of innovation require different types of knowledge used in organizations. For this reason, we adopted the perspective of knowledge components (Garud, 1997; Le Dinh et al., 2013), which covers different types of knowledge, such as know-what, know-how, know-who, know-why, know-when, know-what, and know-with. Depending on the context of application, each type of innovation requires a subset of knowledge components.

We identified certain limitations within our approach, especially with regard to the empirical validation and completeness of the framework. To test the framework, we successfully evaluated the artefacts with analytical and descriptive evaluation methods and conducted an applicability check on an IT service company according to Rosemann and Vessey (2008). Nevertheless, further empirical validation of our approach might be useful. For instance, action and case study research are appropriate means of conducting additional research and deeper empirical validation of the KBCM framework, in particular within other business contexts. We argue that our approach is comprehensive and applicable; however, we do not claim that it is entirely complete for all circumstances. Especially in specific business contexts and in special cases, adjustments could be necessary. Furthermore, KM involves various aspects such as socio-cultural, organizational, and technological aspects (Lindvall et al., 2003), while in this paper, we generally addressed the technological aspect, as we enhanced the ECM architecture to support different KM activities.

CONCLUSION AND OUTLOOK

In this paper, we addressed the general lack of ECM literature and the need to reconcile ECM and KM. We, therefore, proposed the KBCM framework – a knowledge-based framework for assessing, classifying, and managing enterprise content in order to promote e-collaboration process and knowledge development. Our approach is one of the first that focuses on applying a knowledge perspective on ECM systems by proposing a theoretical foundation

for content classification and management based on the perspective of knowledge components. The objectives of the framework are to analyze and optimize the interplay of ECM and KM, add more business value to ECM systems, promote knowledge development, and enhance intellectual capital. According to the DSR principles, we iteratively designed and evaluated the framework, which consists of different artefacts with different levels of abstraction: construct, model, method, and instantiation (March & Smith, 1995; Hevner et al., 2004). The applicability of the framework was initially tested on an IT service company. In this context, its usefulness and applicability were shown; however, individual specific adjustments might be necessary.

With regard to practical and theoretical implications, our approach aims at linking enterprise content and knowledge management. Due to the different levels of views, we suggest that the artefacts of our framework could be adapted (reduced or enhanced) to several real-world scenarios in which each view could be more or less important. Integrating KM within the ECM context following our knowledge-based framework could help practitioners make better use of their content and information assets and to accumulate organizational knowledge. When an enterprise intends to use an ECM system, the KBCM framework provides a starting point to classifying and organizing content according to knowledge components, and to share content within and among organizations. From an academic point of view, the suggested approach could be applied and refined by researchers to improve its generalizability and broaden its scope. Moreover, the integration of KM and ECM as IS research disciplines and the future development of those two disciplines within the IS research domain play a vital role in the knowledge economy.

The potential implications of the KBCM framework for practitioners are mainly twofold: On the one hand, it contributes to and stimulates the continuous alignment of business and technology-oriented views also from the perspective of KM and ECM. In this way, it supports the organizational and technical cooperation between consumers and providers of information and knowledge, thus addressing emerging requirements of modern service-oriented, dynamic, and connected organizations (Demirkan et al., 2008; Gray and Vander Wal, 2012). A particular result of a successful alignment based on the KBCM framework is thus an integrated and holistic view of an organization's knowledge and information infrastructure with the potential of providing a more complete and reliable basis for decision makers. On the other hand, the KBCM framework gives detailed insights into an integrated solution space provided by academic research in the fields of KM and ECM. Thus, it allows practitioners to identify scientific contributions that are relevant for their day-to-day operations and engage in cooperation with researchers for creating innovative artifacts (Oesterle et al., 2011). Thereby, the KBCM framework implies three target areas at its core: i) It defines application spaces of KM and ECM in terms of the information, user, system, and network view; ii) It integrates these application spaces in terms of a structural meta model that highlights how information products and knowledge components are positioned and related in the application spaces; and iii) It specifies the dynamics of transitioning between data, information, knowledge, and understanding. Practitioners may thus select the elements most relevant to them as starting points for KM and ECM initiatives and the implementation and/or adaptation of new or existing organizational and technical solutions.

In addition to the classic DSR literature, we anticipate the use of qualitative research methods within this context in our future work. Currently, we are working on experimenting and further validating our approach with knowledge-intensive organizations based on the DSR guidelines and using especially observational and experimental evaluation methods. A controlled experiment was performed in a university research center to study the artefacts for usability in a real-world environment. We are also conducting a case study with an IT

outsourcing company to study the framework artefacts in depth in a network environment.

Besides, we will investigate the transformation from business-oriented views to more formalized views. One possible direction thereby is to use formal meta-modeling approaches, e.g. (Fill et al., 2012) to create an IT-based conceptual modeling method based on the above meta-models. In this way, further evaluation in the sense of creating an artefact that could be applied to real-world scenarios is envisaged (Hevner et al., 2004).

We believe that a framework for KM should address all the three aspects of KM: technological, organizational, and social-cultural. For this reason, the socio-cultural and organizational aspects will be an interesting direction for research in the future. We intend to enhance our work with this in mind. We believe that the organizational aspect of KM in ECM systems could be based on the activities and practices related to the organizational readiness and the tacit-explicit model (Nonaka & Takeuchi, 1995). Each knowledge conversion activity can use various types of activities and resources of ECM systems. Concerning the socio-cultural aspect, we intend to extend the network view of the KBCM framework in order to cover different collaboration styles and network structures in an innovation system or in a business ecosystem.

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