

Mass Customized Knowledge Management: A Project for Adequate and Dynamic Knowledge Transfer for Small and Medium Enterprises

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Abstract. Knowledge is one of the most important resources today and, thus, companies in general and SMEs in particular need effective and efficient knowledge management solutions. In this paper, activities in the project MACKMA, which aims at implementing a knowledge management system tailored to the needs of SMEs, are introduced. Central findings include methods for establishing the product-service-portfolio of a company, a metamodel for knowledge artifacts and an accompanying incentive system for increasing knowledge management system usage.

Keywords: Knowledge management · Knowledge artifacts · Incentive systems · Knowledge customization

1 Introduction

Today's economic environment is characterized by increasing competition resulting from heterogeneous customer demands. Companies need to provide individual offers that are tailored to the specific requirements of customers. In particular in the domain of services, customer knowledge is a vital quality factor [1]. In addition, modern products and services produce a plethora of data (e.g. due to using sensors) which requires companies to manage, analyze and interpret these data. Working with data is a knowledge-intensive task and, thus, a greater need for knowledge management has to be stated. This results in several challenges, especially for small and medium enterprises (SME). On the one hand, SME usually lack financial resources to implement complex knowledge management solutions. On the other hand, knowledge in SME is often bound to a specific person and needs to be explicated. Though the challenges of SMEs concerning knowledge management are well-known, to date there is no solution satisfying the specific requirements of SMEs [2, 3].

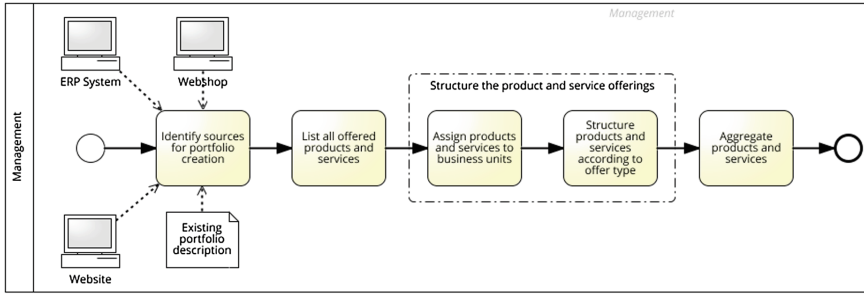


Fig. 2. Process for establishing a company portfolio

responsibilities [4]. To identify the individual situation of a company, it is, on the one hand, necessary to formalize the company structure. On the other hand, the specific portfolio of a company needs to be structured. Using the items of the portfolio, it is possible to assign knowledge artifacts.

For establishing the company structure, a twofold approach is used. First, existing documentation is taken into account, e.g. employee contracts and descriptions of activities. Based on these documents, the formal structure of the company can be identified. However, as stated above, SMEs often have organically grown structures and, thus, analyzing formal documentation is not sufficient. To represent the organizational structure thoroughly, it is necessary to survey employees focusing on their daily work and interactions with other employees. This allows for revealing the embodied company structure.

To represent the entire product and service offering of a company, it is necessary to define its portfolio. The portfolio is used as a starting point for identifying and collecting knowledge artifacts. The general process for establishing a portfolio is presented in Fig. 2.

As a first step, it is necessary to identify possible sources for supporting portfolio creation. These sources are existing collections of products and offers, e.g. the company website, contract templates, or ERP systems. In addition, questioning responsible employees are fruitful resources. In the second step, an unsorted and unstructured list of offered products and services is established. As a third step, the list is structured according to business areas of the company and according to offering types, e.g. hardware, software, and services. In the final step, single items are aggregated into item groups.

3 Metamodel of Knowledge Artifacts

The specification of the product and service portfolio of a company forms the foundation for defining knowledge artifacts. Knowledge artifacts link the portfolio view with the activities of employees. For being able to describe the knowledge artifacts in a structured way, a metamodel was established and is partially presented in Fig. 3. Defining the knowledge metamodel and, thus, specifying the structure of knowledge artifacts, is an important prerequisite for integrating different knowledge sources [5].

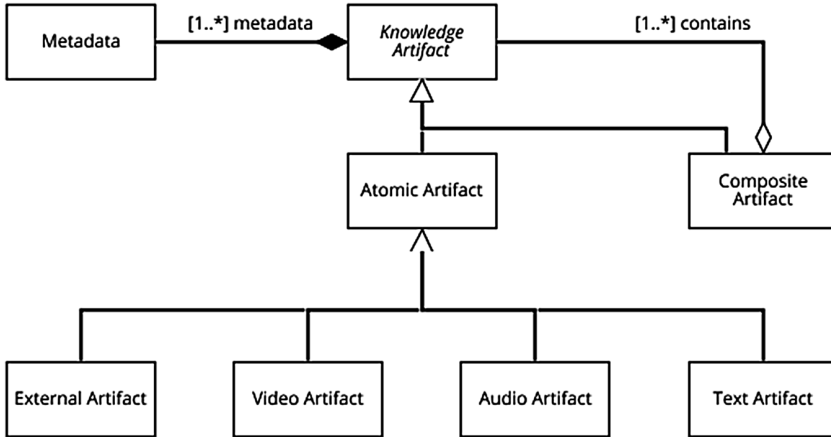


Fig. 3. Metamodel of knowledge artifacts

The metamodel covers three application areas. First, it is possible to define hierarchical knowledge artifacts. Second, responsibilities are assigned to knowledge artifacts to define roles. Third, to capture activities, a processual dimension is included. In this paper, we focus on the hierarchic structure. The interested reader is referred to [6] for further information.

To enable hierarchic structuring of knowledge artifacts, the two entities *atomic artifact* and *composite artifact* are defined. An atomic artifact is a single piece of information and represents knowledge using a textual description, an image, audio data, or video data. Using these different types of artifacts, it is possible to define knowledge artifacts for a specific usage context. For example, video artifacts are suitable for users of desktop applications. Contrary, smartphone users cannot access video artifacts due to bandwidth limitations. Therefore, they are provided with text artifacts. In addition to these types, there exists an entity *external artifact* to foster integration of existing systems (e.g. corporate wikis or issue trackers) into the KMS. External artifacts are of special importance because a large amount of knowledge is distributed over different applications and needs to be integrated redundant free.

Composite artifacts consist of existing knowledge artifacts and enable knowledge reuse. For example, a video and a text artifact might be combined into a composite artifact to increase understandability of the represented information. According to the metamodel specification in Fig. 3, it is also possible to reuse composite artifacts.

To enable a more detailed description of knowledge artifacts, metadata are used. Relevant metadata for knowledge artifacts were identified using a threefold approach consisting of performing a literature review, surveying practitioners, and analyzing existing metadata standards. For consolidation purposes, the list of metadata was aggregated, i.e. redundant metadata were eliminated and synonyms were identified. As a result, 70 different metadata could be identified. To increase comprehensibility,

Table 1. Metadata of knowledge artifacts

Metadata class	Metadata
Lifecycle	Creation date, modification date, creator, contributor, interactions, subscribers
Structure	Categorization, links, tags, identifier, references
Security, Quality	Access privileges, approval process, flaws
Content	Assessment, language, comments, audience, description, format, title, type
Recipient	Affected people, compulsory access

metadata were structured into the groups *lifecycle*, *structure*, *security/quality*, *content*, and *recipient*. An excerpt of the identified metadata is presented in Table 1².

4 Fostering SME Knowledge Management

A big challenge in providing a KMS for SMEs results from time and resource constraints. Contrary to large enterprises, SMEs often do not have the financial resources that are necessary to invest in an ample KMS. In addition, SMEs need flexible strategies and systems that support the implementation of KMS. In particular, knowledge management activities in SMEs must not require additional expenditure of time and long training periods [7].

Motivating employees for using a KMS in their daily work is a critical success factor. Incentive systems are an approach to increase the motivation. As Fig. 4 depicts, an incentive system is the combination of single incentives and has impact on the motivation of employees. For establishing an incentive system, it is first necessary to define incentive goals. The incentives that form the incentive system are means to achieve these goals. To identify the influence of incentives, it is important to assess the performance changes using indicators.

Within the MACKMA project, KMS usage is supported by an integrated incentive system based on the connections shown in Fig. 4. Therefore, different approaches concerning incentives were analyzed resulting in the morphological box presented in Table 2. Using the elements of the table, it is possible to define an individual incentive system as a combination of incentive goal, recipient, instrument, reward system, and indicator. For example, increasing the usage quantity is bound to an individual employee's motivation which can be addressed by using bonus payments with a sudden reward. Success of this system is measured by quantitative indicators.

² The thorough list of metadata is accessible via <https://www.informatik.uni-leipzig.de/ifi/fileadmin/ServiceEngineering/files/hcii/WAMetadaten.pdf>.

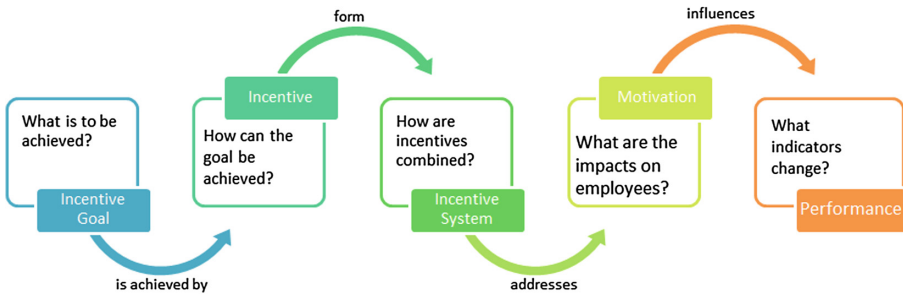


Fig. 4. Components and links of an incentive system

Table 2. Morphological box for incentive systems

Goal	Increase Knowledge Quality		Increase Knowledge Quantity		Increase Usage Quantity	
Recipient	Individual			Group		
Instrument	Quiz	Usage Statistics	Peer Recognition	Bonus Payment	Compensatory Time Off	...
Reward System	Sudden Reward	Rolling Reward	Random Reward	Fixed Action Reward	Social Treasure	...
Indicator	Qualitative Indicators			Quantitative Indicators		

Incentive systems for KMS generally can be geared towards increasing the quality of the content, increasing the quantity of the content, or increasing the usage frequency. In addition, achieving the incentive goal might be bound to an individual employee or to a group, i.e. a team of employees.

The incentive system is established by defining the instruments which should be used and by the way the incentives are given to the users. For usage in an IT-based system like the KMS, several instruments are feasible. For example, a quiz is an educational game that increases usage by using gamification approaches [8]. In addition, well-known instruments like bonus payments or non-cash benefits can be used.

5 Conclusion and Outlook

In this paper, insights about the MACKMA project were outlined. The presented steps are necessary preconditions for developing and implementing a KMS tailored to the specific needs of SMEs. Using the product and service portfolio of a company, it is possible to structure existing knowledge using the metamodel. The structure lays the foundation for the KMS content.

To get further insights about specific SME challenges regarding knowledge management, a qualitative survey of SME representatives concerning their understanding of the terms *knowledge*, *knowledge artifact*, *knowledge management*, and *knowledge management system* is currently conducted. Though no final results of this survey exist, it can be stated that there exists a wide interpretation spectrum for the different terms. Regarding the term *knowledge management system*, a majority of respondents puts a strong emphasis on methods and tools for supporting knowledge distribution. According to the results, it is also necessary to provide domain-specific knowledge.

The design and implementation of the KMS is influenced by the results of the survey. On the one hand, including an incentive system can help in supporting KMS usage. On the other hand, knowledge distribution requires a unified knowledge description which can be achieved using the metamodel and metadata. Using the metamodel, it is possible to define knowledge artifacts which can be combined according to specific requirements of a company.

Future work will include two aspects. First, a KMS platform will be implemented based on the theoretical findings. The KMS integrates the metamodel and supports the process for defining the product and service portfolio of a company, e.g. by using existing ERP data. The introduction of the KMS will be accompanied by a knowledge management method tailored on the specific needs of SMEs. Second, the customization of knowledge artifacts will be targeted. This is possible by defining influencing factors like the environment which affect possible types and arrangement of knowledge artifacts. For example, the experience of an employee has great impact on the amount of knowledge that is necessary for performing an activity.

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