

Support of Knowledge-oriented Business Processes through Workflow Management Systems

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Abstract

A major challenge in implementing business process-related knowledge management is to encourage employees to participate in knowledge processes. On the one hand, the educational work should be integrated harmoniously into the work context and, on the other hand, information must be presented and actively distributed as needed. In order to be able to introduce systematic knowledge management in companies, the design dimensions that a knowledge management project encompasses must first be taken into account. In the literature, the "three pillars of knowledge management" are often described in this regard, according to which successful knowledge management is based on the aspects of organization, people and technology, embedded in a corresponding corporate culture. The organization, i.e. both the organizational structure and the processes, must be tailored to the specific goals of knowledge management. The basis for filtering, addressing and control mechanisms is meta information about the knowledge content. Workflow management systems (WFMS) are software systems that, on the basis of a defined process model, support the processing of tasks by people who have specific roles or are assigned to specific organizational units and thereby provide the corresponding information objects. These systems offer an order structure for the classification and presentation of process-related knowledge, which reflects the experience and information needs of the users. This article presents a concept for the management of process-related knowledge and illustrates its implementation using a prototype.

Keywords: Business process, Knowledge process, Management system, Information system, Knowledge management.

INTRODUCTION

In order to anchor knowledge management in organizations, processes of organizational learning have to be integrated with the handling of business processes. To this end, technical, organizational and social barriers have to be removed and incentives to participate in knowledge processes have to be created [1]. A major obstacle for the learning organization are media disruptions between objects of business processes and instruments of knowledge management, because they have to interrupt the work flow for employees to participate in knowledge processes. Even if it is necessary in many cases to "take a step back" to question the given process organization, knowledge acquired in the processing situation should be able to flow directly into the organizational memory. As processes of

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organizational learning or knowledge processes we refer to processes in which employees develop knowledge, Provide and adapt relevant information for the work group or organization [2]. In the context of business process processing, knowledge processes generate and transport e.g. questions and answers on process processing, references to weak points, experiences or suggestions for improvement [3]. Business processes with a high proportion of information processing activities, in which unpredictable information needs arise and new information is

often generated, are referred to as knowledge-intensive business processes. Further characteristics of this process class are variance and dynamic development of the process organization in all components, frequent adjustment requirements and high decision-making freedom of the employees [4]. Figure 1 shows how knowledge processes within and between knowledge-intensive business processes, e.g. experience or background knowledge, capture and distribute.

In this article, we present a concept for the integration of process-related Organizational Memory Information Systems (OMIS) and workflow management systems (WFMS), which on the one hand is intended to improve process-related knowledge management and, on the other hand, an expanded workflow Technology is opening up a new class of processes, knowledge-intensive business processes.

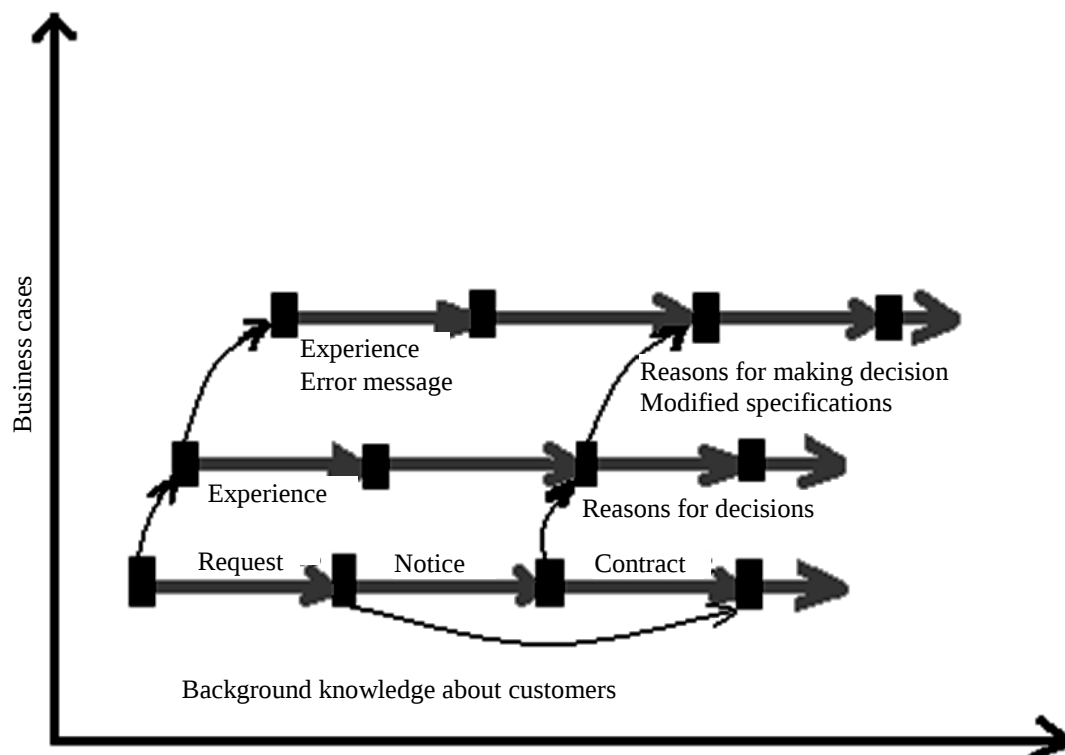


Figure 1. Knowledge-oriented business processes and knowledge processes.

A KNOWLEDGE-ORIENTED BUSINESS PROCESS: CONTRACT MANAGEMENT

The following example of a knowledge-intensive process is based on the “Contract Management” process for creating contracts with special conditions at a logistics service provider. Essentially, a rebate request created by a seller with the negotiated contract conditions is sent to a central price committee, which decides on the rebate request and, if necessary, initiates the creation of a contract. Figure 2 shows the associated process model in a simplified manner and shows in particular the documents supported by the workflow application. In addition to the necessary documents, other documents and sources of knowledge are used for processing in the examined process, the development and use of which can only be modeled with difficulty with the WFMS available on the market.

Example 1>> Information emerges from the negotiation with the customer that is important for later business cases in this process and that may be relevant for the implementation of other business processes relating to the customer. For example, such discussions sometimes reveal which competitors the customer is also negotiating with or how his market knowledge is to be assessed. The seller receives insights into the success of his own negotiation strategy.

Example 2>> The price committee often needs additional information for decision-making, such as information as to whether discount requests for this customer have already been approved or rejected, or the experience with this seller or with similar business cases. In complex cases, contact with an experienced colleague is helpful in making a decision. In complex cases, contact with an experienced colleague is helpful in making a decision. What is important here is the later traceability of the decision path and the reasons that led to the decision.

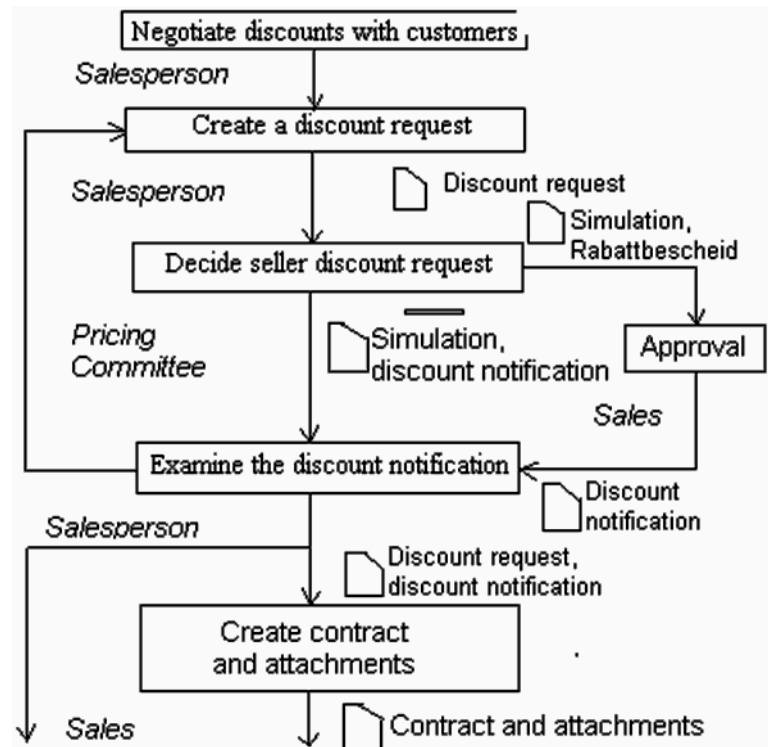


Figure 2. Overview of the contract management business process.

REQUIREMENTS FOR THE SUPPORT OF KNOWLEDGE-ORIENTED PROCESSES BY WFMS

In the contract management business process described, there are many requirements that are characteristic of knowledge-intensive processes, which are systematized below and supplemented by further requirements relevant to process-related knowledge management.

Manage Entire Workflow-Relevant Knowledge

Required knowledge about process processing and improvement comes from different sources and is generated or communicated in different media. An OMIS related to the business processes should consider as many sources as possible and integrate different media, e.g.:

- Results of the business process survey
- Training and work instructions
- Protocols of communication with external and internal partners-
- Process models knowledge, experience, questions and advice from employees
- Characteristic values, statistics and reports saved and processed by the WFMS

The exchange of information in transient media should be traceable. Relevant aspects of process-related knowledge management are the elements of the business process model as well as other factors that are not represented in the business process model, e.g. the quality of the working conditions or information on external partners. Finally, there are different types of contributions to consider: error messages, contributions to discussions, questions and answers, etc.

Business Case and Cross-Process Cooperative Knowledge Development

In order for an organization to learn from mistakes, experience must be transported from one business case to the next. Knowledge that is required in different business processes and business areas must be conveyed across business processes. For this purpose, common learning interests and knowledge needs must be identified and networked using suitable structures. After all, valuable experience can be lost during reorganization. Therefore, when revising the business processes, it is not only necessary to check which information and suggestions for improvement are to be implemented, but also which empirical values and which knowledge are required in the new business processes. Information on and from older versions of the business process model must still be available after the revision.

Presentation and Contextualization of the Knowledge According to the Processing Context

A process-related OMIS must present content as required. Often data cannot be interpreted without the context in which it was created and to which it relates. The representation of the context, however, causes additional effort. Therefore, tools are needed to support users in the explication and reconstruction of context data. Context data can also be used to provide information depending on the user and his current work situation.

Active Control of the Flow of Information during Collection and Recycling

In addition to the technical obstacles, there are also organizational and motivational obstacles [5]. The incentive and expectation situation differs fundamentally from that in business processes. The benefit of a contribution in OMIS is less transparent at the time it is recorded. There is no customer waiting for a result, and thus often immediate feedback on participation. In addition, users can combine very different intentions with their contributions, for which appropriate control mechanisms must be selected. After all, with the occurrence of certain events, a lot of information becomes more relevant or becomes invalid. These factors contribute to the fact that the necessary active promotion of knowledge processes [6] must be very flexible and difficult to control [7].

Support in All Phases of the Workflow Life Cycle

In addition to supporting the processing of business processes, process-oriented OMIS should also be able to be used in other phases of the workflow life cycle, e.g. as an archive for the results of the business process survey:

- as a repository of Design Rationals in the modeling phase
- as a filing system in which user feedback and workflow statistics can be compared with one another
- as a forum for discussing design alternatives or
- as a medium for the help desk and as a training tool for new releases

Existing approaches to the integration of workflow management and knowledge management only partially implement the requirements presented. In particular, structuring, presentation and contextualization based on the processing situation are only inadequately supported. The WorkBrain system [8] represents an OMIS to support workflow-relevant knowledge and organizational learning by improving business processes. The focus is on supporting the processing of flexible processes through the possible search for similarly expired cases. The objective of KnowMore [9] is to actively provide workflow-relevant information. The information requirements and the methods for providing information are determined by modeling “knowledge-intensive tasks”, but without the processor being able to explicitly explain knowledge at runtime or being able to contribute cooperatively to building up knowledge. The system MILOS [10] supports the cooperative knowledge building in the processing of workflows through the process improvement. When editing, a user has the option of entering additional information for an activity that is not contained in the model. These can be made accessible for later business cases if the person responsible for the process inserts the information into the process model.

CONTEXTS AS A MEANS OF STRUCTURING INFORMATION FOR PROCESS-RELATED KNOWLEDGE MANAGEMENT

Acquisition, storage, search and retrieval of information in OMIS essentially depend on the available structuring features or labeling features of the information to be managed. WFMS are particularly suitable as a basis for process-related knowledge management because they manage a wide range of information that can be used to structure and contextualize information relating to processing. This information includes, for example, case data, data on the processing status or employee data. On the basis of the requirements collected from "*Requirements for the Support of Knowledge-Oriented Processes by WFMS*" as explained above, in the "*Process-Related Knowledge*" we summarized aspects that characterize the content of a process-related OMIS. Building on this, "*Structuring and context formation*" proposes a concept for structuring process-related information..

Process-Related Knowledge

In the context of workflow management applications, process-related knowledge or related information mapped in the system can be divided into two classes. Primary information refers to the data or documents specified in the workflow model that are considered necessary for the processing of each business case. In addition, there is further process-related information that is only considered relevant in certain situations or only by individual processors, or whose creation and use at the time of modeling cannot be determined according to the requirements of a formal workflow model. We refer to this information as secondary information. Primary and secondary information do not differ in terms of their content or meaning, but rather in terms of the role assigned to them in the system of workflow-based business process processing. By making an empirical value a regulation, for example, secondary information can be converted into primary information. The processing of secondary information is only very incompletely supported by the WFMS available on the market. The following properties of secondary process-related information must be particularly observed during processing:

Source of Knowledge or Information

Workflow-internal and workflow-external stocks are to be processed as secondary information. The WFMS can provide internal workflow information itself. Information from the process model or about the current or completed business cases is to be mentioned here, which is presented at a suitable point, e.g. can support the decision-making of processors. In addition, workflow-external information allows the integration of various information systems such as document management systems or groupware, e.g. to provide additional background information. Finally, the transparency of the arranger's knowledge must also be supported in order to be able to make experiences or references to the consultation of experts easily comprehensible, for example.

Function

The function that an information object takes on during process processing, e.g. background information, error messages, feedback or suggestions for improvement, must be clearly recognizable for the reviser. The information function can be used to define how this information is to be used after it has been set in the process-related OMIS. For example, in the case of feedback information or suggestions for improvement, it can be specified that these are automatically forwarded to certain people.

Visibility

Experience shows that reviser do not disclose all experiences or process-related information for various reasons. However, in order to be able to use this knowledge at least to a limited extent, it is necessary that auditors can also enter information into a process-related OMIS that is only visible to them.

Provision

The provision of process-related information must be possible according to both the pull and the push principle. The selection of the addressee group can be supported by the WFMS. For example, it

can make sense to send the reason for the termination of a business case to all persons involved in the processing, whereby these persons can be selected by the WFMS.

Other Aspects

In addition to other meta information, such as the author or brief description, it should be possible to link information, e.g. to present answers to questions or to structure contributions to the discussion.

Structuring and Context Formation

The flexible filtering, addressing and control of process-related knowledge is based on metadata that is used to identify content and with which, for example, it can be identified where information comes from or for whom it should be visible. Many different metadata are required in order to control knowledge as required (See the above in Process-Related Knowledge). However, this increases the effort involved in entering information and makes it more difficult to retrieve knowledge. To facilitate access to knowledge, we propose the selection of a primary structuring feature that orders the perspective on the knowledge. It does not always make sense to force a binding organizational structure by selecting a priority feature. In the case of process-related knowledge, however, we find generally shared organizational features with the objects of the workflow model, which appropriately reflect the recording and retrieval situation.

A context is created for each workflow object (activity, tool, document, role, business process and business case) that records information that is assigned to this object. In the activity context there are, for example, suggestions for new processing methods, in the tool context reports on functional errors that have occurred. It is possible to assign information, e.g. a success story to a certain sales strategy, to the context of a business case and the context of one or more other objects at the same time. Figure 3 shows assignments based on an excerpt from Contract Management.

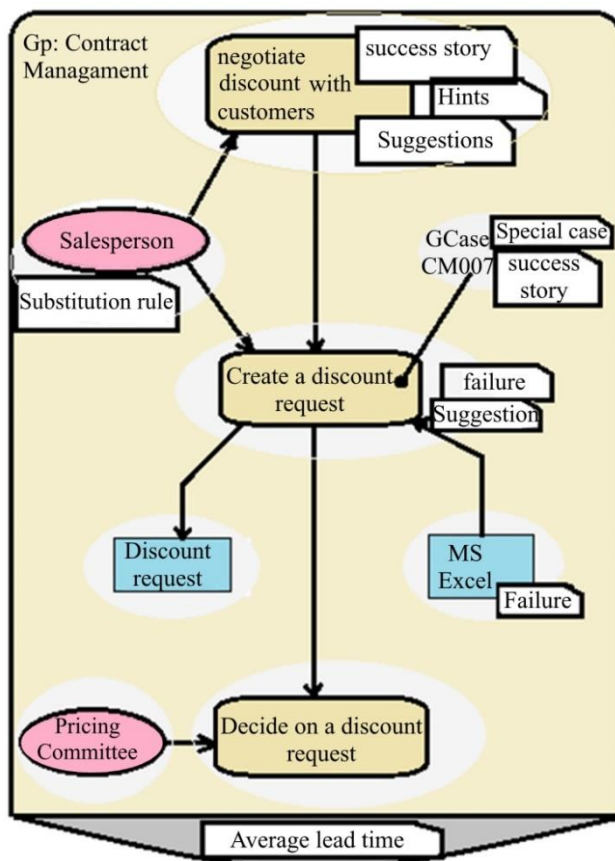


Figure 3. Allocation of information to the contexts of the workflow objects.

The figure uses the SeeMe modeling language [11].

Due to the assignment to contexts, the framework specified by the workflow model is used as an ontology for structuring information. Because this organizational structure is familiar to the employees and reflects situational information needs, a higher degree of consistency in the assignment and better support for retrieval and recycling can be expected.

When entering new content, the author must assign the information to workflow objects. The system can support him in this. In order for information to reach its addressee, however, one cannot rely on them to search through a multitude of contexts. Rather, the system must provide notification and push mechanisms.

When the information is presented, content from different contexts is presented together. Figure 4 shows how content assigned to an activity, the tools used in the activity, the documents to be processed, the current business case or the roles authorized to carry out the activity are presented to the reviser as a whole.

Content that has been assigned multiple times may have particular relevance to the current situation and is therefore highlighted (Figures 3 and 4). By combining information during the presentation, the depth of the search path for the workflow reviser is reduced. The navigation options in the information space created by the workflow objects are reduced to searching through the neighboring activity contexts. An additional expansion of the information space is possible by including the context of the entire business process or contexts of activities from other workflows.

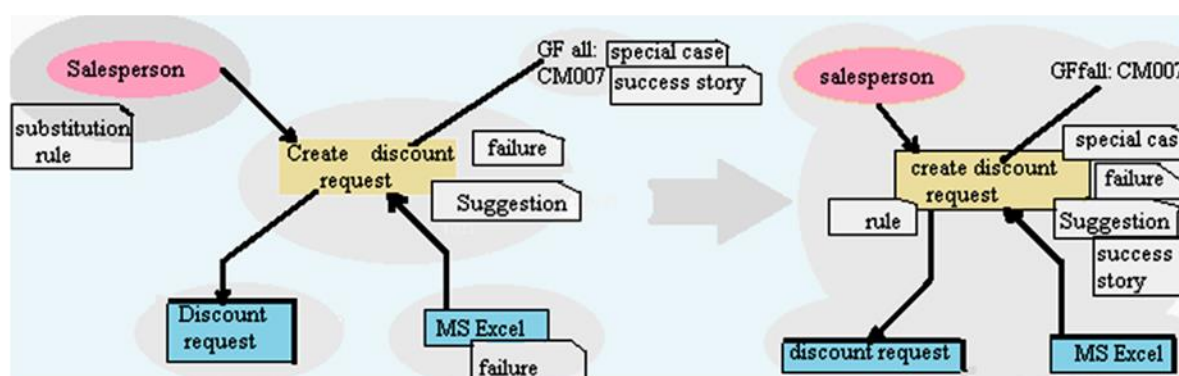


Figure 4. Joint presentation of contextual content.

In order to exchange experiences between business processes, the possibilities described are not sufficient due to cross-process contexts of tools, documents and roles. By linking similar activities to one another, content can be inherited between activity contexts. This option is also provided for other workflow objects. Furthermore, employees should be able to place information directly in the context of other business processes. Experience from other projects [12] suggests that by integrating the knowledge processes into the primary work tasks, motivational barriers can be reduced. In most cases, however, editorial support is also required in order to delete information that is no longer valid, to prepare information, to distribute it via process contexts or to rearrange the information that is still valid after a re-modeling of the workflows.

THE WORKFLOW MEMORY INFORMATION SYSTEM WOMIS

The concept of using contexts as a means of structuring information for process-related knowledge management led to the implementation of the Workflow Memory Information System (WOMIS), a prototypical extension of a commercial WFMS to support process-related knowledge management. Mechanisms for the active control of knowledge processes and possibilities for the integration of

WOMIS in the entire workflow life cycle are missing so far. WOMIS is a system that prototypically implements core requirements of the "Contract Management" process worked on in the MOVE project. An evaluation in terms of productive use of the system was not carried out in the project.

With reference to the example described in section 2, a typical interaction of a seller with the WFMS and WOMIS could take place in the following steps: The seller accepts the task of creating a discount request in his WFMS client and opens the corresponding workflow documents. Since this is a complex case, the salesperson starts WoMIS directly from the WFMS client, whereupon WOMIS shows the context for the current activity „Create discount request“. The salesperson opens a document in WOMIS that describes their scope for discounts and accesses current information on competitors that other employees have already hired. With the help of this information, the salesperson can make optimal use of his leeway when creating the discount request, and he then sends the business case on. However, the specifications regarding the possible discounts appear to him again and again to be too inflexible. Therefore, in WOMIS, he opens the context to the entire contract management business process and stores a corresponding note declared as a suggestion for improvement.

WOMIS was implemented as an extension of the commercial WFMS CSE workflow on the basis of Internet technologies. The server-side part of WOMIS was implemented using CGI programs that query the defined processes, activities and business cases from the CSE Workflow Server in order to initialize the corresponding process contexts, and also provide the functionalities for user interaction. WOMIS stores metadata on the information objects, such as their association with certain process contexts, in a separate database.

CONCLUSION

Representations of action situations in process models, as they arise in workflow management applications, can support the categorization work in the explication of knowledge and the recontextualization in the interpretation of content. Even if commercial WFMS are still too inflexible today to adequately map unstructured processes, we consider process-related mapping of action situations to be trend-setting for knowledge management. The support of knowledge-intensive processes by WFMS requires their expansion to include concepts of process-related knowledge management in order to remove the current separation between business management and knowledge management. The concept of the process contexts presented here represents an approach to enable the structuring and presentation of knowledge based on the processing context provided by the WFMS and to integrate it into the workflow processing.

This means that participation in knowledge processes, e.g. when searching for information, asking questions, answering or presenting empirical values, can be harmoniously integrated into the primary work tasks, so that the effort required for the employee is minimized to the essentials.

Knowledge processes that occur during the processing of business cases can have very different characteristics, whereby the context information, which comes from the WFMS on the one hand and from the processor on the other, e.g. when a document is placed in a process-related OMIS, is used for the active promotion and control of knowledge processes should be. Future work will therefore investigate in particular the question of which classes of knowledge processes are relevant in this context and how the concept of process contexts must be expanded accordingly.

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