The EU-Project PROMOTE: A Process-oriented Approach for Knowledge Management

D. Karagiannis
BOC GmbH
Bäckerstraße 5/3
1010 Vienna, Austria /
University of Vienna
Department of
Knowledge Engineering
Brünner Straße 72
1210 Vienna, Austria
dk@dke.univie.ac.at

R. Telesko
University of Vienna
Department of
Knowledge Engineering
Brünner Straße 72
1210 Vienna, Austria
telesko@dke.univie.ac.at

Abstract

PROMOTE is a EU project dealing with knowledge management and running in the IST programme, Nr. IST-1999-11658 [IST00]. The overall goal of the project is to develop an integrated framework for process-oriented knowledge management based on the existing business process management toolkit ADONIS®, to validate it by developing a product named PROMOTE® and to test it with end user companies from the financial and insurance sector. Information about the project can also be found under the website http://www.boc-eu.com/promote.

1 Process-oriented Knowledge Management

In this paper we propose knowledge management to be based on processes. A process-based point of view enables - similar to business process management - the development of an integrated framework for documenting, analyzing and improving knowledge activities. As opposed to a purely document-centric perspective for knowledge management we examine what processes create knowledge objects like documents, human expertise etc. and how to represent this knowledge in an organizational memory (OM) so that employees can it easily retrieve and manipulate. But knowledge management activities cannot be separated from other business processes, because knowledge is generated and used in business processes. Up to now, there have been two approaches to specify knowledge management activities:

The knowledge management point of view focuses on knowledge management activities while neglecting the relation to other business processes. A favorite way of conceptualizing knowledge management is to divide it into tasks like knowledge identification, generation, acquisition, storage, distribution and usage. However, in a company different knowledge objectives and business processes exist that determine which knowledge is valuable and also influence how it is acquired, stored and used. The knowledge management tasks mentioned above need to be adapted to these different objectives and customized accordingly.

From the business process point of view knowledge management activities are part of business processes. Work in this direction mainly supports business process execution by context-sensitive information retrieval and active presentation of relevant information [Sta99], [Abe98]. However, knowledge use is only one task of knowledge management. It is not ingenious to specify knowledge management activities for each business process separately, because many activities occur in a similar manner in various business processes.

In this paper we present an approach to be realized within the PROMOTE project that combines knowledge management processes (KMPs) and business processes. This means in particular that we do not favor any of these kinds of processes. Both, KMPs and business processes, are specified and the relation between activities of both processes can be explicitly modelled.

1.1 PROMOTE: A Multi-dimensional Approach

The overall goal is to adapt the existing "Business process management systems" methodology for realizing "Process-oriented knowledge management", to validate it by developing a product named PROMOTE®, and to test it in end user companies from the financial services sector. PROMOTE® guides the accumulation, retrieval and distribution of product-process related knowledge and employees' know-how, and serves as an on-line support tool for knowledge managers as well as for the employees who generate and use knowledge.

The product will be based on a meta-model that can be customized to suit a whole range of knowledge management approaches as long as these are expressed in terms of activities. The business process view provides an integrating framework, which enables a focused analysis of knowledge assets and requirements in a company. By relating knowledge management to business process modelling, one gains a basis for knowledge representation and it is guaranteed that knowledge is represented in the context of its generation and use. The process-based knowledge management approach will be applied in three investigation areas:

– the business processes supporting the delivery of products/services
– the product/service development process
– the human capital of the company

We adopt this division because it covers all the important parts of the strategic, operational and human resources aspects of knowledge management. Therefore it provides a clear framework of where to start, how to start and what issues to address. There is no turnkey knowledge management solution available in the market today. Several methods and tools exist that employ intelligent techniques developed by research in various disciplines such as artificial intelligence, psychology, databases, computer supported cooperative work etc. These tools however lack functionality that

– enables them to perform as complete solutions
– supports thousands of end users (Existing applications are only suitable for departmental solutions.)
– guarantees their proper integration into the enterprise's value chain and the successful application of them to products and services.

1.2 The Consortium

The coordinator of the project is BOC (Austria), developer of ADONIS®, the most powerful business process management (BPM) toolkit available today. ADONIS® [Kar95], [Kar96] supports the whole cycle of business process optimization from knowledge acquisition to performance evaluation. The business areas of BOC are further development and marketing of ADONIS®, consulting and project management in business process optimization projects in the financial services sector and consulting in workflow technology applications. BOC has conducted two EU projects in the BPM area, namely REFINE [REF00] where ADONIS® was tailored for the insurance sector and ADVISOR [ADV00] where the ADONIS® toolkit is currently extended to cover business process-oriented learning and training activities.

The user organizations are FIDUCIA (Germany) and INTERAMERICAN (Greece). FIDUCIA is the largest computing centre service of the co-operatively organized bankers' syndicate in Germany. Together with its subsidiaries it supports a large clientele from various industries. The performance reaches from the conversion of complex data processing tasks up to the outsourcing of complete applications. INTERAMERICAN, an insurance company in Greece, has a strong position in the domestic

market and also significant operations in other European countries. Both end users have vital interest in exploiting the know-how and the tools that the PROMOTE project will produce.

2 Methodology and Product

The basic assumption in PROMOTE is that many central aspects of a company's knowledge are connected to the business processes realized in that company (also the ones that span the company's boundaries), some in explicit form (e.g. documents), many in implicit form. We speak of implicit knowledge with two connotations: Implicit because it is not documented/externalised but in the "head" of (single) employees, and implicit because is not mentally represented but only tied to practice.

An important goal of the project is to make both kinds of implicit knowledge around business processes explicit, not only in form of text documents, but also in form of (multimedia) case descriptions, models, and enriched multimedia documents. To accomplish this, knowledge activities in a company must be thoroughly integrated with a company's strategic goals as well as its business processes and with the development of its human resources. The notion of KMP is one of the central concepts in PROMOTE for a better understanding of knowledge activities in a company.

2.1 The Concept of KMP

Today's knowledge management approaches are often formulated in rather general terms, lacking a tool set to support implementation in organizations. The consortium will develop the PROMOTE® product by adapting the model-editor of the ADONIS® toolkit. For capturing the various KMPs with different degrees of formalization in the different investigation areas, a graphical model-editor that incorporates a powerful modelling language will be developed.

KMP modelling deals with the representation of acquisition, search & retrieval and maintenance of domain knowledge. The tool set to be developed and tested will allow to model KMPs in a form similar to the modelling of business processes. Note that with this tool knowledge processes are modelled independently of specific IT tools and platforms. KMP modelling basically deals with the kind of entities and activities PROMOTE will help to manage and realize. By introducing KMPs it is not aimed to simulate cognitive abilities of human beings like in artificial intelligence, but to provide efficient means for amplifying the intelligence of employees. In the project generic and specific KMPs will be developed. These processes will be initially designed for the end users. By means of the meta-architecture of the product, KMPs will then be transferred to the financial services sector and later on to other sectors. Companies will be able to take PROMOTE® and a large library of KMPs, customize them according to their specific needs and apply them in parallel with their business processes. In addition, users will have the possibility to define their own KMPs depending on the objectives they have (a new product

development/introduction, market monitoring, competitor analysis etc.). The consortium believes that in different industry sectors there exist quite different knowledge needs and processes. Even within one sector or company, different knowledge objectives may exist that determine which knowledge is valuable and also influence how it is acquired, stored and used. Generic knowledge management approaches need to be adapted to these different objectives and tools need to be customized accordingly.

The architectural basis for PROMOTE® will assure that knowledge managers can design knowledge management strategies and measures in their organizations relying on different knowledge management approaches, on different departmental and company-specific needs, and independent of the specificity of the underlying IT. An immediate advantage is that the specific approach in the project - by abstracting away from the information level - allows for a fully integrated approach towards knowledge management. A knowledge manager will even be able to plan and monitor knowledge activities which are not (or at least not at planning time) realizable with IT. Since the knowledge level is not restricted by the information level, one can for instance plan for brainstorming sessions or conferences as a knowledge acquisition method without having to commit oneself to specific IT or to IT at all: "Human-only" knowledge management measures can be integrated with those that involve IT. The knowledge management strategy of a company can be planned and monitored without being constraint by today's IT solutions. Rapid implementation is guaranteed by supporting the mapping from the meta-level (KMPs) to whatever IT exists or is under development.

The product will be integrated into the end user IT environment and linked with existing tools for process modelling, collaboration, document management etc. Substantial end user involvement will allow for testing and evaluating the tool under realistic conditions.

2.2 The PROMOTE® architecture

Figure 1 shows the different levels of the PROMOTE approach for knowledge management:
- The knowledge level realizes the process-oriented knowledge management. KMPs are explicitly modelled and their relation to business processes is specified.
- The OM level models structure and content of the OM and provides functions for knowledge storage, search and retrieval.
- The IT level implements the OM and integrates it into the infrastructure of the enterprise.

This approach is also concerned with the implementation of the following management activities:
- allowing for different knowledge management approaches by using PROMOTE®
- modelling and realization of the KMPs
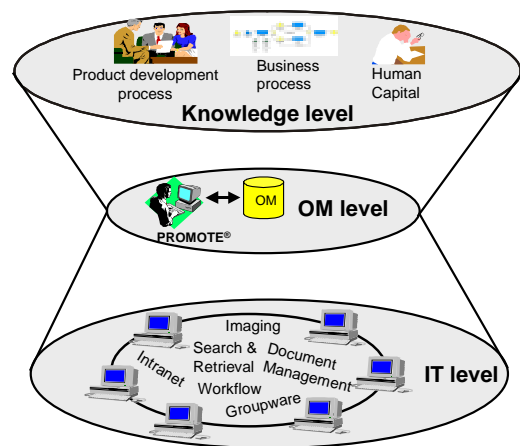- supervision, assessment and evaluation of PROMOTE® by a knowledge officer

Figure 1: The PROMOTE Architecture

The method to be developed will allow knowledge officers and employees in organizations to plan, configure, monitor and evaluate the core knowledge activities in a company.
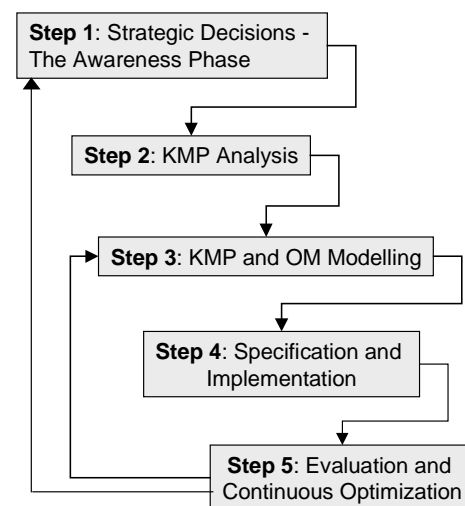

Figure 2: Steps in PROMOTE

2.3 The PROMOTE® Methodology

The methodology consists of the following steps (Figure 2) which are now described in more detail.

2.3.1 Strategic Decisions - The Awareness Phase

In the project each end user focuses on a particular investigation area. In the first step, users consider knowledge management as a task that will only be successful if accompanied by appropriate management strategies and policies. Strategic decisions concerning knowledge management deal with points like:
- linking the knowledge management initiative with corporate objectives, in other words, deriving the

extent and content of the knowledge management initiative from predefined business goals. Company-specific knowledge management procedures and objectives are to be formulated here.
- identifying activities in the investigation areas that have a strong knowledge leverage potential
- identifying the so-called "soft factors". Experience has shown that the impact of cultural and psychological factors on knowledge management projects is tremendous and companies should readjust and take complementary actions to tackle these issues effectively.
- defining criteria for evaluation. Based on the PROMOTE approach, knowledge activities are planned and modelled. This does not only allow for a clear implementation of the activities in the operational field, but also for a thorough evaluation. Expectations about the effects of knowledge activities can be formulated based on the models and empirical observations can be matched against these expectations.

2.3.2 KMP Analysis

In a business process, knowledge exists in the form of data and information in combination with experience, communication, reflection, expertise, techniques and cognitive abilities. PROMOTE starts from a careful analysis of the existing business processes (i.e. analysis of work practice) and identifies what kind of knowledge is created/used by whom in the context of the respective business processes. Even if a company has not yet taken explicit measures to assess its knowledge and knowledge processes, they exist in an implicit form, connected to the activities of employees in the context of their daily work.

Starting from the modelled business processes of selected trial cases, this step aims to identify knowledge contents, knowledge flows, and knowledge sources. The complete cycle of knowledge acquisition, storage, distribution and usage is to be covered in the course of this analysis. In the course of identifying processes also the human resources required to realize these processes will be identified and described in terms of the functions they have for the knowledge processes.

Identification of these activities can be done in a top-down as well as bottom-up manner, building on an analysis of the respective processes in the user trials. These activities are partly organizational (such as providing for specific communication routes and forms), partly IT support, partly training and human resource related.

Knowledge acquisition refers to the identification of the relevant knowledge to be represented in an OM [Abe98]. Our focus is on assessing how knowledge is related to processes and their execution. Empirical research will be done at the user sites beginning with the identification of knowledge contents. Some of the tasks involved in this step concern:
- knowledge acquisition methods
- identifying know-how of employees
- capturing practice and experience

- capturing brain storming session outcomes
- capturing knowledge distributed across a number of employees who perform a process
- integrating "hard" information, for instance from benchmarking

For the end user FIDUCIA a benchmarking study in the application development department showed that the numbers of errors per functions points is too high. With the trial area "Additional quality management: Finding errors in applications in time" the application development department pursues the goal to avoid errors in the early phases of an application project. Within this trial scenario FIDUCIA wants to recognize errors as soon as possible by establishing a consulting pool (experience database) in a process-based environment.

The selected trial area for INTERAMERICAN is the "Legal protection insurance claims management". Legal protection insurance protects against eventualities, which either increase the liabilities of persons/companies or decrease the level of their assets. The intention is to focus on reducing the claims process execution time with the view to increasing customer satisfaction by providing user friendly knowledge objects linked to business processes.

2.3.3 KMP Modelling and Optimization, OM Modelling

In step 3 the KMPs as well the OM using the results of the analysis of step 2 are modelled. Both processes and OM are at this point specified conceptually, using an adequate ontology and corresponding modelling tools, not in terms of specific IT.

KMP Modelling

One of the big issues in PROMOTE will be the development of an adequate and complete KMP language capturing all different types of KMPs. In the following a list of possible KMPs is given:
- Acquisition: Integrating new knowledge in the OM (Direct acquisition, guided acquisition, automatic acquisition, interaction knowledge producer – knowledge consumer)
- Search and retrieval: Retrieving knowledge from the OM (Querying, full-text search, entity-based search, knowledge navigation assistant, knowledge selection, information agent)
- Maintenance: Management functions of the OM (Archive, validation, feedback, knowledge format transformation etc.)

There exists a lot of approaches for process-oriented knowledge management [Abe99], [Nis00], [Rei00], [Rem00]. The specific aim of the project is to develop a language for capturing different types of knowledge activities. For modelling simple types of KMPs elements of process chains can be used. This is shown for the KMP "Web publishing" in Figure 3, where some basic activities to set up a webpage are modelled using the model-editor of ADONIS®.
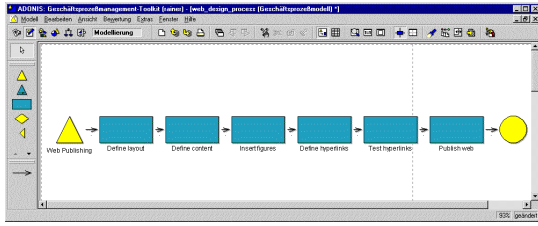
Figure 3: KMP "Web publishing"

A more complicated case requiring additional modelling constructs is shown in Figure 4, where access to some knowledge sources is designed.
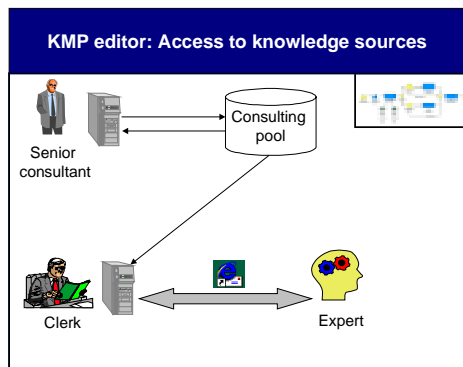

Figure 4: KMP "Access to knowledge sources"

Only two roles of employees are distinguished here, a normal clerk and a senior consultant. Both have access to the consulting pool, yet the senior consultant is also allowed to update the consulting database. This is indicated through the direction of the arrows. For the clerk it is also possible to contact an expert via e-mail when solving a specific problem. The context of this KMP is given by a business process depicted in a corner of the model editor.

KMP models will also be enriched with the notion of "user groups" in order to adapt knowledge acquisition and access to specific user-group needs and capabilities.

OM Modelling

A common approach in knowledge management for designing an OM is to take a document-centric, technical perspective: Which of the documents and database records produced in a company contain "knowledge" and how can that "knowledge" be distributed to employees?

In PROMOTE, we see the OM from a learning perspective - both individual and organizational learning - and ask: How can we represent information in an OM so that people can rapidly turn it into knowledge? (On the side: We believe that only people have "knowledge" because they, but not machines, are able to use information to solve new problems. IT provides data that need to be turned into knowledge by people in the context of problem solving. The art of designing an OM is to provide the right data at the right time in the right format.)

Our innovative approach consists in providing end users with knowledge objects instead of documents or records. A knowledge object can be one of many things: Case descriptions capturing an experience or an instance of best practice, rules and procedures, a model of a business process, comments on a business process, etc. Knowledge objects are not so much defined in terms of what they contain as by how they can be generated, accessed and modified. Knowledge objects are information structures which are designed in manner so that they can be quickly turned into knowledge (be used for solving problems).

Building on a generic model of an OM, which is to be developed in the project, it will be formally described how KMPs and their outcomes are stored. Note that this OM will not only allow to store process outcomes (such as documents), but also the knowledge generation and use processes. This is important to have this contextual information represented in the OM.

The OM will store knowledge representing artefacts (documents, multimedia documents, process models, formal knowledge representation models such as conceptual graphs, databases, informal as well as formal case representations etc.) together with a description (in form of KMPs) of the processes and human resources which produce and use these artefacts. In addition, it will structure its content (the knowledge objects) in a manner that is optimized for information navigation and learning. A first set of requirements to operationalize this goal is that information should be

- presented in the problem solving context it is most useful
- associatively linked to other pieces of information
- represented in multiple forms covering multiple perspectives
- represented in a narrative, story-like, application-oriented form
- judgeable by credibility
- shareable with other people

Knowledge Management Optimization

Having a formal model of the KMPs and the OM in a company, improvements („knowledge process re-engineering") upon the current state can be suggested, modelled and analyzed. For instance, the knowledge officer can plan for additional and/or more systematic knowledge acquisition activities, for more user-friendly access mechanisms, design different tools and access mechanisms for different user groups in the company etc.

2.3.4 Specification and Implementation

Once the knowledge-related processes are identified (step 2) and conceptual models of KMPs and OM are developed (step 3), the next step is to implement the PROMOTE® product and to map the models onto company-specific IT platforms which serve then as the infrastructure which supports employees in knowledge-intensive activities. Like for the toolkit ADONIS® core activities have to be defined for the PROMOTE® product:

- Investigation: This component determines the interface between the modelled business processes and the KMPs. Here it is specified which knowledge objects can be assigned to business processes.
- Modelling: This component serves as a platform for modelling KMPs and the interaction with the OM structure (see Figure 4) and will be realized by adapting the model types of ADONIS®.
- Analysis: The analysis component is concerned with standardized queries both on the schema (e.g. queries concerning knowledge management structures) and the data level (e.g. How many experts have provided useful answers to queries of employees concerning the activity "Risk assessment" in the business process "New policy application"?). Also scenarios like a "knowledge management gap analysis" can be performed here where the difference between an "as is"- and a "should be"-state is measured.
- Simulation: Like in ADONIS® predefined simulation scenarios will be implemented. A scenario might be the knowledge-based skill management where impacts of changes in some skills of certain employees on the performance of the business processes under investigation are measured.
- Automation: Similar to business processes KMPs can be executed in different ways (workflow environment, standard software etc.). For example the KMP "Web publishing" can be executed with the documentation toolkit of ADONIS® thus producing the knowledge object web page.
- Export: This component is concerned with the transformation of knowledge objects and KMPs in different formats.

A main issue when implementing the product is the interface to business processes in ADONIS®. Information systems that do not only store large amounts of information but are able to combine it and make it available in the organizational context are indispensable for knowledge management. It is important to note that from the content of a document or an information object alone it is not possible to assess its relevance. Information is relevant if it helps a person to better perform his/her activity, e.g. to make better decisions. The activities are part of business processes. Thus, without the consideration of the process context it is impossible to provide the right information to the right place at the right time. The problem of actively providing relevant information during execution of business processes has already been tackled by recent work [Sta99]. But knowledge is not only used but also generated during business processes execution. This means that for any kind of a KMP an integration with business processes must be possible. The most simple integration is to invoke a KMP during execution of a business process activity. In this case, the KMP does not interfer with the execution of the other activities of business processes. This kind of integration is also made by [Sta99], however, they did not explicitly model the knowledge task as a process. To invoke KMPs from business processes we developed an

extended representation frame for process activities. Knowledge activities, i.e. process activities that either need knowledge support or can generate new knowledge, additionally have
- attributes that describe the context information
- a mapping function that maps this context information to attributes of the KMP
- an invocation condition

For the KMP "Access to knowledge sources" possible attributes describing context information, the mapping function and the invocation condition are listed in the table below.

Table 1: Interfacing Business Processes with KMPs

Attributes describing context information	• Name of employee (e.g. Mr. Miller) • Role (e.g. clerk) • Short description of the activity where he needs support (e.g. assessment task)
Mapping function	• Clerk -> Knowledge worker • Description of the activity and the problem -> body of the e-mail sent to the expert • Recipient: Expert via e-mail-address

Invocation condition	Mr. Miller needs support from an expert when executing an assessment task
	• Mode:
	  - Automatic: e-mail sent automatically
	  - Not automatically: Content checked before and e-mail sent "by hand"

The invocation condition can either be checked by the participant who is performing the process activity or automatically. Automatically checking the invocation condition can be a very complex task and thus can only be realized for well-defined applications.

When a KMP is invoked from within a business process, the context information is mapped to the attributes of the KMP. Consider, for example, the above mentioned KMP "Access to knowledge sources". The context is given by the employee who is executing the business process and his role in the company, a textual description of the activity etc. The mapping function then maps this person to the role of the knowledge worker, the description of the activity and the problem to the body of the e-mail sent to the expert etc.

2.3.5 Evaluation and Continuous Optimization

The use of PROMOTE® will imply several advantages for the organization:
- Employees will be supported with knowledge that goes deeper (and is more case-specific) than captured in standard organizational handbooks and process models (extending depth).

- Employees will be supported in getting knowledge about a whole case, not only isolated information about single activities (extending scope).
- Employees will also be enabled to formulate suggestions for process improvement not only in form of documents and annotations to documents, but in form of process models.
- Employees will be motivated to contribute their knowledge to an OM because of the various motivational factors (avoiding extrinsic incentives as much as possible) built into the approach (rapid input, graphical and multimedia-based input, knowledge sharing, rapid feedback, rapid implementation of high-quality suggestions, assuring intellectual ownership etc.).

Evaluation will take place in various dimensions:

- Technical: Evaluation of the approach in terms of technical feasibility.
- Organizational: How does knowledge management affect organizational structure and process execution?
- Socio-psychological: Issues such as barriers, participation, acceptance, work satisfaction, usability, learnability and sustainability, reward mechanisms.
- Business goals: Outcomes in terms of quantifiable and non-quantifiable parameters as these where defined in the first step (financial results, time to market, customer satisfaction, quality improvement etc.).
- "Cultural" aspects of knowledge sharing (i.e. usage, access, maintenance, feedback).

3 Conclusions

PROMOTE is a EU project dealing with process-oriented knowledge management and currently running in the IST programme. The two paradigms in PROMOTE are to link knowledge management with the business processes in a company and to model knowledge management processes and knowledge objects in a way similar to business processes. In PROMOTE a methodology for process-oriented knowledge management and a product are developed to be tested with end user companies from the financial and insurance sectors.

References

[Abe98] A. Abecker, A. Bernardi, K. Hinkelmann, O. Kühn, M. Sintek. Towards a Technology for Organisational Memories. *IEEE Intelligent Systems & Their Applications*, 13(3): 40-48, 1998.

[Abe99] A. Abecker, A. Bernardi, M. Sintek. Enterprise Information Infrastructures for Active, Context-Sensitive Knowledge Delivery. *Proceedings of*

ECIS'99 – The 7th European Conference in Information Systems, Copenhagen, Denmark. June 1999.

[ADV00] The ADVISOR project. http://www.boc-eu.com/advisor Access 19/06/2000.

[IST00] The IST programme. Overview of the programme. http://www.cordis.lu/ist/overview.htm Access 19/06/2000.

[Kar95] D. Karagiannis. BPMS: Business Process Management Systems. *ACM SIGOIS Bulletin*, 16: 10-13, 1995.

[Kar96] D. Karagiannis, S. Junginger, R. Strobl. Introduction to Business Process Management System Concepts. In: B. Scholz-Reiter, E. Stickel (eds.), *Business Process Modelling*, 81-106. Berlin: Springer 1996.

[Nis00] M.E. Nissen, M.N. Kamel, C. Sengupta. Torward Integrating Knowledge Management, processes and Systems: A Position Paper. In Steffen Staab et al. (eds.), *Proceedings of the AAAI Spring Symposium Series 2000 Bringing knowledge to business processes*, Stanford, CA, March 2000.

[REF00] The REFINE project. http://www.boc-eu.com/refine Access 19/06/2000.

[Rei00] U. Reimer, A. Margelisch, M. Staudt. A Knowledge-Based Approach to Support Business Processes. In Steffen Staab et al. (eds.), *Proceedings of the AAAI Spring Symposium Series 2000 Bringing knowledge to business processes*, Stanford, CA, March 2000.

[Rem00] U. Remus, F. Lehner. The Role of Process-oriented Enterprise Modeling in Designing Process-oriented Knowledge Management Systems. In Steffen Staab et al. (eds.), *Proceedings of the AAAI Spring Symposium Series 2000 Bringing knowledge to business processes*, Stanford, CA, March 2000.

[Sta99] S. Staab, H. Schurr. Knowledge and Business Processes: Approaching an Integration. *Proceedings of the Workshop on Knowledge Management and Organizational Memories*, in conjunction with IJCAI'99, http://www.inria.fr/acacia/WORKSHOPS/IJCAI99-OM/proceedings.html, Stockholm, August 1999.