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Editorial: Organizational memory and knowledge management

Stefan Decker
University of Karlsruhe, Institute AIFB, D-76128 Karlsruhe, Germany
email: stefan.decker@aifb.uni-karlsruhe.de

Frank Maurer
University of Calgary, Department of Computer Science, Calgary, Alberta, T2N 1N4, Canada. e-mail: maurer@cpsc.ucalgary.ca

1. Introduction

> "KNOWLEDGE IS CRITICAL FOR DEVELOPMENT, because everything we do depends on knowledge. Simply to live, we must transform the resources we have into the things we need, and that takes knowledge. And if we want to live better tomorrow than today, if we want to raise our living standards as a household or as a country and improve our health, better educate our children, and preserve our common environment we must do more than simply transform more resources, for resources are scarce. We must use those resources in ways that generate ever higher returns to our efforts and investments.
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> That, too, takes knowledge, and in ever-greater proportion to our resources. For countries in the vanguard of the world economy, the balance between knowledge and resources has shifted so far toward the former that knowledge has become perhaps the most important factor determining the standard of living more than land, than tools, than labor.
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> Today's most technologically advanced economies are truly knowledge-based. And as they generate new wealth from their innovations, they are creating millions of knowledge related jobs in an array of disciplines that have emerged overnight: knowledge engineers, knowledge managers, knowledge coordinators."

From a birds eyes view, this quote taken from the World Development Report 98/99 (1998) of the World Bank describes why Knowledge Management receives more and more interest nowadays. Enterprises are learning this lesson, and are promoting Knowledge Management to increase their competitiveness. The globalization of businesses produces an enormous market pressure. This enforces ever shorter product-life cycles and demands more efficient usages of all resources. At the same time, technology supports geographically dispersed development teams, virtual enterprises and close cooperation with suppliers, customers and service providers. These factors lead to complex communication and coordination flows, complex both in technical and in conceptual terms.

Under the label of lean management and downsizing, the last wave of enterprise engineering efforts cut of middle management and older employees from many organizational structures. This level of employees had been an important stakeholder of know-how and experience about projects, customers and products, and used to perform

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the task of knowledge gathering, filtering, interpretation and routing as a preprocessing step preparing decisions of the upper management.

Knowledge Management technology tries to compensate all the above-mentioned issues.

1.1. TECHNICAL ASPECTS OF KNOWLEDGE MANAGEMENT & ORGANIZATIONAL MEMORIES

Although Knowledge Management (KM) is an issue in human management and enterprise organization beyond any specific technology questions, there are important aspects that can be supported or even enabled by intelligent information systems. Identification, acquisition, development, dissemination, utilization and preservation of knowledge in the enterprise have been identified as basic KM activities (cf. Davenport, Jarvenpaa & Beers, 1997). Knowledge acquisition and related fields provide solutions for important parts of the overall KM problem. Knowledge Engineering and Enterprise Modeling technique can contribute to the identification and analysis of a company's knowledge-intensive work processes (e.g. product design or strategic planning). The analysis of knowledge required for a specific task allows to identify shortcomings of business processes. It is the basis for specifying requirements on potential information technology support. In an organization, know-how consists of, e.g. problem-solving expertise in functional disciplines, experiences of human resources, process experiences, technical design issues and lessons learned. The coherent integration of this dispersed know-how is called Organizational Memory (OM) or Organizational Memory Information System (OMIS) (cf. Stein, 1995). It is regarded as the central prerequisite for Knowledge Management support and is a means for knowledge conservation, distribution and reuse (cf. Abecker & Decker, 1999). An OM enables organizational learning and continuous process improvement. An OM has to meet a set of distinctive requirements.

- *Representation format*: The OM may contain formalized knowledge as well as semi-formal (like visual design documents or SGML/XML documents) and completely informal representations (like plain text documents). The reason for this is that knowledge will only be formalized if it has reached a stable state of acceptance and if the effort of formalization will be paid off by application systems that make use of it. Applications usually require deeply integrated use of all these different types of knowledge. They demand abilities to manage disparate know-how and heterogeneous viewpoints, to make it accessible and suitable for all members of the organization.
- *Building and maintenance*: The ongoing maintenance of an OM is expensive and has to pay off for the company. An OM cannot continuously be filled and maintained manually by experienced knowledge engineers. Instead, the maintenance of the system needs to be a by-product of the daily work of its users. On-the-fly acquisition of knowledge from ordinary users must be supported by carefully designed cooperative user interfaces. More formalized knowledge must be acquired using easy-to-use modeling languages, e.g. visual languages, etc. In the long run, OM maintenance may be supported by machine learning or text understanding facilities.
- *Knowledge retrieval and utilization*: The very mass of knowledge stored in an enterprise-wide OM, as well as its diversity in terms of representations, media and contents, make retrieval using conventional information access methods difficult. Process-based indexing, formal ontologies, cooperative interactive user interfaces, personalized

information agents, and knowledge-based retrieval will help to provide knowledge actively and in the right context. This task may be eased if sufficient meta-data is stored, e.g. the description how a knowledge item was derived, why it is believed to be valid, in which context it holds or who supports it. But this raises other questions, because nobody can keep thousands of concepts in mind. So, tool support is necessary to find right terms needed to pose a query or to define a new concept. Apart from querying, push technologies based on domain-specific causality and traceability relations can enable an active, context-dependent knowledge supply directly to users. This, however, raises other questions, e.g. how to formulate appropriate selection criteria to determine an adequate list of recipients so that information overload is avoided.

1.2. ORGANIZATIONAL MEMORIES VS. KNOWLEDGE-BASED SYSTEMS

The goals of OMS and the "old" knowledge-based systems (KBS) are very similar. So, it is fair to raise the question why OMIS will succeed whereas the application of KBS technology is rather limited (although its development was heavily funded). However, there are some important differences between a conventional knowledge based system and an OMIS.

- A KBS focuses on the solution of a single task (typically solved by a *problem-solving method*). This is not true for an OMIS: it supports at least a collection of different business processes and thus has to support different tasks.
- A KBS tries to automate reasoning processes or parts of them. Therefore, a KBS requires formalized knowledge which is expensive to develop. An OMS supports its human users (and their reasoning processes) by providing access to relevant knowledge entities. An OMIS integrates different kinds of knowledge, e.g. best practices (Althoff, Bomarius & Tautz, 1998), design rationales (Buckingham Shum, 1997), process knowledge (Maurer and Dellen, 1998) in different formats, e.g. hypertext (Euzenat, 1996) and formal knowledge bases. Typically, informally represented knowledge is usually much more important in an OMIS than formally represented knowledge. This kind of knowledge is generally cheaper to acquire.
- Groupware and knowledge dissemination techniques are usually not part of a KBS, but are essential for an OMIS because the knowledge inside the system has to be communicated to the employees of the company. In addition, an OMIS has to integrate different existing legacy applications.

A KBS can be part of an OMIS. Then it supports the knowledge-based solution of single business tasks. Furthermore, techniques developed in Knowledge Engineering and Acquisition (cf. Wielinga, Sandberg & Schreiber, 1997) can contribute to a methodology for building an OMIS and supporting a Knowledge Management Strategy.

1.3. MOTIVATION FOR THIS SPECIAL ISSUE

Several past and future workshops dealt with or will deal with KM & OMIS.

- KAW-99 Session on "Knowledge Management and Knowledge Distribution through the Internet" (Banff, Canada, 16–22 October 1999).

- IJCAI-99 Workshop on "Knowledge Management and Organizational Memories" (Stockholm, Sweden, 31 July–6 August 1999).
- AAAI-99 Workshop on "Knowledge Management and Case-Based Reasoning" (Orlando, USA, 18–22 July 1999).
- ECAI-98 Workshop "Interdisciplinary Workshop on Building, Maintaining, and Using Organizational Memories" (Brighton, UK, 1998).
- KAW-98 Session on "Knowledge management and knowledge distribution through the Internet" (Banff, Canada, 1998).
- AAAI Spring Symposium Workshop "AI in Knowledge Management" (Stanford University USA, 1997).

Knowledge Management and Organizational Memory Information Systems are also discussed in many different fields of research, e.g. in computer-supported cooperative work, economics, psychology, and knowledge engineering. These developments are currently quite unrelated and independent and not much discussion is going on between these different research communities. Thus, a major goal was to bring together results discussed in various knowledge engineering events together with results from other fields to present a snapshot of an emerging discipline. Although the field is still young, there are some trends, which seem to stabilize.

2. Topics of the special issue

In this section, we will briefly describe the different topics dealt within this special issue along with a brief description of how the various papers fit in.

2.1. METHODS AND TOOLS FOR BUILDING ORGANIZATIONAL MEMORIES

When a company decides to spend effort in defining and realizing a knowledge management strategy, this involves typically several tasks. At first, an initial project is set-up, which defines the goals to reach. Second, typically, also the position of a "knowledge manager" is introduced. This initial project as well as the knowledge manager need methodological support for defining and establishing a knowledge management strategy. The papers introduced in this section deliver this kind of support.

Siemieniuch and Sinclair define knowledge types in their paper "Organisational Aspects of Knowledge Lifecycle Management in Manufacturing". They draw conclusions how to manage knowledge dependent on its type.

In "Knowledge Management Techniques: Teaching & Dissemination Concepts", Macintosh, Filby and Kingston describe a knowledge management dissemination model that helps establishing a KM framework.

For effectively providing such a framework, a knowledge manager needs a set of methods and tools. Dieng, Corby, Giboin and Ribière in "Methods and Tools for Corporate Knowledge Management" give a survey of methods and tools aimed at managing an organization's knowledge.

Special tools are described by David Schwartz in "When email Meets Organizational Memories: Addressing Threats to Communication in a Learning Organization". Schwartz analyses threats to communication inside an organization and addresses these threats with the development of the HyperMail system, a meta-knowledge and ontology

based email system that helps to organize email messages.

Tools that are well known in the Knowledge Acquisition area are extended and used for Knowledge Management in "Towards a Knowledge Technology for Knowledge Management" by Milton, Shadbolt and Cottarn.

2.2. APPLICATION OF ORGANIZATIONAL MEMORIES AND KNOWLEDGE MANAGEMENT

The papers in this category concentrate on application aspects. Knowledge Management is an important issue in software development projects. This point is stressed by Landes, Schneider, and Houdek in "Organizational Learning and Experience Documentation in Industrial Software Projects". The authors present findings regarding the usage of best practices and lessons learned in software development.

Another case study is presented by Robertson and Reese in "A Virtual Library for Building Community and Sharing Knowledge". Here the authors focus on making a digital library a place to exchange knowledge rather than just a means to look up information.

Benjamins, Fensel, Decker and Gómez-Pérez describe the (KA^2) initiative and their Ontobroker system in "(KA^2): Building Ontologies for the Internet: a Mid term Report". The authors aim at the joint establishment of an ontology for the Knowledge Acquisition community.

3. Conclusions

We think that this special issue provides a valuable collection of papers representing a snapshot of today's Knowledge Management and Organizational memory research. The papers cover a broad range: from methodological issues over tools to applications. We hope that we succeeded in putting together a collection of papers that is interesting for many readers.

We gratefully thank the reviewers who dedicated their time to make this a high-quality issue. The quality of journal publications is the hands of qualified and knowledgeable volunteers since reviewing is mostly an anonymous job. However, without reviewers there would be no good publications. Reviewers for this special issue were: Andreas Abecker, Mark Ackerman, Klaus-Dieter Althoff, Richard Benjamins, Richard Bentley, Frank Bomarius, Uwe M. Borghoff, Jürgen Branke, Simon Buckingham Shum, Nicholas H. M. Caldwell, Olivier Corby, Leela Damodran, John Debenham, Vladan Devedzic, Rose Dieng, John Domingue, Jérôme Euzenat, Dieter Fensel, Olivier Gerbé, Asuncion Gomez Perez, Udo Hahn, Knut Hinkelmann, Frank Houdek, Avon Huxor, Matthias Jarke, Dieter Landes, Franz Lehner, Ann Macintosh, Patrizia Marti, Simon Masterton, Nada Matta, David W. McDonald, Peter Mertens, Nick Milton, Hector Munoz-Avila, Markus Nick, Cyrus F. Nourani, Andreas Oberweis, John O'Neil, Mark Perry, Jean Pierre Poitou, Ulrich Reimer, Myriam Ribiere, Scott Robertson, Paul A. Rodgers, Duska Rosenberg, Kurt Schneider, David Schwartz, Steffen Staab, Rudi Studer, Tamara Summer, Carsten Tautz, Bidjan Tschaitschian, Christoph Wargitsch and Stuart Watt.

References

ABECKER, A. & DECKER, S. (1999). Organizational Memory: Knowledge Acquisition, Integration, and Retrieval Issues. In: F. PUPPE (ed.): Knowledge based systems: Survey and Future Directions, *Proceedings of the 5th German Conference on Knowledge-based systems*, Wuerzburg, March 1999, LNAI, Vol. 1570. Springer-Verlag.

ALTHOFF, K.-D., & BOMARIUS, F. & TAUTZ, C. (1988). Using case-based reasoning technology to build learning software organizations. *Proceedings of the 1st Interdisciplinary Workshop on Building, Maintaining, and Using Organizational Memories* (*OM*-98), *13th European Conference on Al* (*ECAI*'98), Brighton. http://SunSITE.Informatik.RWTH-Aachen.DE/Publications/CEUR-WS/Vol-14/

BUCKINGHAM SHUM, S. (1997). Negotiating the construction and reconstruction of organisational memories. *Journal of Universal Computer Science* (Special Issue on Information Technology for Knowledge Management), **3,** Springer Science Online. 1997.

DAVENPORT, T. H., JARVENPAA, S. L. & BEERS, M. C. (1997). Improving knowledge work processes. *Sloan Management Review*, **37,** 53–65.

EUZENAT, J. (1996). Corporate memory through cooperative creation of knowledge bases and hyper-documents. *Proeedings of the 10th Knowledge Acquisition, Modeling and Management for Knowledge-based Systems Workshop* (*KAW'96*), Banff.

KÜHN, O. & ABECKER, A. (1997). Corporate memories for knowledge management in industrial practice: prospects and challenges. *Journal of Universal Computer Science* (Special Issue on Information Technology for Knowledge Managment), **3** Springer Science Online. URL: http://www.iicm.edu/jucs_3_8/corporate_memories_for_knowledge.

MAURER, F. & DELLEN, B. (1998). An Internet based software process management environment. *Proceedings ICSE*'98 *Workshop on Software Engineering* over the Internet. http://sern.cpsc.ucalgary.ca/ ~ maurer/ICSE98WS/Submissions/Maurer/ICSE.html

STEIN, E. W. (1995). Organizational memory: review of concepts and reconmmendations for management. *International Journal of Information Management*, **15,** 17–32.

WIELINGA, B. J. & SANDBERG, J. & SCHREIBER, G. (1997). Methods and techniques for knowledge management: what has knowledge engineering to offer. *Expert Systems with Applications* **13,** 73–84.

World development report 98/99 (1998). Published for the World bank by Oxford University Press, See also: http://www.worldbank.org/wdr/wdr98/contents.htm.