

# Corporate Semantic Webs

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## INTRODUCTION

An organization is made up of people interacting for common objectives, in a given structure (may be rather formal in the case of a company, an administration, or an institution, or rather informal in the case of an interest community or a practice community), in an internal environment, and with an external environment.

Based on definitions of Grundstein (2004) and O'Leary (1998), we define knowledge management (KM) as the “*management of knowledge resources of an organization in order to ease:*”

- *access, sharing, reuse of this knowledge (that can be explicit or tacit, individual or collective), with an objective of capitalization;*
- *creation of new knowledge, with an objective of innovation.”*

Among the various approaches for KM, this article focuses on those aimed at knowledge capitalization and sharing. They can rely on the notion of corporate memory (or organizational memory (OM)) that, extending van Heijst's definition (1996), we define as the “explicit and persistent materialization of crucial knowledge and information of an organization in order to ease their access, sharing out and reuse by the members of the organization in their individual and collective tasks” (Dieng-Kuntz et al., 2001).

As such an OM relies on individuals interacting in an organization, with support of software tools, construction and management of a corporate memory require a multidisciplinary approach, taking into account at least three dimensions: (1) *individual* (memory must be compatible with users' cognitive models and their work environment), (2) *organization* (memory must be compatible with culture and strategy of the organization), and (3) *technology* (the chosen software tools must be adapted to the memory objectives and to the environment of future users).

This article will detail a particular approach of OM called the “corporate semantic Webs” approach, proposed by the Acacia team which the author deeply thanks.

## BACKGROUND

### From Knowledge-Based Systems to Knowledge Management

If the need of KM in enterprises has long been emphasized in management sciences (Grundstein, 2004), this notion started to be studied thoroughly at the beginning of the '90s by artificial intelligence researchers who had previously worked on expert systems and knowledge-based systems (KBSs), and had evolved towards knowledge engineering (KE): Steels (1993) was one of the first researchers in this community to stress the notion of corporate memory in order to promote knowledge growth, knowledge communication, and knowledge preservation in an organization; since 1993, the ISMICK conferences have been dedicated to these topics (Barthès, 1996). In 1996, the KE community emphasized the interest of OMs and its differences with regards to KBS: definitions were proposed (van Heijst, Van der Spek, & Kruizinga, 1996), as well as concrete examples (Dieng et al., 1996). Then several workshops at KAW, ECAI, IJCAI, and AAAI thoroughly studied methods and tools for building and using OMs (Dieng & Matta, 2002).

### Ontologies and Knowledge Management

Meanwhile, the KE community was working on *ontologies* (Gruber, 1993). The Banff Knowledge Acquisition workshops (KAW)<sup>1</sup> enabled a better comprehension of foundations of ontologies (Guarino & Garetta, 1995; Guarino, 1996). Researchers proposed tools for collaborative building of ontologies (Farquhar, Fikes, & Rice, 1996; Domingue, 1998; Tennison & Shadbolt, 1996), as well as concrete, huge ontologies in KM large applications (Swartout et al., 1996; Golebiowska, Dieng, Corby, & Mousseau, 2001). Moreover, some researchers on ontologies emphasized the interest of ontologies for KM (Benjamins, Fensel, & Gómez-Pérez, 1998a; Dieng et al, 2001).

The (KA)<sup>2</sup> initiative (Benjamins et al., 1998b) was a significant example of collaborative building of an ontology and of semantic annotations by the knowledge acquisition community.

## Knowledge Management Based on Ontologies and Documents

The evolution from KBS to KM was based on the idea that a corporate memory could be naturally materialized in a knowledge repository without any reasoning aims; therefore ontologies seemed to be a quite natural way to make the conceptual vocabulary shared by an organization explicit. But this evolution led to recognition that the most frequent knowledge sources that could be integrated in an OM were documents. The need for a link between documents (considered as informal knowledge sources) and knowledge bases/ontologies (expressing formal knowledge) was emphasized by research that associated to a document a knowledge base aimed at making the underlying semantics of the document explicit and at improving information retrieval by reasoning on this knowledge base (Martin, 1997; Euzenat, 1996). The advent of XML led several KM researchers to rely on XML-based formalisms and on the future semantic Web (Rabarijaona, Dieng, Corby, & Ouaddari, 2000; Martin & Eklund, 2000). Shoe (Luke, Spector, Rager, & Hendler, 1997) and Ontobroker (Fensel, Decker, Erdmann, & Studer, 1998) offered an ontology-guided information retrieval approach; community semantic portals were developed using such tools (Staab et al., 2000).

## Knowledge Management and the Semantic Web

The interest of the Web for KM and knowledge distribution over the Internet, either through an intranet or through the open Web, was stressed by O’Leary (1997), by the KAW’98 track on “Knowledge Management and Distribution over the Internet,”<sup>2</sup> as well as some special issues of journals (Dieng, 2000) and books (Schwartz, Divitini, & Brasethvik, 2000).

In 1998, Berners-Lee proposed his vision of the semantic Web:

*The Web was designed as an information space, with the goal that it should be useful not only for human-human communication, but also that machines would be able to participate and help. One of the major obstacles to this has been the fact that most information on the Web is designed for human consumption, and... that the structure of the data is not evident to a robot browsing the Web. Leaving aside the artificial intelligence problem of*

*training machines to behave like people, the Semantic Web approach instead develops languages for expressing information in a machine processable form.*

He gave a roadmap for evolving “from the Web of today to a Web in which machine reasoning will be ubiquitous and devastatingly powerful” (Berners-Lee, 1998).

Several research communities (database, intelligent systems (Schwartz, 2003), knowledge engineering and knowledge representation, information retrieval, language technologies, distributed artificial intelligence and multi-agent systems, machine learning, Computer-Supported Collaborative Work, etc.) recognized in this ambitious objective a fabulous potential application of their research.

Last, the importance of social networks in which interactions and cooperation could be enhanced through the Web explains the privileged role of the semantic Web as a basis for supporting such networks, in particular with participants distributed geographically.

## European Projects on Knowledge Management and the Semantic Web

Several collaborative European or national projects studied semantic Web approaches for KM:

- The C-WEB<sup>3</sup> (Community Webs) project (Christophidès, 2000) proposed an infrastructure for Web portals in user communities requiring efficient query answering using various information sources. This infrastructure, aimed at semantic portals, can be seen as an architecture for a community semantic Web.
- The On-to-Knowledge<sup>4</sup> project (Davies, Fensel, & van Harmelen, 2002) offered languages—such as OIL (Fensel et al., 2000), one precursor of OWL—methods, and tools aimed at applying ontologies to electronically available information for improving KM quality in large, distributed organizations.
- The CoMMA<sup>5</sup> (Corporate Memory Management through Agents) project (Gandon, Dieng-Kuntz, Corby, & Giboin, 2002) developed an ontology (O’CoMMA), as well as a *multi-agent system* for managing a distributed corporate memory materialized in a corporate semantic Web, some agents having machine learning capabilities.
- The British AKT (Advanced Knowledge Technologies) project (Shadboldt & O’Hara, 2004) relies on an integrated approach, combining artificial intelligence, psychology, linguistics, multimedia, and Internet technology, for developing the next generation of knowledge technologies in order to support

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