

# Preface

*To those who dream of a scientific world of fewer egos and more open minds and to all who dream of a world of peace and prosperity through knowledge and learning for everyone.*

In the knowledge society, the traditional facts of business life are volatile and not given. Every organization is challenged in this context, to enrich its sensors, and its internal processes toward the exploitation of tangible and intangible resources.

During the last few years, an important shift in management science and informatics has occurred. Human capital, knowledge and learning management have been recognized as key issues in every strategy and as new competitive resources of organizations. Due to this qualitative shift, several new scientific areas have emerged that jointly contribute to the understanding of how modern organizations work.

This edited book has a clear strategy and vision. We want to make clear that knowledge and learning management is not just two more buzzwords of the 21<sup>st</sup> century. We want to communicate that a solid theoretical background, in fact, an emerging discipline, has been exploited through specific technologies that support the operational and strategic function of organizations.

The selected chapters, that will be discussed briefly later, provide a context of questioning that triggers the interest in the crucial role of knowledge and learning management toward the establishment of intelligent infrastructures in modern organizations. Apart from promoting a clear style of presentations, this book reveals a scientific dialogue with references, promotes critical thinking, and seeks for creative feedback by the readers.

Our objective goes beyond the typical issue of describing the “overall theme” in scientific terms. We want to communicate that knowledge and learning management are the cornerstones of every business function. In this direction, we have decided to deploy an interdisciplinary approach: We combine the syllogisms of modern management and the leading edge approaches of information systems, informatics, and computer science, and the resulted synergy extends the value and the practical implications of the issues discussed in the various chapters of the book.

Theories and frameworks of knowledge and learning management are discussed in practical contexts, giving not only directions for implementations but also evidence for the increased knowledge-oriented performance.

Several scientists worldwide claim that the next “peaks” for the human mind are related to the design, development, and support of ubiquitous business intelligence. In this book’s 16 chapters, this milestone has been the subject of an in-depth analysis.

The Semantic Web flavor that we have decided to give to this book is not for marketing purposes. Our involvement in the Semantic Web and information systems community is dynamic:

- The Special Interest Group on Semantic Web and Information Systems in the Association for Information Systems (<http://www.sigsemis.org>) forms the basis.
- The official quarterly *AIS SIGSEMIS Bulletin* provides a flexible communication channel where research articles, news, and interviews by renowned people of SW support a great awareness campaign.
- The launch of the *International Journal on Semantic Web and Information Systems* (inaugural issue January-March 2005, available online at <http://www.idea-group.com>) was a key event for our contribution to our research community. With the leadership and inspiration of Professor Amit Sheth, *IJSWIS* is a high-quality journal that promotes important research.

We encourage you to become part of this exciting community.

This edited book is about organizing and utilizing the knowledge and learning resources of organizations. However, our vision goes a step further. Humanity’s collective knowledge and intelligence is the ultimate objective. In the next few years, we will be part of an exciting revolution with respect to how to manage knowledge and learning. Together, let us prepare for the future.

## Structure

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Being part of the knowledge and learning management research community for several years, we have decided to contribute by editing this book. Of course, one more book in a “rich” literature of the field might not be a significant issue. However, we think that we really developed a book that has three unique characteristics:

- It discusses all the key issues of the relevant research agenda.
- It provides practical guidelines and presents several technologies.
- It has a teaching orientation.

The last characteristic is a novelty of our book. Several edited books seem like a compilation of chapters but without a real orientation towards readers. We believe that leading-edge research must be beneficial for the target audiences, since otherwise it remains closed to “scientific clubs,” and the benefits of the knowledge sharing and dissemination are severely diminished. This is why every edited chapter is accompanied by a number of additional resources that increase the impact for readers.

Our “lenses” for the analysis of the various issues are based on management science and informatics, and our concluding remark points out that in the next years the strategic decision-making of organizations will be based on the management of knowledge and learning.

From this perspective, the theme of the book is more than in fashion. Knowledge and learning management, two issues that at first sight could be judged as general or descriptive, are put at the center of a systematic analysis. This book is the first one of a trilogy already planned. *Intelligent Learning Infrastructure for Knowledge Intensive Organizations: A Semantic Web Perspective* discusses interesting themes, and, concurrently, a didactic and learning approach is pursued in each chapter.

In the near future two more editions have been scheduled:

- *The Encyclopedia of Semantic Web Research*, an edited encyclopedia endorsed by the AIS SIG on Semantic Web and information systems (<http://www.sigsemis.org>), with a systematic analysis of the new technological and business reality of the technologies and frameworks that the Semantic Web promotes. This edition is a forthcoming publication by Idea Group Reference.
- *Knowledge Management Strategies: A Handbook of Applied Technologies* is an authored book emphasizing the business exploitation of knowl-

edge management. This book is a forthcoming publication by Idea Group Publishing.

The research fields of knowledge and learning management combine two challenging aspects of human life: First, they concentrate on two processes that are the first step toward any progress of humankind, even though their complexity and intellectual character poses many obstacles to their understanding. Moreover, the deployment of technology for their support is a socio-technical phenomenon, which means that no technological solution can ignore the importance of the human factor with all those behavior-intensive parameters. Given these general guidelines, we began planning the edited book. Three objectives were critical for us:

1. *To include chapters at the leading-edge of research* that discuss the complementary and dual character (social and technological) of the two key subjects, avoiding an extensive theoretical discussion by emphasizing the justification of technologies and systems.
2. *To develop an open book or a reference book*, where the summarized knowledge provides bridges for new journeys to the extensive knowledge on the Internet. This interactive game is evident in each chapter of the book. Case Studies, Further Readings, Internet Sessions, and Suggested Essays or Assignments provide excellent contexts for the exploitation of the knowledge presented in each chapter.
3. *To reveal the importance of critical thinking* with the main emphasis on solutions to real-world situations.

Next, we will try to sketch the flow and the purpose of each chapter. The book consists of 16 chapters. In each of them, we follow a common didactic learning approach.

At the beginning of each chapter we provide an *Editors' Notes* section, where we give our basic understanding of the chapter. The authors also provide a relevant section titled *Abstract*, which is a short synopsis of their chapter.

At the end of each chapter there are some very interesting sections, where readers can spend many creative hours. More specifically the relevant sections are titled:

- *Internet Session*. In this section we present one or more Web sites, relevant to the discussed theme in each chapter. The short presentation of each chapter is accompanied by the description of an *Interaction* where the readers

(students) are asked to make a guided tour of the Web site and to complete an assignment.

- *Case Study.* For each chapter, we provide “realistic” descriptions for one or more case studies that readers must consider in order to give strategic advice. The questions exploit the key concepts and technologies presented in the chapters. Of course, as readers reach the last chapters, these case studies can be analyzed in more detail and answers have to combine directions given in several chapters.
- *Useful URLs.* Web sites, with content capable of exploiting the knowledge communicated, are provided in every chapter, even though we know that several of them will be broken in a time horizon, since their synergy with the content of the chapter can support the final learning outcome.
- *Further Readings.* These refer to high quality articles available both on the Web and in electronic libraries. We have evaluated these resources as of significant value and conditionally we initiate criticism and creative ideas. Readers can spend many hours with these resources.
- *Possible Paper Titles/Essays.* Under this section, a number of titles for assignments are given. In the best case, essays could be working research papers. The general rule is that we provide three to six essay titles in each chapter, and in their abstract title readers can find an excellent context of questioning. The ultimate objective is that the knowledge delivered in each chapter should be exploited toward a scientific document that will provide a thesis for the readers.

The edited book consists of 16 chapters. Fifteen of them discuss various aspects of the theme, while one chapter features case studies. We provide a short synopsis of each chapter.

*Chapter I: The Corporate Learning Environment, by Jerry Klein and Deniz Eseryel*

Emerging technology has changed the focus of corporate learning systems from task-based, procedural training to knowledge-intensive problem-solving with deep conceptual learning. In addition, the deployment of open systems and distributed processing are adding new stresses to learning systems that barely can keep pace with the current rate of change. Learning environments to address these challenges are viewed within a framework of the conventional learning curve, in which different learning elements are required to support different levels of expertise. An adaptive development model for creating and sustaining a learning environment is proposed that consists of iterative applications of three phases: (1) analysis and reflection, (2) architecture inception and revision, and (3) alignment. The model relies on the notion that analysis deals as

much with synthesis and learning as it does with decomposition. The authors conclude that the concept of a “learning environment” provides a viable construct for making sense of the array of systems designed to support knowledge management, document management, e-learning, and performance assessment. A learning environment with a well-defined architecture can guide the convergence of multiple systems into a seamless environment providing access to content, multimedia learning modules, collaborative workspaces, and other forms of learning support. Finally, the authors see future learning environments consisting of networks of databases housing content objects, elegant access to the content, ubiquitous virtual spaces, and authoring tools that enable content vendors, guilds, and universities to rapidly develop and deliver a wide range of learning artifacts.

*Chapter II: Enabling Technologies for the Semantic Web, by Kevin Parker*

Before understanding the Semantic Web and its associated benefits, one must first be somewhat familiar with the enabling technologies upon which the Semantic Web is based. The extensible markup language (XML), uniform resource identifiers (URIs), resource definition framework (RDF), ontologies, and intelligent agents are all key to the realization of the Semantic Web. Understanding these key technologies gives readers a firm foundation before progressing on to subsequent chapters. This chapter provides a broad overview of each technology, and readers new to these technologies are provided with references to more detailed explanations.

*Chapter III: Knowledge Management Technologies for E-Learning: Semantic Web and Others, by Jinwei Cao and Dongsong Zhang*

This chapter explores some fundamental knowledge management technologies that have been applied to e-learning systems, including collaboration technologies, Semantic Web, information retrieval, and information visualization. However, the focus of this chapter is the Semantic Web and its related topics such as metadata and ontology, since it is now a new trend of the e-learning market. Instead of simply listing these technologies, this chapter provides an in-depth analysis and comparison between them. After reading this chapter, readers will understand the major knowledge management technologies used in e-learning and will be able to choose the proper technologies for different contexts or requirements.

*Chapter IV: From Knowledge Management System to E-Learning Tool, by Tang-Ho Lê, Chadia Moghrabi, John Tivendell, Johanne Hachey, and Jean Roy*

In this chapter the authors try to bridge the gap between e-learning, knowledge management (KM), and the Semantic Web (SW) by identifying the

principal properties and techniques that characterize each domain. They note that although there is a major difference in the knowledge nature of each domain, there is a knowledge evolution and an interrelation throughout the three domains. In this perspective they examine the similarities and differences, from a theoretical point of view, between knowledge management systems (KMS) and intelligent tutoring systems (ITS). They specifically focus on the knowledge transfer techniques in both systems such as the knowledge analysis needed to determine the knowledge content for both cases, the pedagogical planning for ITS, and the teaching model for KMS. Later, they examine the common task of ontology construction in the KM and SW domains as well as recommendations. Next, they tackle the experimental issues by presenting the dynamic knowledge network system (DKNS), a general purpose KMS tool that also is used as self-learning software in several projects. Finally, they highlight some emerging trends within the three previously-mentioned domains.

*Chapter V: Knowledge Management and Knowledge Management Systems, by Deniz Eseryel, U. Yeliz Eseryel, and Gerald S. Edmonds*

Organizations are fast realizing that knowledge management (KM) is critical to achieve competitive sustainability. However, mere realization that KM is critical does not ensure a smooth road to success. Fifty to 70% of KM initiatives reportedly fail. One of the main reasons of this failure is the lack of understanding of effective dimensions of KM implementation. In this chapter, the authors propose an integrated framework for knowledge management. Special attention is given to how knowledge management systems should be positioned within organizations. Examples of successful integration are provided by three case studies from different organizations.

*Chapter VI: Building Integrative Enterprise Knowledge Portals with Semantic Web Technologies, by Torsten Priebe*

The goal of this chapter is to show how Semantic Web technologies can help building integrative enterprise knowledge portals. Three main areas are identified: content management and metadata, global searching, and the integration of external content and applications. For these three areas the state-of-the-art as well as current research results are discussed. In particular, a metadata-based information retrieval and a context-based portlet integration approach are presented. These have been implemented in a research prototype which is introduced in the Internet session at the end of the chapter.

*Chapter VII: Knowledge Agents: Exploiting the Community Paradigm for Collective Intelligence, by Achilleas Anagnostopoulos, Nikolaos Lampropoulos, and Sotiris Michalakos*

In this chapter, the authors approach some significant concepts consistent with knowledge and cognitive processes that are essential for any kind of contemporary organization. Therefore, after citing a generic approach to knowledge management and its facilitating tools, along with a description of software agents and their categories, the authors indicate precious elements and details for the prerequisites while designing and implementing such intelligent solutions. They also discuss collaborative agent systems, known as agent societies, and present some appealing implementations of complex agent systems. Finally, they portray some of our thoughts regarding the perspective of employing smart agent technology in our everyday life.

*Chapter VIII: Intelligent Tutoring Systems for the New Learning Infrastructure, by Marko Rosic, Vlado Glavinic, and Slavomir Stankov*

Intelligent tutoring systems (ITS) are a generation of computer systems which provide students with learning and teaching environments adapted to their knowledge and learning capabilities. In this chapter, authors analyse the conception of intelligent tutoring systems in the new learning infrastructure environment, encompassing technologies like the Semantic Web and Web services.

*Chapter IX: Classroom for the Semantic Web, by Goran Simic, Dragan Gasevic, and Vladan B. Devedzic*

This chapter emphasizes integration of Semantic Web technologies in intelligent learning systems by giving a proposal for an intelligent learning management system (ILMS) architecture that the authors call Multitutor. This system is a Web-based environment for the development of e-learning courses and for the use of them by the students. Multitutor is designed as a Web-classroom client-server system, ontologically founded, and it is built using modern intelligent and Web-related technologies. This system enables teachers to develop tutoring systems for any course. The teacher has to define the metadata of the course: the chapters, the lessons and the tests, and the references to the learning materials. The authors also show how the Multitutor system can be employed to develop learning systems that use ontologically created learning materials as well as Web Services. As an illustration, authors describe a simple Petri net teaching system that is based on the Petri net infrastructure for the Semantic Web.

*Chapter X: Toward an Integrated E-Collaboration Framework for Learning Purposes, by Nikos Karacapilidis*

This chapter discusses issues to be considered in the development of a framework with advanced e-collaboration features for learning purposes. Having first identified the underlying requirements, the author reviews enabling technologies and proposes an approach that seamlessly integrates knowledge management, decision-making, argumentative discourse, and simulation issues. In addition, the author comments on the extent to which the approach satisfies the needs of virtual learning communities and supports various learning methods, such as learning by doing, conversational learning, and constructive criticism of an issue or an abstract idea. The proposed framework acts as a medium in which diverse knowledge and information sources can be delivered, thus aiding people involved in a learning process to widen their perspectives and learn from past experiences.

*Chapter XI: Ontology-Based Competency Management: Infrastructures for the Knowledge Intensive Learning Organization, by Miguel-Angel Sicilia*

Learning activities can be considered as an outcome of a complex process inside knowledge-intensive organizations. This process encompasses a dynamic cycle, a loop in which business or organizational needs trigger the necessity of acquiring or enhancing human resource competencies that are essential to the fulfillment of the organizational objectives. This continuous evolution of organizational knowledge requires the management of records of available and required competencies, and the automation of such competency handling thus becomes a key issue for the effective functioning of knowledge management activities. This chapter describes the use of ontologies as the enabling semantic infrastructure for competency management, describing the main aspects and scenarios of the knowledge creation cycle from the perspective of its connection with competency definitions.

*Chapter XII: From Knowledge Repository to Knowledge Space, by Martin Dzbor, Enrico Motta, and Arthur Stutt*

Management literature recognizes that knowledge is replacing more traditional sources of competitive advantage, and perhaps the only sustainable competitive advantage is the ability to use and embed knowledge into an organization's working life. In this chapter, the authors look at the notion of embedding knowledge chunks in a variety of contexts from the viewpoint of ontological frames. They suggest a three-level typology that was driving their efforts to develop a knowledge-rich application based on Semantic Web technologies. The core concepts refer to their Frame-Annotate-Navigate framework, and they discuss this extrapolation in terms of moving from designing knowledge portals and centralized repositories toward supporting open and modular knowledge spaces.

*Chapter XIII: Ontologies and E-Learning: How to Teach a Classification by Matteo Cristani*

Ontologies define the kind of things that exist in the world, and, possibly, in an application domain. In other words, an ontology provides an explicit conceptualisation, which describes the semantics of data, providing a shared and common understanding of a domain. This chapter can help readers understand a number of crucial issues about the adoption of learning within organizations through ontologies and Semantic Web technologies. Moreover, this chapter gives answers to the frequently asked question: What is an ontology?

*Chapter XIV: A Case Study in Supporting Distributed, Loosely-Controlled and Evolving Engineering of Ontologies, by York Sure, Christoph Tempich, Sofia Pinto, and Steffen Staab*

Knowledge management solutions relying on central repositories sometimes have not met expectations, since users often create knowledge ad-hoc using their individual vocabulary and using their own decentralized IT infrastructure (e.g., their laptop). To improve knowledge management for such decentralized and individualized knowledge work, it is necessary to, first, provide a corresponding IT infrastructure and, second, to deal with the harmonization of different vocabularies/ontologies. In this chapter, the authors briefly sketch the technical peer-to-peer platform that they have built, and then focus on the harmonization of the participating ontologies. The objective of this harmonization is to avoid the worst incongruencies by having users share a core ontology that they can expand for local use at their will and individual needs. The task that then needs to be solved is one of distributed, loosely-controlled, and evolving engineering of ontologies. Finally, the authors present a corresponding process template and a case study.

*Chapter XV: Collaboration and Pervasiveness: Enhancing Collaborative Learning Based on Ubiquitous Computational Services, by Kazuhiko Shibuya*

This chapter attempts to contribute towards exploring fundamental conceptualizations on collaboration and pervasiveness in education. An assigned task is to clarify concepts on collaborative learning based on ubiquitous computation and Semantic Web perspectives. Collaborative activities and computer-supported collaborative learning (CSCL) per se include various needs to encourage the motivation and understanding of each student. The author recognizes that collaborative learning in a ubiquitous environment can provide more interactive, experiential, spatio-temporal, and distributed aspects for anyone who wants to acquire information and solve educational tasks, coordinating with others at any time. Furthermore, the author concentrates on exploring possibilities of collaborative learning with semantic technologies which inspires and facili-

tates more reciprocal exchanges among affiliated relationships in ubiquitous environments.

*Chapter XVI: Case Study: Knowledge Sharing, Communities of Practice, and Organizational Change at the World Bank Group, by Lesley Shneier*

The author has prepared an excellent case study. The World Bank, or the “Knowledge Bank” Case, is an excellent teaching tool for those who wish to exploit the contents of this book for learning purposes. We have added some effort and developed some assignments for students. It is a good case for supporting a modular week per week assignment.

We used to say that each end is just a new start. We are very happy about the completion of this book and the excellent collaboration that brought together 40 academics and practitioners who worked for more than a year and a half on this book. We hope that you enjoy the contents and we would be grateful for your comments and ideas as well as for inquiries on knowledge and learning management.

Our Knowledge Management Research Group, at the Royal Institute of Technology, Sweden, <http://kmr.nada.kth.se>, in the next year will be expanded further aiming to become one of the highest quality leading competence and research centres on knowledge and learning management with many branches worldwide.

We are developing two more edited books, both forthcoming:

- *Open Source for Knowledge and Learning Management: Strategies Beyond Tools*, and
- *Ubiquitous and Pervasive Knowledge and Learning Management: Semantics, Social Networking and New Media to Their Full Potential*.

We invite you to join us again!! Au revoir, Arrivederci!!

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