Chapter XIII
Integration of Knowledge Resources in R&D Organizations: The Case of Mihajlo Pupin Institute

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ABSTRACT

This chapter introduces a business integration framework suitable for knowledge management in research and development (R&D) organizations in the high-technology sector. The knowledge management platform design is based on the latest technological trends and standards. Two main constituents of the proposed system are: the document warehouse layer, based on data warehousing methodology; and the semantic layer, based on the latest semantic technologies—ontologies and Web services. The initial results of introducing such a platform at the Mihajlo Pupin Institute (MPI) in accordance with the adopted ISO 9001 Quality Assurance standard are presented and discussed. The implementation of this integrated system is a large, multifaceted project carried on by turns in a bottom-up and top-down manner. Its use at MPI will facilitate reusability of knowledge items, and enhance creativity and innovation.
The most important activities in an R&D process are governance of research efforts towards innovation (Suh, Derich Sohn, & Kwak, 2004) and effective management of scientific and technical knowledge transfer towards industry (Rodrigues, Castellanos, & Rangelov, 2004). To improve creativity and speed up product development, research work typically requires internal integration of heterogeneous knowledge resources, such as publication database, project management database, human resources database and so forth. Furthermore, technology transfer to other research groups or industry depends on business integration of the partnering companies; that is, the compatibility of their information infrastructures. Therefore, business integration is of high importance for an R&D organization.

The term “business integration” usually refers to plans, methods and tools aimed at modernizing, consolidating and coordinating the computer applications in an enterprise; for example, migrating the existing legacy applications and databases to be used in semantic Web. The business integration initiative is often carried out under the umbrella of a knowledge management initiative that aims to enhance knowledge processing and organizational learning capacity, protect and develop intellectual capital, be innovative and competitive on the market, serve customers and so forth. Current state-of-the-art business integration systems are based on open standards (Java/J2E, eXtensible Markup Language/XML, XSLT, WSDL) as well as on semantic technologies (Resource Description Framework/RDF & RDF Schema, DAML+OIL, Web Services Description Language/WSDL, Web Ontology Language/OWL, etc.) (Omelayenko, 2002; Tsai et al., 2003; Turner, Budgen, & Brereton, 2003). Besides business automation and enterprise integration, knowledge solutions support all aspects of knowledge processing and exchange, including knowledge extraction, representation and retrieval.

A year ago, a knowledge management initiative started at MPI with the aim to create a knowledge sharing environment that will integrate and automate indoor information flows, facilitate research work by providing a standard access to documentation and research results (publications, technical documentation, methods, prototypes, software products), as well as help protect the intellectual capital of the company. As employees are one of the main assets of the company, the new integration system should keep up-to-date information about the researchers’ professional skills, experience and expertise. The new integration system should also simplify and centralize the administration of registries (e.g., products database, reference database), thus providing consistent information for all users involved in marketing and sales activities.

This chapter presents the results of designing and implementing an integration system suitable for R&D organizations in the high-technology industry. The integration system is based on the data warehousing methodology and the latest semantic technologies; that is, ontologies and Web services. The chapter is organized as follows: First, we enlighten the relation of business integration and knowledge management in general, as well as the need for business integration in R&D environments. Then, we propose a holistic knowledge management infrastructure applicable for R&D organizations and discuss state-of-the-art technologies for business integration, knowledge creation and exploitation. The following section introduces the problem of knowledge resources integration in MPI, as well as the undertaken activities carried on by turns in a bottom-up and top-down manner. Next, we present the future MPI knowledge management architecture and the chosen tools and technologies. The proposed architecture is composed of two main layers: the document warehousing layer and semantic layer, both of which are described. Concluding remarks and future work are discussed in the last section.
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