316d An Ontology-Based Platform for the Systematic Management and Analysis of Chemical Engineering Knowledge

Antonis Kokossis and Alexandros Kourakis

Chemical engineering is challenged to manage an increasing amount of technical knowledge critical and essential to business functions. The diverse knowledge accounts for innovations, new products and markets, emerging standards and environmental constraints, as well as important trends in technology and product design. Suppliers, competitors, employment markets, research groups, patents and new technologies can be monitored almost on a daily basis but general-purpose tools fail to produce solutions as the context of technical knowledge is complex. A systematic and validated methodology is presented to monitor and assess the changes and the trends of technology intensive domains.

In parallel to simulation or optimisation models, knowledge models can be developed around processes, products, professional duties and projects so that to monitor and manage changes, monitor trends and improve access to information that is available in research and industrial projects. Such models would naturally assume the form of ontologies and can be processed by agents to automate and systematize tasks required for searching and monitoring available resources. The research, which has been produced in collaboration with technology-intensive industries, makes use of ontologies and semantically enriched models done to facilitate a technical representation approach. The tools enable knowledge sharing and reuse, in accordance with recommendation of the Semantic Web. Ontologies are deployed to search, retrieve and analyze technical structured and unstructured context from heterogeneous sources of information. The research concluded to a prototype platform that capitalised and integrated the proposed tools and methods (crawlers, NLP tools, tokenizers, agent-enabled search methods) that is illustrated here with a real-life examples.

Technology-intensive industries assume particularly dynamic profiles whose attributes and composition face frequent and dramatic changes. The driving forces are new developments in science and engineering that reshape the industries, create opportunities for new expertise or displace professions of a lesser demand. Chemical Engineering, for example, is a discipline that reformed an original profile out of drilling, petrochemicals and dyes to polymers processing, and then to chemicals in agriculture (fertilizers, herbicides, and pesticides), biotechnology products, advanced materials, environmental design, and, more recently, to systems technologies, biomedical and genetic engineering products.

The dynamics of the different professional areas and scientific disciplines feature strong interactions with each other. Consequently, the assessment of trends and the evaluation of available opportunities represent particularly challenging problems. Technology intensive companies are usually global players and highly integrated industries. Knowledge management platforms dedicated to particular disciplines and expertise apparently neglect the underlying dynamics that constitute the driving forces for changes. Dynamics remain untraceable and elusive despite the vast amount of information available. Knowledge management is essentially practiced using ‘dumb' technologies such as databases, email tools and word processors, whereas access to resources is solely accomplished.

The paper aspires to this challenge and presents a systematic procedure that was tested with a variety of industrial examples for relevance and value. The research further promotes knowledge management practices with a generic approach that marshals state-of-the-art technologies towards a semi-automated approach that addresses dynamics of knowledge and takes the shape of a Knowledge Management Platform (KMP) that: ü enables knowledge seekers to search the Web for information relevant to their discipline and extract the intelligence (trends, emerging areas etc.) required to make decisions. ü empowers users to personalize and evolve knowledge maps of selected industrial/technological fields. Maps are evolved as new information is embedded enabling discoveries of implicit and explicit trends,

and ü serves as an intelligence aid to businesses challenged by dynamic markets, technology integration, technology-driven competition and the need to promote new products and services. Real life scenarios from the field of Chemical Engineering are presented. The examples are: 1. Technology watch, a real scenario to demonstrate how a leading chemical company can use the methods proposed to update a sample ontology that manages information on the technologies related to a key product. 2. Market watch, an example of a chemical company that uses the proposed tools to collect information and monitor the trends of the market of their concern.