KMIR – An ontology-based Framework for the successful Introduction of Knowledge Management

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Abstract

We present KMIR, an ontology-based framework, which supports organizations in the successful implementation of Knowledge Management (KM). The framework follows the holistic approach of a KM introduction by considering technological, organizational and human aspects, as well as the organizational culture in equal measure. KMIR provides recommendations based on Semantic Web technologies and Case-Based Reasoning (CBR) techniques. The best practices cases for a successful KM implementation are structured by the use of an ontology.

1 Introduction

In addition to the classical production factors land, work and capital, knowledge is qualified as the fourth factor of production in our day. Moreover, knowledge is regarded as a crucial competitive factor in the age of market globalization, harder competition of enterprises, shorter product life cycles, higher innovation speeds and ascending customer needs. The above-named changes demand an increasing knowledge transfer in and between organizations as well as the efficient acquisition and structuring of knowledge. However, the introduction of KM in an organization has to overcome innumerable barriers, which can be of an organizational, technical or cultural nature. Nevertheless KM is often regarded as a purely technical task, whereas organizational structure and infrastructure are not considered. Beyond that, so called "Best Practices", which are experiences from organizations, that have already implemented KM are often unstructured and therefore not directly transferable to the own organization's needs.

2 Method of Resolution

Our developed Knowledge Management Implementation and Recommendation Framework[1] (KMIR) provides the ontology-based structuring of Best Practice Cases (BPCs) for a (successful) introduction of holistic KM. Figure 1 depicts an excerpt of the KMIR ontology's conceptual level.

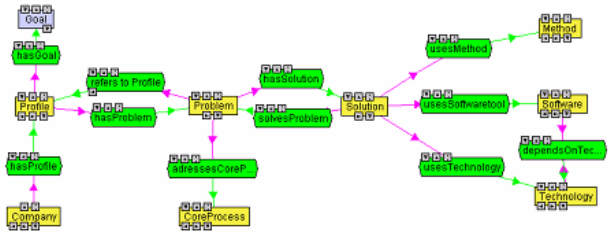

Figure 1: Excerpt of the KMIR ontology

Each BPC is stored as a set of interlinked "profile-instances" into the ontology. A BPC consists on the one hand of a general description of the organization, including size and sector, organizational structure and technical infrastructure as well as of several financial ratios (e.g. turnover and profit) and information about KM implementation costs and time. This has been realized by the two main concepts "company" and "profile" that are linked together using the property "Company has Profile" as well as by further sub-concepts of these two concepts that are faded out in figure 1. On the other hand, the case base structures organizational, technical and human-based problems and barriers, which the companies have/ had to solve, while introducing KM and how they managed to solve them. Therefore each modeled problem is linked to the profile by using the property "Profile has Problem" as well as to a solution by using the property "Problem has Solution" and the inverse property "Solution solves Problem". Problems can also be linked to a specific core process of KM (i.e. knowledge acquisition, knowledge sharing, etc.) [Probst *et al*. 2000]. Furthermore, problems can be divided into sub-problems (by the use of a property "problem consists of/ is part of problem") because KM approaches are of course never identical, and the organizations have sometimes already existing partial solutions with regard to a specific knowledge problem that can then be extended. Another purpose for dividing problems into sub-problems is that the assigned solutions of different profiles can individually be combined to new solutions. Modeled solutions follow the above-mentioned holistic approach, meaning that a solution considers technical, organizational and human aspects which are additionally linked

[1] http://wim.fzi.de:8080/kmirportal/dispatcher

among each other by modeled properties for each link. This is necessary because the implementation of a KM system depends for instance on a specific technology and furthermore requires a methodology for the successful introduction as well as a cultural change in the organization. Technical solutions, which are implemented in the context of the KM introduction, are linked to the technology on which they depend, can consist of further solutions, or just be a part of a larger solution. Several other concepts of the ontology are furthermore specialized by sub-concepts in order to have the possibility for more precisely defining a BPC. Further regarded attributes to structure BPCs are currently the following:

- form of the organization
- number of KM workers actually involved KM
- departments actually involved in KM
- affected level of KM (team, department, etc.)
- (knowledge intensive) processes
- normative, strategic and operative knowledge goals
- implementation status
- considered quality standards
- qualitative/ quantitative benefits and savings
- increased competitiveness
- application and sustainability
- external support and funding
- KM maturity level of an organization

Based on that pre-defined ontology for structuring and storing BPCs, KMIR provides technical means for on the one hand describing a (successfully) completed KM introduction, or for on the other hand accomplishing a so called "Organizational Audit", a subsequent retrieval of (a) similar case(s), the adaptation and reuse of that case(s) and finally the case revision and retainment as a new case. The underlying methodology for our approach has been taken over from the Case-based Reasoning Cycle of Aamodt & Plaza [Aamodt *et al*. 1994]. The components of KMIR are described as follows in section 3.

3 Components of KMIR

KMIR consists of the following technical components:

1. A **web-based self-description component** supports on the one hand the description of best practice cases (BPC) based on a KM introduction and on the other hand to support an organizational audit.
2. An **ontology-based matching component** retrieves most similar cases with regard to a described profile from the organizational audit. Here, we apply a similarity component which has been developed on the basis of our theoretical "Similarity framework for Ontologies" [Ehrig *et al.* 2005]. The similarity component allows flexible XML-based configuration, nesting and weighting of syntactical similarity measures (equality, syntactical similarity and distance-based similarity) and semantical similarity measures (taxonomic similarity relational similarity and set similarity), as well as the definition of pre- and post filters for filtering matching results.
3. The **recommendations component** provides recommendations about how to introduce KM based on retrieved most similar cases, by presenting the identified most similar case including similar problems, solutions and methods to the user of the system.
4. A **learning component** stores adapted, reused and revised best practices cases as a new case into the case base.

4 Originality

Through the synergetic combination of proven methodical approaches from Case-based Reasoning and Semantic Web technologies, thus to structure problem-solution pairs (cases) by the use of an ontology-based case base and to identify a solution for a new problem by retrieving the most similar case using syntactical and semantical similarity measures emerged a rather novel approach, which is even unique in the context of supporting the introduction of KM.

4 Field of Application

The aim of the research work in KMIR is to assist consultants in advising organizations concerning the implementation of KM projects. Starting with a system-based diagnosis of the organization, its organizational structure and technical infrastructure, of financial issues as well as of (knowledge) problems and goals, the consultant is better able to spontaneously provide recommendations based on experiences already stored in the system. Moreover, the KMIR technology can be used for further application domains where experience values can be structured, stored and reused (e.g. for customer service, troubleshooting, diagnoses, error diagnosis, etc.).

References

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KMIR – Demo

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1 Demo Description

We will demonstrate KMIR, an ontology-based framework, which supports organizations in the successful implementation of Knowledge Management (KM). The framework follows the holistic approach of a KM introduction by considering technological, organizational and human aspects, as well as the organizational culture in equal measure. KMIR provides recommendations based on Semantic Web technologies and Case-Based Reasoning techniques. The best practices cases for a successful KM implementation are structured by the use of an ontology.

A web-based demo and further information of KMIR can be assessed on

http://wim.fzi.de:8080/kmirportal/dispatcher

http://www.fzi.de/ipe/publikationen.php?id=1184

In this demo, we will walk through selected features of the KMIR framework and furthermore provide an opportunity to discuss with one of the developers.

Figure 2: Case Description Component

The following figures show screenshots of the Case Description Component (Figure2), the configuration of syntactical/ semantical similarity measures (Figure3), as well as of the matching results (Figure4).

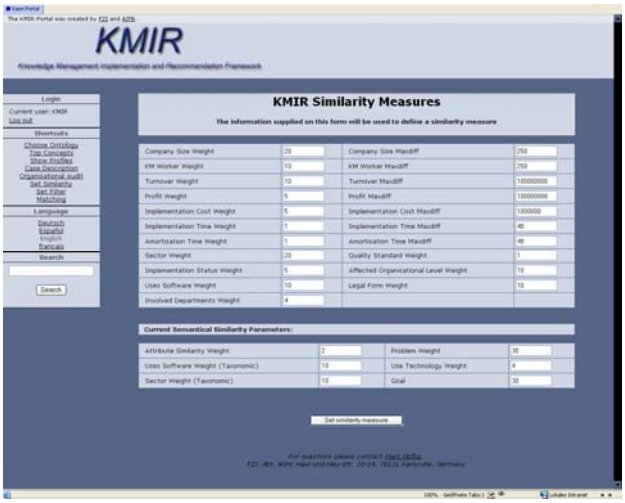

Figure 3: Configuration of Similarity Measures

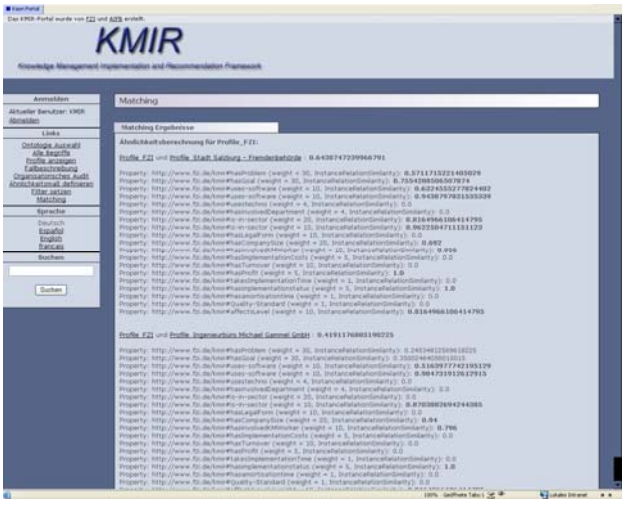

Figure 4: Matching Results