Life Cycle Based Approach for Knowledge Management: A Knowledge Organization Case Study

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Abstract. Knowledge Management (KM) is emerging as one of the management tools to gain competitive advantage. Though several organizations have reported successful KM projects, there are a large number failures due to a variety of reasons including the incongruence between strategic and KM objectives, as well as lack of a sound framework and architecture that supports KM activities. This paper presents a knowledge management framework that takes into account the different levels of knowledge that exists within an organization, and an architecture for a KM environment that incorporates enabling technologies such as intelligent agents and XML. A proof-of-concept prototype is currently under development.

1 Introduction

Knowledge Management (KM) concepts and techniques are permeating the corporate world and organizations such as Chevron, Xerox, AT&T, Hewlett-Packard, FinnAir, and 3M have successfully implemented KM initiatives and reported tremendous benefits [3]. While several organizations have successfully implemented KM initiatives, there are many reported cases of unsuccessful KM projects [1], [5]. Some of the pitfalls of KM projects [4] include lack of congruence between strategic objectives and KM objectives, identification and standard representation of knowledge assets to be managed, routine processes to support KM life cycle, and infrastructure to support access. Fahey and Prusak [5] also point out that the fundamental purpose of managing knowledge is to create a shared context between individuals, which is not always achieved.

Hence, the objective of this research is to develop a knowledge management framework for systematically capturing, manipulating and disseminating knowledge using systems life-cycle concepts and discuss an architecture to implement this framework using enabling technologies such as intelligent agents and XML. A case study is used throughout to illustrate both the development and implementation of this framework.

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2 Knowledge Management Framework

Probst et al. [7] identify processes such as identification, acquisition, development, utilization, distribution and retention for knowledge management. However, these processes are defined from the perspective of knowledge worker (an *application* or stakeholder view). A firm has to ensure that the knowledge gathered and managed is *aligned* with its knowledge goals to effectively articulate and develop individual performance measures. The successful development of a KM system requires a design phase, where both the logical and physical model of the knowledge is developed prior to its implementation, which is the primary focus of this research.

The first step in developing the logical knowledge model is to *acquire* various pieces of knowledge that are known about a specific problem domain and are needed to meet both the alignment and application needs. We will refer to this knowledge as "logical knowledge model – Level 0." While acquisition forms the basis for gathering instances of various problem case scenarios, one needs to *abstract* broad generalizations across various dimensions to support their potential reuse. This abstraction process, using appropriate techniques such as qualitative synthesis and machine learning, will lead to the development of "logical knowledge model – level 1."

The knowledge, abstracted from internal experiences, has to be validated and refined using knowledge acquired from various outside sources. In other words, knowledge in level 1 may be *augmented* with external knowledge (theories, proven methodologies, etc.) to ensure that an organization can fully leverage its access to all its available sources. The knowledge, thus appended, will form the basis for "logical knowledge model - level 2." Thus, the design of a KM system calls for the extraction of a logical knowledge model at levels 0, 1 and 2 using three major steps: acquire, abstract and augment. Next section will use a case to illustrate these three steps.

3 Example Logical Knowledge Model – A Case Study

A project-based organization, which completes "*corporate projects,*" is used to illustrate the derivation of the logical knowledge model. At the time of this report, the organization has completed over 200 corporate projects with over 40 corporations.

Acquisition. The project team meets with the corporate clients and gathers project related information, which becomes part of the "project definition document". The team generates a project plan and estimate of resources needed. In addition, weekly status reports and presentations are created. The firm also documents each project on various characteristics such as the system development phase the project addresses, functional area it supports, primary technologies used, experience level of team and the project type. All of this information becomes part of the project knowledge repository. Much of this knowledge is available for future extraction. However, there is no effective way to relate this knowledge to a new project that is not exactly similar. In other words, generalizations are needed from specific instances of these projects so they can be used in new situations. This leads to the *abstraction* phase.

Abstraction. Three possible means of abstraction or generalization are used here and others may be possible. A project may use some standard techniques that have been already used elsewhere and references to such techniques may be available in the project document. Secondly, the project coordinator may see similarities in projects with respect to the approaches used, complexity, level of coordination or technology support necessary, team experience, etc. Thirdly, some of the project data may be fed directly to algorithms (statistical or artificial intelligence) to help the organization establish factors that are contributing to project success. Thus, the acquired project knowledge is used to generate three levels of abstraction: *established procedures*, *references from external sources*, and *new abstractions* created through knowledge manager's intervention, or by the application of algorithms.

Augmentation. The greater reliance the organization can put on its knowledge artifacts, the greater the chance of their utilization. Deployment of specific knowledge elements, which have been abstracted from "project instances," can only be effective if it is augmented with external data or research. For example, in this case study, several training projects involving ERP or large systems were completed and through this experience, a few factors for determining training success were extracted. However, these observations were augmented with research on "training enablers" and a full-training model was developed.

4 Design and Implementation of KM Environment

Based on the knowledge activities discussed in the previous section, we propose the KM environment shown in Figure 1. This environment distinguishes between three levels of knowledge: 'level 0,' 'level 1,' and 'level 2.' 'Level 0' knowledge deals with project details and characteristics whereas 'level 1' knowledge captures higher-level abstractions derived from a group of similar projects. 'Level 2' knowledge relates to application domain knowledge derived from internal and external sources. This environment also emphasizes easy access to these different levels of knowledge for all the stakeholders and has a feedback mechanism between the different levels of knowledge. It provides facilities for aligning the knowledge repository with strategic objectives by specifying what type of knowledge to gather and how to utilize it.

A proof-of-concept portal prototype, which uses three-tier client-server architecture, is currently under development. The client is the basic web browser that the stakeholders use to carryout different tasks. For example, students use the portal to create and store project related artifacts. The sponsors use the portal to monitor the progress of the projects as well as gaining insights from the application domain knowledge. The server side consists of the KM application, which facilitates knowledge alignment, deriving the knowledge models, and populating the knowledge repositories. The server-side features are supported by the following agents: a) interface agent, b) acquisition agent, c) abstraction agent, and d) augmentation agent. These agents are being implemented using JADE [2], and their reasoning capabilities implemented through JESS [6]. The project knowledge and the application domain knowledge are stored using XML with appropriate DTDs.

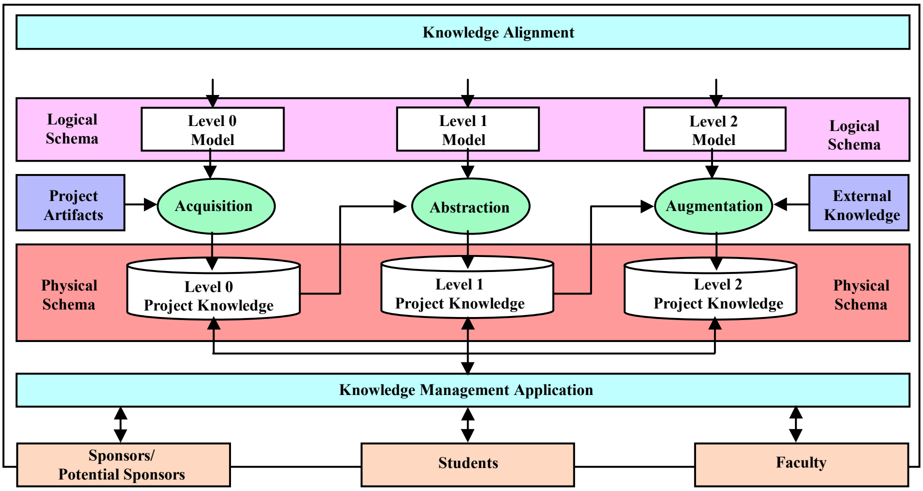

Fig. 1. Knowledge Management Environment

5 Summary

This paper has presented a KM framework that takes into account different levels of knowledge that exists within an organization. Drawing from system development principles, this framework differentiates between the logical and physical knowledge models and provides a phased approach for knowledge creation (acquisition, abstraction, and augmentation), storage and utilization. It also emphasizes the need for the alignment between the strategic and knowledge management objectives. A proof-of-concept prototype is currently under development, which uses a client-server architecture that integrates enabling technologies such as intelligent-agent and XML.

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