Chapter 21
Constructive Knowledge Management Model and Information Retrieval Methods for Software Engineering

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ABSTRACT

In this book chapter, the authors discuss two important trends in modern software engineering (SE) regarding the utilization of knowledge management (KM) and information retrieval (IR). Software engineering is a discipline in which knowledge and experience, acquired in the course of many years, play a fundamental role. For software development organizations, the main assets are not manufacturing plants, buildings, and machines, but the knowledge held by their employees. Software engineering has long recognized the need for managing knowledge and that the SE community could learn much from the KM community. The authors introduce the fundamental concepts of KM theory and practice and mainly discuss the aspects of knowledge management that are valuable to software development organizations and how a KM system for such an organization can be implemented. In addition to knowledge management, information retrieval (IR) also plays a crucial role in SE. IR is a study of how to efficiently and effectively retrieve a required piece of information from a large corpus of storage entities such as documents. As software development organizations grow larger and have to deal with larger numbers (probably millions) of documents of various types, IR becomes an essential tool for retrieving any piece of information that a software developer wants within a short time. IR can be used both as a general-purpose tool to improve the productivity of developers or as an enabler tool to facilitate a KM system.

1. KNOWLEDGE MANAGEMENT

Knowledge management is fundamentally corporate intellectual assets to improve the organization's effectiveness, as well as its business opportunity enhancement. Key to knowledge management is capturing tacit knowledge for the tangible benefits for the organization. The aim of knowledge management is to continuously improve an organization's performance in which sharing, creating, assimilating, disseminating, and applying knowledge throughout the organization. Knowledge management is a continuous process to understand the organization's knowledge needs, the location of the knowledge, and how to improve the knowledge.

1.1 Fundamental Concept of Theory and Practice

Knowledge is one of the organization's most important value and influencing its competitiveness. In this age of information organizations see their people as their key assets. The knowledge, skills and competencies of these people add to the growth of the organization.

The first section of this topic presents fundamental knowledge – the "tacit" or personal knowledge versus the "explicit" or organizational knowledge (Nonaka and Takeuchi, 1995). Tacit knowledge resides in individuals and teams which includes personal experiences, thinking, competence, perceptions, insights and know-how that are indicated but not actually expressed. Explicit knowledge that is codified and conveyed to other thought which will be transformed to data, information later documents, records and files.

As Nonaka and Takeuchi (1995) illustrate that there are four ways to transform the knowledge. Firstly, "Socialization" means to share experience from tacit knowledge to tacit knowledge. This process is first to share experience and then to exchange tacit knowledge. Thus, socialization is used in sharing learners' experience and know-how with other learners. The second concept is "externalization" that means the conversion of tacit knowledge into explicit knowledge. This process is to rationalize tacit knowledge and articulate it into explicit concept. Third one is "Internalization" that is a process of embodying explicit knowledge into tacit knowledge. Individual gained knowledge and experience through the explicit knowledge and individual can develop the new tacit knowledge internally. The fourth one is "Combination" that converts explicit knowledge into more complex and systematic sets of explicit knowledge. In this process, individuals combine and exchange different explicit knowledge to explicit knowledge with others.

The second section presents the Five Learning Cycles model of "organizational learning" (Sanchez, 2001). In this general model of learning processes in an organization, five kinds of learning cycles are identified that link of individuals, groups, and the overall organization in an organizational learning process.

Sanchez (2001) illustrates that the first learning cycle is "Individual Learning Cycle" whose individuals imagine alternative interpretive frame works and new kinds of knowledge. The second learning cycle is "Individual/Group Learning Cycle" who shares their new knowledge within groups to evaluate the new knowledge developed by individuals. The third learning cycle is "Group Learning Cycle" whose interact with other groups to determine whether new knowledge developed by a given group becomes accepted within the overall organization. In this stage managers or leaders are the domain expert of the learning. The fourth learning cycle is "Group/Organization Learning Cycle" in which new knowledge accepted at the organizational level which is embedded in new processes, systems, and the culture of an organization. The fifth learning cycle is "Organization Learning Cycle" which is new knowledge embedded in new processes, systems, and organizational

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