Chapter 2.10
Developing and Maintaining Knowledge Management Systems for Dynamic, Complex Domains

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ABSTRACT

An effective knowledge-based organization is one that correctly captures, shares, applies and maintains its knowledge resources to achieve its goals. Knowledge Management Systems (KMS) enable such resources and business processes to be automated and are especially important for environments with dynamic and complex domains. This chapter discusses the appropriate tools, methods, architectural issues and development processes for KMS, including the application of Organizational Theory, knowledge-representation methods and agent architectures. Details for systems development of KMS are provided and illustrated with a case study from the domain of university advising.

INTRODUCTION

An effective knowledge-based organization is one that correctly captures, shares, applies, and maintains its knowledge resources to achieve its goals. Knowledge Management Systems (KMS) enable such resources and business processes to be automated. Possibly the greatest benefits, but with the biggest challenges, emerge from creating KMS for environments with dynamic and complex domains (DCD). If knowledge is viewed as

information applied in a particular context, then a dynamic domain is one in which information such as policies and procedures are subject to frequent change. A complex domain is one in which many interrelated policies exist with informally defined and tacit exceptions.

Typical parameters used to describe or classify organizational structures in any environment are centralization, hierarchy, and standardization. Dynamic and complex environments tend to coerce organizations into highly centralized, hierarchical structures with many strictly enforced standards-based rules of operation. This environment results in organizations wherein only a few experienced individuals have the knowledge and experience to cope with frequent change, exceptions, and their complex interrelationships. The rest of the organization is thus poorly informed and subject to making errors when employees must make decisions. Obviously, this highly centralized, hierarchical structure is the wrong approach for a knowledge-based organization. The organizational goal is to get the right knowledge to the right person at the right time so better decisions and fewer mistakes will be made. The knowledge management challenge is to support this goal through the development of KMS that can readily adapt to change while dealing with complexity. The emerging science of knowledge management should preserve and build upon literature that exists in other fields (Alavi & Leidner, 2001). We believe, and research on knowledge as a contingency variable (Birkinshaw, Nobel et al., 2002) indicates, that any KMS will benefit from the application of Contingency Theory (CT) and Information Processing Theory (IPT), both well established in the field of Organizational Theory (OT).

The chapter begins with the role of CT and IPT in examining the organizational aspects of dynamic, complex environments, followed by an overview of classic knowledge management and tools for KMS development. Next, the organizational, domain, development, maintenance,

and KMS issues for dynamic, complex domain environments are presented. The recommended strategies and tools are illustrated through a case study of a recently developed university advising system, a classic case in which a few knowledgeable individuals (departmental advisors) attempt to serve a large population (students) in a dynamic, complex domain. Additional recommendations and future trends conclude the chapter.

CONTINGENCY THEORY

A basic tenet of CT is that organizations are structured according to their situational environment. OT is a field of study that examines an organization's structure, constituencies, processes, and operational results in an effort to understand the relationships involved in creating effective and efficient organizations. Countering the "one best" organizational structure approach of classical organization theory, the subfield known as CT (Galbraith, 1973; Pfeffer & Salanick, 1978; Dess & Beard, 1984; Thompson, 1967) recognizes that environment influences appropriate structure. CT has been applied to a wide variety of fields including software design (Lai, 1999). In CT an organization's environmental context may be described by two characteristics: (1) the complexity and heterogeneity of the entities in the environment and (2) their rate and predictability of change (dynamicism). Successful organizations survive by adapting to the demands of their task environments (March & Simon, 1958). There may be more than one equally effective organizational design, as each varies by degree of centralization, hierarchy, and standardization. Fortunately, due to interdependencies between components, organizational configurations tend to fall into a limited number of coherent patterns, and thus the set of possibilities is limited. In proposing IPT-aiding application of this theory, Galbraith proposed that complexity, predictability, and interdependence actually measure one underlying concept, that

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