Developing Effective Knowledge-Based Systems: Overcoming Organizational and Individual Behavioral Barriers

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This article deals with the situational theory of management and develops situational guidelines for managers planning knowledge-based system development and introduction within their organizations. It includes a discussion of two specific company situations and the different ways in which the general approaches to implementing knowledge-based systems are applied to meet the unique situational requirements of each company.

Considerable work has been, and continues to be done in an effort to provide a theoretical basis for the structuring and implementation of knowledge-based system development projects, particularly during the expert knowledge acquisition and definition phases. These efforts draw upon several disciplines, including the cognitive, organizational, and individual behavioral areas.

Cognitive studies have, for example, attempted to define conceptual modeling differences between an expert’s thinking patterns and the formal thinking pattern representations used in computer inferential reasoning (e.g., Gruber & Cohen, 1987). Other studies have examined different modeling and interviewing approaches helpful in the definition of expert thought processes, translating those thought processes into computer compatible models, and extracting expertise from the expert (e.g., Delgrande, 1987; Evanson, 1988; Garber, 1987; LaFrance, 1987; Mitchell, 1987; Mockler, 1989a, 1989b). Yet other studies, several of which are described below, focus on the factors of organizational and
individual human behavior that can affect computer system development projects.

Building on these studies and work done by the authors, this article defines and develops methods to overcome some of the organizational and individual behavioral barriers frequently encountered in developing and introducing knowledge-based systems within a business environment.

Beginning with a discussion of knowledge-based systems and how they are developed, some of the organizational and individual human behavior problems encountered in implementing the system development process are considered. The difficulties in obtaining the expert/user involvement essential to successful knowledge acquisition and system use are afforded special consideration. In conclusion, appropriate methods for two companies, each with unique requirements, are developed to suggest situationally appropriate organizational and management mechanisms to assist in overcoming each organization’s particular potential problems.

Expert Knowledge-based Systems and How They Are Developed

Knowledge-based systems are one branch of artificial intelligence (Charniack & McDermott, 1985; Harmon & King, 1985; Hart, 1986; Keller, 1987; Mockler, 1989a; Rauch-Hindin, 1985, 1986), designed to replicate the functions performed by a human expert. For example, DuPont has developed knowledge-based systems to perform such tasks as selecting the right grade and kind of rubber for customers, diagnosing equipment failures, and scheduling machines on the factory floor. Similar systems exist at other companies and offer expert advice in such areas of management planning and decision making in sales management, media and new product selection, financial services, capital budgeting, inventory and distribution management, and configuring computer systems.

Typically, knowledge-based systems enable a user to consult a computer system as they would an expert advisor in order to diagnose what might be the source of a problem or to determine how to solve a problem, do a task, or make a particular decision. Like a human expert, such a computer system can extract additional information from a user during a consultation by asking questions related to the problem. It can also answer questions generated by a user as to why certain information is required. The computer system is then able to make recommendations regarding the problem or decision at the end of the consultation, and, when asked by a user, will explain the reasoning steps applied in reaching its conclusions.

These systems are termed “knowledge-based” because they are largely based upon expert knowledge and reasoning processes (called heuristics). Their distinguishing characteristics are that they:

- contain symbolic programming and reasoning capabilities;
- contain a knowledge base about a specific decision domain or situation, which is in large measure distinct from the inferencing mechanism;
- contain an inference engine, or inferential reasoning capability, which is in large measure distinct from the knowledge base.

The term “expert” is applied here only in a relative sense. It refers to persons who perform their jobs well or in a professional manner. The
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