Chapter XII

Integrated Analysis and Design of Knowledge Systems and Processes

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Although knowledge management has been investigated in the context of decision support and expert systems for over a decade, interest in and attention to this topic have exploded recently. But integration of knowledge process design with knowledge system design is strangely missing from the knowledge management literature and practice. The research described in this chapter focuses on knowledge management and system design from three integrated perspectives: 1) reengineering process innovation, 2) expert systems knowledge acquisition and representation, and 3) information systems analysis and design. Through careful analysis and discussion, we integrate these three perspectives in a systematic manner, beginning with analysis and design of the enterprise process of interest, progressively moving into knowledge capture and formalization, and then system design and implementation. Thus, we develop an integrated approach that covers the gamut of design considerations from the enterprise process in the large, through alternative classes of knowledge in the middle, and on to specific systems in the detail. We show how this integrated methodology is more complete than existing developmental approaches and illustrate the use and utility of the approach through a specific enterprise example, which addresses many factors widely considered important in the knowledge management environment. Using the integrated methodology that we develop and illustrate in this chapter, the reader can see how to identify, select, compose and integrate the many component applications and technologies required for effective knowledge system and process design.

KNOWLEDGE MANAGEMENT AND SYSTEM DESIGN

The power of knowledge has long been ascribed to successful individuals in the organization, but today it is recognized and pursued at the enterprise level through a
practice known as knowledge management (see Davenport and Prusak, 1998). Although knowledge management has been investigated in the context of decision support systems (DSS) and expert systems (ES) for over a decade (e.g., see Shen, 1987), interest in and attention to this topic have exploded recently. For example, knowledge capital is commonly discussed as a factor of no less importance than the traditional economic inputs of labor and finance (Forbes, 1997), and the concept knowledge equity is now receiving theoretical treatment through research (e.g., see Glazer, 1998).

Many prominent technology firms now depend upon knowledge-work processes to compete through innovation more than production and service (McCartney, 1998), and Drucker (1995, p. 271) writes, “Knowledge has become the key economic resource and the dominant—and perhaps even the only—source of comparative advantage.” This follows his assertion that increasing knowledge-work productivity represents the great management task of this century, on par with the innovation and productivity improvements made through industrialization of manual-work processes (Drucker, 1978). Brown and Duguid (1998, p. 90) add, “Organizational knowledge provides synergistic advantage not replicable in the marketplace.” Indeed, some forecasts suggest knowledge work (e.g., performed by professionals and managers) will account for nearly 25% of the workforce soon after the 21st century begins (Labor, 1991). And partly in anticipation, fully 40% of Fortune-1000 companies claim to have established the role of Chief Knowledge Officer (CKO) in their companies (Roberts, 1996). Miles et al. (1998, p. 281) caution, however, “Knowledge, despite its increasing abundance, may elude managerial approaches created in 20th century mindsets and methods.”

In fact, knowledge is proving difficult to manage, and knowledge work has been stubbornly resistant to reengineering and process innovation (Davenport, 1995). For one thing, Nonaka (1994) describes knowledge-creation as primarily an individual activity, performed by knowledge workers that are mostly professional, well-educated and relatively autonomous, often with substantial responsibility in the organization. They tend to seek and value their relative autonomy and often resist perceived interference by management in knowledge-work activities (Davenport et al., 1996). Moreover, substantial, important knowledge is tacit, unstructured (Nonaka, 1994) and external to the organization (Frappaolo, 1998). This can greatly impede the identification, acquisition, interpretation and application of such knowledge. Also, corporate knowledge has historically been stored on paper and in the minds of people (O’Leary, 1998). Paper is notoriously difficult to access in quantity and keep current on a distributed basis, and knowledge kept in the minds of workers is vulnerable to loss through employee turnover and attrition. Vulnerability to such loss of knowledge is exacerbated by recent waves of downsizing associated with reengineering (McCartney, 1998) and the constrained labor markets affecting many professions (especially, information technology and software engineering).

Moreover, most information technology (IT) employed to enable knowledge work appears to target data and information, as opposed to knowledge itself (cf. Ruggles, 1997). We feel this contributes to difficulties experienced with knowledge management to date. Knowledge, almost by definition, lies at the center of knowledge work, yet it is noted as being quite distinct from data and information (e.g., see Davenport et al., 1998; Nonaka, 1994; Teece, 1998). Drawing from Arrow (1962) and others, we understand that even information economics has many important differences from standard economic theory (e.g., negligible marginal costs, network externalities, consumption without loss of use),
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