

ICT and Knowledge Management Systems¹

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INTRODUCTION

Rapid changes in the field of knowledge management (KM) have to a great extent resulted from the dramatic progress we have witnessed in the field of information and communication technology. ICT allows the movement of information at increasing speeds and efficiencies, and thus facilitates sharing as well as accelerated growth of knowledge. For example, computers capture data from measurements of natural phenomena, and then quickly manipulate the data to better understand the phenomena they represent. Increased computer power at lower prices enables the measurement of increasingly complex processes, which we possibly could only imagine before. Thus, ICT has provided a major impetus for enabling the implementation of KM applications. Moreover, as learning has accrued over time in the area of social and structural mechanisms, such as through mentoring and retreats that enable effective knowledge sharing, it has made it possible to develop KM applications that best leverage these improved mechanisms by deploying sophisticated technologies.

In this article we focus on the applications that result from the use of the latest technologies used to support KM mechanisms. Knowledge management mechanisms are organizational or structural means used to promote KM (Becerra-Fernandez, Gonzalez, & Sabherwal, 2004). The use of leading-edge ICT (e.g., Web-based conferencing) to support KM mechanisms in ways not earlier possible (e.g., interactive conversations along with the instantaneous exchange of voluminous documents among individuals located at remote locations) enables dramatic improvement in KM. We call the applications resulting from such synergy between the latest technologies and social or structural mechanisms knowledge management systems. We discuss the topic of KM systems in detail in the next sections.

BACKGROUND

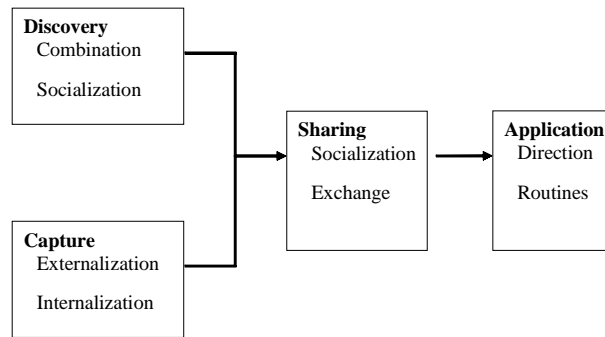
We describe the variety of possible activities involved in KM as broadly intending to (a) discover new knowl-

edge, (b) capture existing knowledge, (c) share knowledge with others, or (d) apply knowledge. Thus, KM relies on four kinds of KM processes as depicted in Figure 1 (Becerra-Fernandez et al., 2004). These include the processes through which knowledge is discovered or captured, and the processes through which this knowledge is shared and applied. These four KM processes are supported by a set of seven KM subprocesses as shown in Figure 1, with one subprocess, socialization, supporting two KM processes (discovery and sharing).

Polyani's (1967) distinction between explicit and tacit is at the heart of most KM papers. These constructs follow in that explicit knowledge is knowledge about things, and tacit knowledge is associated with experience. Nonaka (1994) identified four ways of managing knowledge: combination, socialization, externalization, and internalization. Of the seven KM subprocesses presented in Figure 1, four are based on Nonaka, focusing on the ways in which knowledge is shared through the interaction between tacit and explicit knowledge. New explicit knowledge is discovered through combination, wherein the multiple bodies of explicit knowledge (and/or data and/or information) are synthesized to create new, more complex sets of explicit knowledge. Therefore, by combining, reconfiguring, recategorizing, and recontextualizing existing explicit knowledge, data, and information, new explicit knowledge is produced. In the case of tacit knowledge, the integration of multiple streams for the creation of new knowledge occurs through the mechanism of socialization. Socialization is the synthesis of tacit knowledge across individuals, usually through joint activities rather than written or verbal instructions. Externalization involves converting tacit knowledge into explicit forms such as words, concepts, visuals, or figurative language (e.g., metaphors, analogies, and narratives; Nonaka & Takeuchi, 1995). It helps translate individuals' tacit knowledge into explicit forms that can be more easily understood by the rest of their group. Finally, internalization is the conversion of explicit knowledge into tacit knowledge. It represents the traditional notion of learning.

The other three KM subprocesses—exchange, direction, and routines—are largely based on Grant (1996a,

Figure 1. KM processes



1996b) and Nahapiet and Ghoshal (1998). Exchange focuses on the sharing of explicit knowledge and it is used to communicate or transfer explicit knowledge between individuals, groups, and organizations (Grant, 1996b). Direction refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to him or her the knowledge underlying the direction. This preserves the advantages of specialization and avoids the difficulties inherent in the transfer of tacit knowledge. Finally, routines involve the utilization of knowledge embedded in procedures, rules, and norms that guide future behavior. Routines economize on communication more than direction as they are embedded in procedures or technologies. However, they take time to develop, relying on constant repetition (Grant, 1996a).

Other KM system characterizations present similar models to describe KM systems. For example, the acquire, organize, and distribute (AOD) model (Schwartz, Divitini, & Brasethvik, 2000) uses a similar characterization to describe organizational memories. Comparing the two models, the acquisition process relates to how we collect knowledge from members of the organization or other resources, and it is related to the processes of knowledge discovery and knowledge capture. The organizing process refers to structuring, indexing, and formatting the acquired knowledge, and it is related to the process of knowledge sharing. Finally, the process of distribution relates to the ability to get the relevant knowledge to the person who needs it at the right time, and it is related to the process of knowledge application.

Knowledge management systems utilize a variety of KM mechanisms and technologies to support the knowledge management processes. Depending on the KM process most directly supported, KM systems can be classified into four types: knowledge-discovery systems, knowledge-capture systems, knowledge-sharing systems, and knowledge-application systems (Becerra-Fernandez et al., 2004). In the next sections, we provide a brief

overview of these four kinds of systems and examine how they benefit from KM mechanisms and technologies.

TYPES OF KNOWLEDGE MANAGEMENT SYSTEMS

Knowledge-discovery systems support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. These systems support two KM subprocesses associated with knowledge discovery: combination, enabling the discovery of new explicit knowledge, and socialization, enabling the discovery of new tacit knowledge. Thus, mechanisms and technologies can support knowledge-discovery systems by facilitating a combination and/or socialization.

KM mechanisms that facilitate combination include collaborative problem solving, joint decision making, and the collaborative creation of documents. For example, at the senior-management level, new explicit knowledge is created by sharing documents and information related to mid-range concepts (e.g., product concepts) augmented with grand concepts (e.g., corporate vision) to produce new knowledge about both areas. This newly created knowledge could be, for example, a better understanding of the products and corporate vision (Nonaka & Takeuchi, 1995). Mechanisms that facilitate socialization include apprenticeships, employee rotation across areas, conferences, brainstorming retreats, cooperative projects across departments, and initiation processes for new employees. For example, Honda “set up ‘brainstorming camps’ (*tama dashi kai*)—informal meetings for detailed discussions to solve difficult problems in development projects” (Nonaka & Takeuchi, p. 63).

Technologies facilitating combination include knowledge-discovery or data-mining systems, databases, and Web-based access to data. According to Nonaka and Takeuchi (1995, p. 67), the “reconfiguration of existing

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