TOWARD DEVELOPING HUMAN RESOURCE MANAGEMENT SYSTEMS FOR KNOWLEDGE-INTENSIVE TEAMWORK

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ABSTRACT

Building on the resource-based view of the firm and complex systems theory, we argue that the effective utilization of knowledge-intensive teamwork (KITwork) can be a source of sustained competitive advantage for firms that pursue a variety of strategies and compete in a variety of industries. KITwork is a multi-dimensional, multi-level social process that promotes knowledge flows within and between organizations. Through KITwork, the knowledge resources of individual employees are transformed into a capability that contributes to the effectiveness of knowledge-based organizations. After introducing and explaining the concept of KITwork, we explore the challenges that organizations must address in order to design HRM systems that support and facilitate KITwork.

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INTRODUCTION

The competitive landscape of the twenty-first century features challenges firms to continually change and adapt to myriad external forces, including globalization, new technologies, new rivals, and unpredictable and ever-changing political conditions. Firms can succeed in this environment by pursuing a variety of competitive strategies. For example, they can seek to create unique new products, produce the highest quality products, offer services at very low cost, build unsurpassable brand loyalty, and so on (e.g., see Campbell-Hunt, 2000; Desarbo, Di Benedetto, Song, & Sinha, 2005; Dess, Lumpkin, & Covin, 1997). To successfully implement these various strategies, firms must build strategic capabilities (systems and processes), which the firm uses to transform its resources and create value.

Of the many strategic capabilities that a firm might use to successfully implement its competitive strategy, the development of systems and processes for managing knowledge-based resources has been recognized as among the most important for creating a sustainable competitive advantage. Indeed, some scholars have argued that the need to effectively manage knowledge-based resources – e.g., skills, abilities, expertise, and learning capacity – is a priority that transcends a firm's choice of competitive strategy (e.g., see Grant, 1996; Nonaka, 1994; DeCarolis & Deeds, 1999).

In this paper, we argue that systems of human resource management (HRM) practices can be powerful tools for improving the effectiveness of organizations that compete on the basis of knowledge. Building on prior work, we integrate concepts from the resource-based view, the knowledge-based view, and complex system theory to argue that knowledge-intensive teamwork (KITwork) is a capability that organizations can use to leverage the knowledge of employees and gain competitive advantage. After introducing and defining the construct of KITwork, we briefly explain our rationale for asserting that a broad range of organizations can use a KITwork capability to create value. Finally, we discuss several issues that organizations must address as they seek to develop HRM systems that facilitate KITwork, and through this suggest new directions for future research.

WHAT IS KNOWLEDGE-INTENSIVE TEAMWORK?

Knowledge-intensive teamwork refers to the collaborative process through which people use their unique and their shared knowledge to achieve a

common outcome. KITwork can describe the activities of traditional work teams as well as activities that occur within communities of practice, task forces, consortia, joint ventures, and so on. In fact, KITwork occurs in many forms throughout firms that deploy knowledge to create market value (e.g., see Swart & Kinnie, 2003). Here, we explain the construct of KITwork in some detail.

Knowledge

Dictionary definitions of knowledge include phrases such as *have direct cognition of, have a practical understanding of,* and *have experience with.* Whereas information is primarily descriptive and somewhat objective, knowledge is anchored in experience and more subjective. Individuals hold and create knowledge as they identify problems and work through solutions to those problems. Consistent with other scholars working on issues of knowledge management, we use the term *knowledge* to refer to a person's subjectively constructed view of information, which accrues as a result of learning through action and reflects the justified beliefs and commitments of its holder (see Nonaka, Toyama, & Byosière, 2003).

We consider knowledge to be, fundamentally, an individual-level construct. When two or more individuals interact to move and transform knowledge, they are engaging in the knowledge-centered activities that comprise KITwork.

We assume that KITwork is one of the central processes through which organizations transform the knowledge held by individuals into something of value to the organizations. Organizations create value from the knowledge of individuals when they develop or adopt organizational processes and routines that reflect and incorporate individual knowledge. For example, quality circles are a technique for ensuring that the knowledge held by individual production workers is transferred to the organization by using it to improve production processes. Quality circles are one example of KITwork.

Teamwork

Teamwork refers to the activities of a group of people working toward a shared objective that requires communication, collaboration, and coordination; it is a process that involves interaction between people who share some common interests. Although teamwork is closely related to the

concept of a team, the two terms are not interchangeable. Teams are just one of several vehicles that organizations use to promote interdependence (Campion, Medsker, & Higgs, 1993). Shared tasks, shared goals, and shared outcomes can all foster repeated interactions among people in an organization, even when they are not members of a designated team or other clearly defined stable work unit (cf., Gully, Incalcaterra, Joshi, & Beaubien, 2002; Saavedra, Earley, & Van Dyne, 1993; Shea & Guzzo, 1987). In many instances, interdependent employees are more accurately described as participants in a network of collaboration. For some of the collaborators, a given project may be their only responsibility, requiring 100 percent of their time and effort. For others, that same project may be one of several responsibilities. Our use of the term "teamwork" is intended to acknowledge and include the many forms of interdependence found in modern organizations.

Knowledge-Centered Activities

KITwork does not denote a distinct category of teamwork. Some collaborators engage in relatively little KITwork, and others engage in a great deal of it. What differentiates KITwork from other types of collaboration and teamwork is the extent to which knowledge-centered activities dominate the interactions. Knowledge-centered activities include the following: knowledge acquisition, knowledge sharing, knowledge combination, knowledge creation, knowledge application, and knowledge revision. Auto manufacturing teams, construction crews, sports teams, and musical orchestras all involve teamwork, but the importance of knowledge-centered activities is fairly low for these tasks. By comparison, KITwork is central to scientists and engineers engaged in new product development, experts from various backgrounds who work together to service customer-focused accounts, multi-functional sales teams, managers charged with planning and implementing a merger, and so on.

As we describe knowledge-centered activities in more detail, below, notice that these activities can characterize interactions among individuals as well as interactions at higher levels of analysis. We address the levels-of-analysis issue later in the paper.

Knowledge Acquisition

Knowledge acquisition includes locating knowledge and incorporating it into one's own repertoire. It occurs when an individual, group, or organization gains explicit or tacit knowledge it did not previously have.

Social collectives such as teams, communities of practice, and organizations (hereafter referred to simply as "collectives") acquire knowledge by reading, listening, observing, imitating, trial-and-error learning, and so on. Collectives acquire knowledge to the extent that their members engage in these behaviors.

Collectives can also acquire knowledge by acquiring new members. Groups can acquire knowledge by involving new people in their collaboration, leveraging their ties to other organizational units (Hansen, 1999), and drawing on experts who reside beyond these boundaries (Bouty, 2000). Communities of practice can acquire knowledge by expanding their memberships. Firms can acquire knowledge by buying other firms and forming strategic alliances, as well as by recruiting new employees (see Deeds, 2003, for an extended discussion).

Knowledge Sharing

Knowledge sharing refers to activities aimed at transmitting knowledge to others. Transferring knowledge from an individual to other parts of the organization can contribute to the organization's performance. However, transferability of knowledge also can threaten competitiveness, for the issue of knowledge inimitability lies at the heart of the analysis of competitive advantage and its sustainability (Spender & Grant, 1996). A challenge for organizations is deriving competitive advantage from internal knowledge transfers, while preventing knowledge from leaking out to their competitors (Argote & Ingram, 2000).

Although knowledge acquisition and knowledge sharing are closely related, they are not merely opposite views of the same process. Indeed, one approach to gaining a competitive advantage may be to maximize knowledge acquisition while minimizing knowledge sharing. In international joint ventures, for example, a firm's ability to keep an appropriate balance between its own knowledge acquisition (e.g., an improved understanding of the market) and knowledge sharing (e.g., technological and management know-how) can be a major determinant of success (Tsang, 2002).

The importance of knowledge sharing has been stressed in many discussions of knowledge-based competition and innovation (e.g., Hargadon & Sutton, 2000). One benefit of effective knowledge sharing is efficiency. No individual knows everything, and no individual can keep up with all of the relevant new knowledge continually being created. Knowledge sharing among employees conserves resources and frees up time for people to actually use the knowledge they have. Moreover, knowledge sharing promotes knowledge application. As employees attempt to share knowledge, they are

forced to articulate what they know; this makes it possible to evaluate the knowledge and apply it to solve problems or create new products (Von Krogh, Ichijo, & Nonaka, 2000).

Knowledge Combination

Combination refers to the process of (a) bringing together elements that previously were unconnected, or (b) bringing together in new ways elements that previously were associated (Nahapiet & Ghoshal, 1998). That is, knowledge combination involves bringing together and perhaps merging bits of knowledge that previously were considered separate and perhaps were viewed as unrelated.

Reaping the anticipated benefits of knowledge combination is often a major reason for using teamwork in organizations. For example, a consumer products company might charge a group of employees to combine the firm's knowledge about its consumer markets with knowledge about its work force and the labor market to develop a new marketing and sales strategy. Teamwork may also be motivated by the belief that knowledge combination is likely to result in knowledge creation. As individuals or work units with different knowledge stocks collaborate, the continual (re)combination of their knowledge serves as the basis for incremental change (Noe, Colquitt, Simmering, & Alvarez, 2003), and occasionally it leads to significant new ideas, products, or procedures. For example, at Gillette, representatives with various areas of expertise formed a cross-functional team, where they combined their tacit knowledge to invent the first battery-operated razor.

Knowledge Creation

Knowledge creation involves producing knowledge that is new, or that is considered new by those using it. Ideas are considered creative if they are novel and have potential usefulness to the organization's growth or effectiveness (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Oldham, 2003). Likewise, knowledge creation occurs when something new is discovered or brought into existence. Generally, knowledge creation requires the acquisition and combination of existing knowledge (Kogut & Zander, 1992).

The creation of new knowledge usually starts from an idea (or ideas) generated by one or more individuals. Most creative ideas do not contribute to an organization's success unless they are available to others in the organization (Oldham, 2003). Bringing together individuals facilitates the combining of ideas that leads to the creation of new knowledge. Until it becomes widely available, new knowledge is rare and unique. By having

exclusive access to such knowledge (and being able to use it effectively), firms can gain a competitive advantage (Barney, 1986).

Knowledge Application

Knowledge application refers to the use of existing knowledge for a specific, practical purpose. Applying existing knowledge to the production of goods and services is a primary responsibility of firms (Grant, 1996). Appropriate and profitable use of knowledge requires recognizing when the knowledge is relevant and then making decisions, solving problems, designing new products, improving current procedures, and so on. Applying knowledge to new tasks and in new situations increases the return on investments that were made to gain that knowledge. Applying knowledge also accelerates the process of knowledge articulation, which may reveal more opportunities for application of the knowledge (Chakravarthy, McEvily, Doz, & Rau, 2003).

Until it is applied, knowledge is of little value to a firm, yet research shows that people often fail to apply their knowledge to problems they face (Thompson, Levine, & Messick, 1999). HR practices such as one-on-one coaching, use of realistic training simulations, and electronic knowledge directories may influence the extent to which employees are able to apply what they know to the work situations they experience (e.g., see Noe et al., 2003).

Knowledge Revision

Knowledge revision occurs when existing knowledge is updated, revalidated, or retired. In rapidly changing environments, knowledge quickly becomes obsolete so continuous updating is essential. Failure to update and revalidate knowledge may result in reliance on knowledge that has decayed and outlived its usefulness (Davis, 1998). Failure to discard useless knowledge leads to knowledge overload and obstructs an organization's ability to act on new information (Anand, Manz, & Glick, 1998). Failure to discard entrenched dominant logics is one of the main reasons organizations fail to respond to changes in their environment (Bettis, 1991; Miller, 1994). In effective organizations, forgetting goes hand-in-hand with knowledge acquisition and creation (Martin de Holan & Phillips, 2003, 2004).

Knowledge-Intensive Teamwork

Following from the above discussion, we use *knowledge-intensive teamwork* to describe people collaborating on tasks that involve knowledge-centered

activities – that is, activities related to acquiring, sharing, combining, creating, applying, and revising knowledge. Brainstorming processes illustrate the type of interactions comprising KITwork. In their study of a product development firm's brainstorming activities, Sutton and Hargadon (1996) found that complex problems were addressed by engaging numerous people in the process. The solutions that were eventually developed were born of teamwork; they were not simply the ideas offered by a particular individual. Across a wide variety of firms pursuing various strategies, examples of the importance of KITwork abound. Here we offer just a few examples to illustrate the role of KITwork in a variety of companies and industries.

Wal-Mart

The importance of information management at Wal-Mart is well-known, but some people may be surprised that KITwork plays a role in Wal-Mart's bid to be the lowest-cost provider of just about everything. Effectively implementing a cost leadership strategy typically requires unyielding pursuit of cost reductions and minimal investment in basic research or new product development (Miles & Snow, 1984; Miller, 1986; Porter, 1980). Wal-Mart and other firms pursuing cost leadership strategies benefit from knowledge that contributes to continual cost reductions. Wal-Mart's innovative and highly developed radio frequency identification (RFID) system eliminates the need for line-of-sight access to conventional bar codes. It speeds the movement of goods through the supply chain, improves inventory management, and ultimately reduces labor costs.

A knowledge-intensive development team directly contributed to the creation of Wal-Mart's RFID system, and KITwork has been at the heart of the firm's efforts to leverage the system. As data from the RFID began to flow into the firm, Wal-Mart's IT directors donated staff members to a seven-month project to determine the best use of the information being captured. Wal-Mart also supports knowledge-intensive collaborations with suppliers and competitors in an effort to ensure that a single RFID technology emerges as the agreed-upon platform for the entire industry (eWeek, 2004; Manufacturing Business Technology, 2005).

Bang & Olufsen

At Bang & Olufsen, providing high-quality products takes priority over reducing costs. KITwork plays a significant role in Bang & Olufsen's ability to develop high-end home electronics. Product development occurs in a team consisting of a team leader, a designer, a psychologist, a member from "Idealand," a software developer, a narrator, and an integrator. Each

member brings an unique perspective and a distinct functional expertise to the endeavor. The team leader's role is to be a product champion. The leader ensures that key constituents in the organization (concept manager, technical product manager, etc.) are in agreement about the worth of the product being developed and that the product is in line with the organization's strategy and objectives. Ultimately, the synthesis of team members' diverse perspectives and knowledge results in the production of technical products that advance the field in design, sound, picture, user interaction, and sound integration (Baerentsen & Slavensky, 1999).

Gillette

As it pursues a strategy of differentiation, Gillette relies heavily on innovation. The company's battery-operated M3Power razor captured 35 percent of the United States razor market in seven months, despite costing 50 percent more than the company's previous high-end razor. The product was created by a cross-functional team that included representatives from three of Proctor & Gamble's brands: Gillette (who understood razors), Duracell Battery (who understood battery operated products), and Braun (who understood small appliances). By transferring and combining tacit knowledge from each brand, the team created the first battery-operated razor (Byrnes, Berner, Zeller, & Symonds, 2005).

Roche Group

Pharmaceutical and healthcare firms provide some of the most familiar examples of KITwork. Roche's pharmaceutical division discovers and develops medicines targeted to treat and monitor diseases in all major therapeutic areas. Innovation is essential to the firm's survival. As medicines come off patents and reach maturity, new products must be introduced to offset declining sales. As of 2005, a significant portion of Roche's products had reached maturity. To offset declining sales, Roche was expected to introduce seven new medicines within three years (Datamonitor, 2005). To speed up its new product development processes, Roche dismantled its highly competitive departmental teams and moved toward greater reliance on KITwork. They started with "corridor meetings" between employees from genomics and oncology and then expanded to include collaborators from numerous countries and various educational backgrounds. Although the diversity added new challenges, team members found ways to bridge the gaps and capitalize on each person's expertise (Anders, 2002).

KITWORK AS A SOURCE OF COMPETITIVE ADVANTAGE

The resource-based view of the firm asserts that resources and capabilities become sources of sustainable competitive advantage when they are rare, valuable, hard to imitate, and difficult to replace with substitutes (Barney, 1991). KITwork is a capability that enables firms to effectively use knowledge resources to design, produce, distribute, and sell goods and services (cf., Grant, 1996). Whereas some capabilities are particularly relevant to specific competitive strategies, knowledge-based capabilities like KITwork have broader relevance to firms. Low-cost providers like Wal-Mart, high-quality providers like Bang & Olufsen, and innovators like Gillette and Roche all use KITwork to meet the challenges of competition in their markets.

Complex systems theory provides a perspective for understanding how particular resources and capabilities contribute to a sustainable competitive advantage (Colbert, 2004); it views organizations as creative and adaptable entities characterized by self-organization and partially random change (Colbert, 2004). Like other complex systems, organizations evolve as the result of repeated interactions among their elements. Over time, the consistent structures, patterns, and properties that emerge define the system. Because the emergent features of a system arise out of a partially random process, they tend to be both unique and difficult for others to imitate. KITwork is an example of a process that brings elements of a system into repeated contact and creates partially random change.

KITwork adds Value

For complex organizations, KITwork is the primary vehicle for knowledge creation and learning, which are needed to solve problems and perform effectively in rapidly changing competitive environments (Nonaka & Takeuchi, 1995; Takeuchi & Nonaka, 1986). As a collaborative process, KITwork is likely to add value by contributing to faster product development (Brown & Eisenhardt, 1995; Hoegl, Weinkauf, & Gemuenden, 2004), more successful marketing (Millson & Wilemon, 2002), better relationships with customers and suppliers, and the ability to reorganize as needed.

A recent study of top management teams and knowledge workers provides support for our argument that knowledge-based activities are central to creating outcomes such as these. Data from a sample of top management teams and knowledge workers revealed that knowledge creation was a

function of the knowledge of employees, their networks, and their organization's climate for teamwork and risk-taking (Smith, Collins, & Clark, 2005).

Employees engaged in KITwork promote an organization's adaptive responses to the external environment and contribute to its long-term survival. Through KITwork activities, organizational members cross internal and external organization boundaries, making them more permeable and thereby reducing organizational rigidity. Thus, a study of 234 manufacturers found that information sharing between a firm and its suppliers was an effective means for developing the management capabilities needed to implement a quality-driven differentiation strategy (McEvily & Marcus, 2005). At the same time, KITwork broadens the knowledge and skill sets of organizational members, which improves individual versatility and provides a foundation for individual adaptive behavior.

Effective KITwork is Rare

Besides adding value, we believe that KITwork capabilities are somewhat rare – at least they are rare at this point in time. Many firms may realize the potential value of effective KITwork, and some are experimenting with using it to improve their performance. Nevertheless, relatively few firms have developed management practices that fully support KITwork as a means to leverage knowledge resources, so heterogeneity is present among firms. As KITwork becomes more prevalent and our understanding of it improves, new techniques for managing it – including new HR practices or systems – may be developed and widely implemented. Currently, however, this is not the situation. Indeed, our review of the academic literature suggests that HRM scholars know relatively little about how HR practices can best be used to promote effective KITwork.

KITwork is Inimitable

A third condition for KITwork to be a source of sustained competitive advantage is inimitability. Complex behavioral systems within organizations often meet this criterion because they are difficult for other firms to observe, and even more difficult to replicate (Kozlowski & Bell, 2003). KITwork establishes a network of intra- and inter-organization linkages and communication paths (Hansen, 1999; Bouty, 2000). It is inherently complex and characterized by disequilibrium, path dependency, and causal ambiguity.

As knowledge moves through a network of collaborators, the organizational system becomes more dynamic and moves further away from equilibrium. Strong norms and a culture that supports cooperation and trust help govern such dynamic systems and prevent them from tipping into chaos. The development of these norms and culture takes time and depends on the unique history of the organization.

Whether employees are involved in the creative process of brainstorming, acquiring knowledge, sharing knowledge, applying what they know to new problems, or debating what they know, KITwork requires repeated transaction-specific interactions. These repeated interactions strengthen the organization's connective social tissue. Over time, unique cultures and norms that are rooted in the organization's particular history develop; these are impossible for competitors to replicate.

There are no Substitutes for KITwork

Finally, to be a source of sustained competitive advantage KITwork must not have substitutes. Competitors must not be able to implement their strategies and create the value added through KITwork using other means (Barney, 1991). Even if KITwork is valuable, rare, and inimitable, to the extent that it can be substituted, it is not a source of sustained competitive advantage. Although it may be possible to conceive of substitutes for KITwork, we believe that the knowledge-centered activities that comprise KITwork are essential to effective knowledge-based competition.

To summarize, KITwork is a capability that serves as a source of sustained competitive advantage for firms pursuing a variety of different competitive strategies. It is a complex and somewhat unpredictable social process that enables firms to achieve the specific imperatives of their competitive strategies and adapt to their ever-changing environments. Next we present a framework for understanding how the elements of human resource management systems can influence KITwork.

A MODEL OF HRM FOR KNOWLEDGE-BASED COMPETITION

The resource-based view of competition among firms suggests that HR practices can contribute to achieving a sustained competitive advantage by attracting and retaining knowledge resources and ensuring that those

resources are bundled and managed in ways that create strategic capabilities. That is, the HRM system can be used to build resources and to transform those resources into capabilities that contribute to firm performance. Fig. 1 illustrates our framework for understanding how HR practices can be used to build knowledge resources and, by supporting KITwork, also ensure that the firm's knowledge resources add value. Building on prior work (see Jackson, Hitt, & DeNisi, 2003; Jackson & Schuler, 2001, 2002; Schuler, Jackson, & Storey, 2001), the framework shown in Fig. 1 includes three components: (1) the systems (2) knowledge resources, and (3) KITwork capabilities.

The HRM System

Shown near the top of Fig. 1 are components of an HRM system. We assume that firms use a full array of HR practices to create an HRM system that accomplishes the four central HRM tasks, namely: identifying needed activities, managing competencies, managing motivation, and managing opportunities. As described elsewhere, in an effective HRM system, the full set of HR practices used in an organization are aligned to support all four of these major tasks (see Jackson et al., 2003; Jackson & Schuler, 2001, 2002; Schuler et al., 2001). For organizations that compete on the basis of knowledge, elements of the HRM system should be aligned to support the development of both knowledge resources and KITwork capability.

Knowledge Resources

Following work by Amit and Schoemaker (1993), resources are characterized as *stocks* of accessible organizational elements, which are at least partially controlled and sometimes owned by the organization. The stock of knowledge held by a firm's employees is a resource of potential value to most firms.

Knowledge stocks include explicit knowledge and tacit knowledge (Polanyi, 1967). Explicit knowledge is more easily codified and recorded. It can be formulated into sentences and equations, which are easily and reliably shared through written documents and oral presentations. Due to these characteristics, explicit knowledge can usually be obtained by competing firms. Thus, explicit knowledge is not likely to serve as the basis for a sustainable competitive advantage (DeNisi, Hitt, & Jackson, 2003).

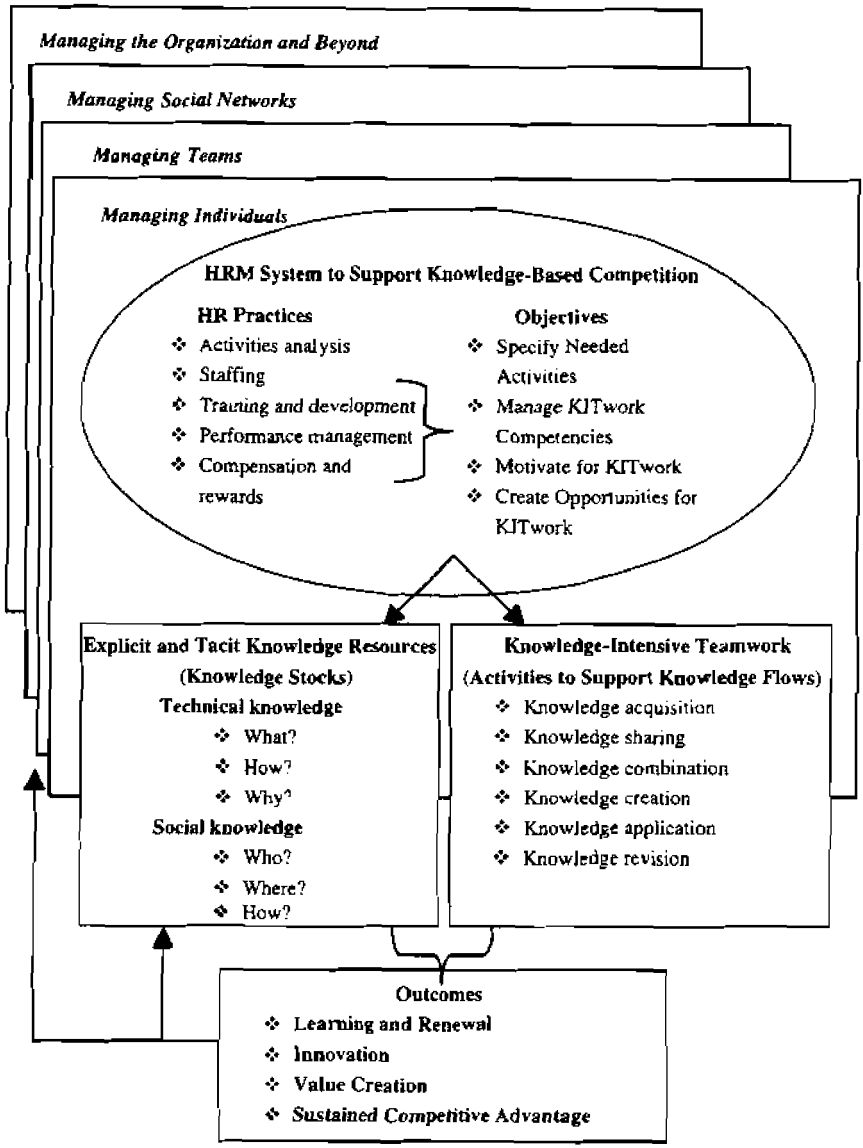

Fig. 1. A Model of HRM for Knowledge-Based Competition.

In contrast to explicit knowledge, tacit knowledge is complex and ambiguous, which makes it difficult to codify and transmit. People accumulate tacit knowledge through observation, imitation, and repeated interactions, which produce actionable skills or "know how." Compared to explicit knowledge, tacit knowledge is sticky – that is, it cannot be easily transferred from one person to another (see Von Hippel, 1994). In order for people to share tacit knowledge, they must be willing to participate in more extensive and perhaps more intimate relationships. When individuals share tacit knowledge, they often do so during casual interactions (Lubit, 2001) that unfold within a relationship characterized by high levels of trust. The stickiness of tacit knowledge makes it potentially more valuable than explicit knowledge as a source of competitive advantage.

HR practices are widely recognized as the primary means through which organizations develop the depth and content of their knowledge stocks. For example, job analysis and competency modeling identify the content and depth of knowledge needed by the organization; selection identifies individuals who have the content and depth of knowledge needed; training seeks to further enhance the depth and content of knowledge available, and compensation may be used to motivate employees to develop new or deeper knowledge.

Fig. 1 recognizes that developing knowledge stocks is one means through which HR practices can be used to promote organizational effectiveness. However, HRM systems that focus exclusively on managing the knowledge stocks of individual employees are likely to be ineffective in organizations that compete on the basis of knowledge. Especially in knowledge-based firms, HRM systems must also effectively manage the social system, for the social system is the conduit of knowledge flows.

KITwork: A Knowledge Capability

In contrast to the emphasis on knowledge stocks that is found in the HRM literature, the strategic management literature has emphasized the importance of managing knowledge flows. Dierickx and Cool (1989) likened knowledge flows to the movement of water coming into and leaking out of a bathtub. In a bathtub, the water level is a result of how much water has flowed in minus the amount that has flowed out. In a firm, the knowledge stock is the cumulative result of inward and outward knowledge flows. The bathtub metaphor points out that managing knowledge stocks

requires managing knowledge flows; stocks and flows are related but distinct constructs.

Likening knowledge to water emphasizes the power of knowledge aggregation and knowledge in motion. A single molecule of standing water has far less power to transform a landscape than does a river of moving water. Combining dispersed knowledge and facilitating the movement of knowledge through an organization makes it possible to exploit lessons that have already been learned, solve technical problems more effectively, and develop creative solutions (cf., Fiol, 2003; Hass & Hansen, 2005).

To date, most efforts to develop knowledge resources and KITwork processes have focused on electronic information technologies – not HRM technologies. The hope was that information technologies would enhance an organization's ability to store, sort, distribute, and (perhaps) analyze the vast array of knowledge hidden within the many nooks and crannies of organizational life. Experienced users of electronic knowledge management systems now realize that IT-based knowledge management systems are ineffective unless they are integrated into a total management approach for creating new knowledge and sustaining continuous learning (Thomas, Kellogg, & Erickson, 2001). By addressing the challenge of using HR practices that encourage and support KITwork, we seek to expand the work of HR scholars to include research that analyzes how HRM systems influence social dynamics throughout an organization.

Consistent with the constructivist perspective (Blackler, 1995), we assume that knowing is grounded in action, and therefore, managing knowledge involves managing activity (cf., Cook & Brown, 1999; Vera & Crossan, 2003). While each of the knowledge-centered activities shown in Fig. 1 can contribute to successful knowledge-based competition, not all aspects of knowledge-centered activities are equally important in all situations.

Like other types of teamwork, KITwork can vary in both degree and kind (cf., Kozlowski & Bell, 2003). Effectively managing an organization requires the identification of the knowledge-centered activities that are most essential to its success. A fully articulated model might include descriptions of alternative HRM systems to support each of several KITwork profiles. Our goal here is more modest. In the discussion that follows, we simply provide suggestions for how HR practices could be used to promote each of the six knowledge-centered activities listed in Fig. 1. Given the considerable overlap and interdependencies that exist among the six knowledge-centered activities, substantial research is needed to determine whether small differences in the preferred KITwork profiles require distinctly different HRM systems.

A Multi-Level Perspective

Managing KITwork involves more than managing the behaviors of individuals; it also involves efforts to manage the emergent social systems that are created as individuals respond to partially random events and interact with each other across time and space (cf., Kozlowski, Gully, Nason, & Smith, 2000). Our framework assumes that KITwork is a construct that can be used to describe phenomena at several levels of analysis. Knowledge that flows only between individuals is not likely to create competitive advantage for a large firm with global operations. Likewise, an HRM system designed to manage only the behavior of individuals will likely miss many opportunities to create value through effective KITwork. Sustained competitive advantage more likely accrues to firms that understand how to manage knowledge flows between teams, throughout and among business units, through ill-defined social networks, and beyond organizational boundaries. Thus, an effective HRM system produces outcomes for individuals, teams, departments, business units, communities of practice, and so on.

Fig. 2 illustrates our multi-level view of KITwork. Consistent with a multi-level perspective, we refer to knowledge-centered *activities* (not behaviors, which often are associated with individuals) as the components of KITwork. Although we do not address all of the possible levels-of-analysis issues suggested by Fig. 2, we encourage readers to consider how focusing on units of analysis other than the individual raises new questions about the possible effects of HR practices on social dynamics within organizations at various levels of analysis (e.g., dyads, communities of practice, and inter-team relations).

To illustrate how KITwork can be conceptualized at multiple levels of analysis, consider one element of KITwork – knowledge-sharing activities. Individual-level knowledge sharing occurs when a person shares what he or she knows with another person or group. Team-level knowledge sharing is more than the aggregation of such individual behaviors, however. For social units (e.g., teams, networks), knowledge sharing involves managing social processes such as participation and decision-making. To ensure that team-level knowledge sharing occurs, a team may follow protocols regarding how to structure and run formal meetings, use technology to permit open access to information, and maintain strong norms to govern the behavior of individual members. Phenomena such as these are meaningfully treated as distinctly group-level phenomena. In order to understand and manage the flow of knowledge through an organization, it is necessary to understand and manage knowledge sharing at all of these levels of analysis.

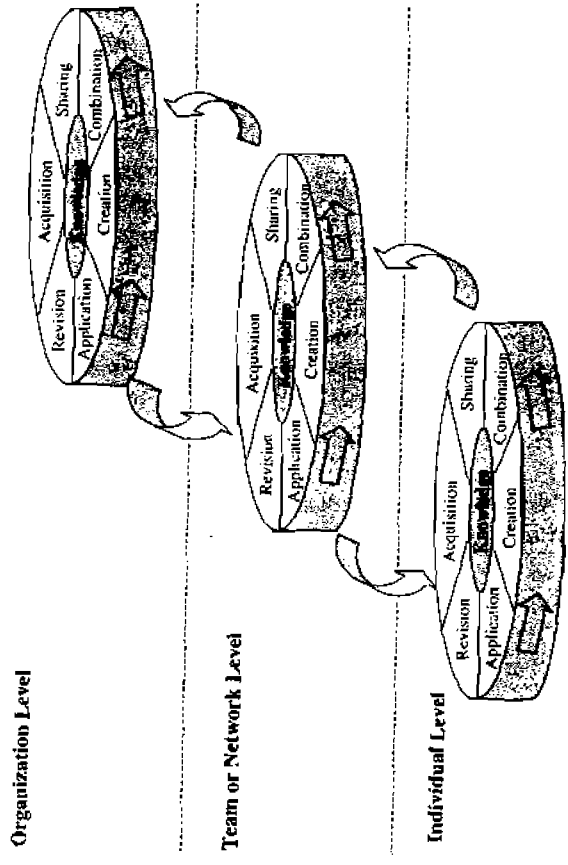

Fig. 2. A Multi-Level View of KITwork.

In this paper, we are not able to provide a detailed description of knowledge-centered activities at each of several levels of analysis. Nevertheless, our discussion of HR practices for managing KITwork presumes that HR practices are relevant to the knowledge-centered activities across the full spectrum of levels of analysis.

CHALLENGES IN DESIGNING HRM SYSTEMS FOR KNOWLEDGE-DRIVEN ORGANIZATIONS

Any HRM system includes a complex array of elements. Presumably, these elements are most effective when they are aligned and integrated with other elements and also aligned and integrated with the organization's unique conditions (e.g., see Jackson & Schuler, 1995; MacDuffie & Krafcik, 1992; Schuler & Jackson, 1987).

During the past decade, scholars have tried to identify bundles of HR practices that comprise integrated and coherent HRM systems (Becker & Huselid, 1998). Implicit in such efforts is the assumption that the many varieties of HRM systems found in organizations can be reduced to a small number of archetypes or configurations (Ostroff & Bowen, 2000; Lepak, Liao, Chung, & Harden, 2006). A potential problem with the search for system archetypes is underestimating the complex effects of an organization's external and internal environments and the path-dependent nature of system evolution. Any search for dominant practice configurations and archetypal HRM systems focuses attention on the commonalities across firms. Yet, the resource-based view asserts that a sustainable competitive advance is gained through the development of unique bundles of resources and distinctive capabilities that are difficult to imitate and distributed heterogeneously amongst competitors.

A process-based approach to understanding how integrated HRM systems emerge represents an alternative perspective for understanding HRM system design. A process-based approach presumes that some approaches to developing HRM systems are more likely to result in the system being internally aligned and appropriately integrated with other elements in the organizational system. If a firm outsources the design and/or implementation of its staffing to one external vendor and outsources the design and implementation of its training programs to another vendor, there is likely to be little integration between these aspects of the HRM system. Likewise, if a firm adopts practices simply because they have been identified as so-called "best practices," the degree of integration and coherence among its practices

would be low if it imitated the staffing practices in one organization, the training practices in another organization, and the pay practices in a third organization.

The development of an integrated and coherent HRM system is more likely to occur when an organization sets this as an objective and adopts a planning process to meet the objective (see Schuler et al., 2001; Jackson & Schuler, 2000). A planning process that addresses issues at multiple levels of analysis is more likely to result in the desired outcomes than is one that focuses on managing individuals. In addition, it seems likely that a coherent and integrated HRM system is more likely to evolve when the design and planning process eschews the traditional HR silos found in many large organizations (staffing, training, compensations, etc.).

Consistent with these assumptions, we assume that effective HRM systems evolve through a series of iterative decisions about how to use HR practices to achieve four major tasks: specifying the desired activities, managing competencies, managing motivation, and managing opportunities. More specifically, firms competing on the basis of knowledge need to: specify the desired knowledge-centered activities, manage knowledge-centered competencies, manage motivation to engage in knowledge-centered activities, and create opportunities for knowledge-centered activities. Next, we suggest how multiple HR practices might be coordinated to achieve these four tasks, and also suggest some future research directions.

Specifying Knowledge-Centered Activities

The behavioral approach to understanding management practices assumes that an effective HRM system includes practices for identifying the required activities of individuals, teams, networks, and so on. An effective HRM system also must ensure that the desired activities are communicated to all members. Because the identification and communication of knowledge-centered activities are intertwined, we include both as components of the first task in our model – specifying knowledge-centered activities.

Activity Analysis

Activity analysis (aka, job analysis) is the primary HR practice for specifying the activities required in a particular firm. Task analysis approaches describe the work activities and outcomes expected from people performing a job or role, while competency modeling (person analysis) describes the skills, knowledge, personality characteristics, and other personal attributes

needed to perform a job or role effectively (see Sackett & Laczo, 2003; Sanchez & Levine, 2001). The potential value of task analysis and competency modeling derives first and foremost from their potential usefulness as analytic procedures for building the foundation of a coherent HRM system.

Extensive research by I/O psychologists has yielded several useful taxonomies for describing the basic underlying dimensions of task performance (e.g., see Campbell, 1999; Campbell, McCloy, Oppler, & Sager, 1993; Pulakos, Arad, Donovan, & Plamondon, 2000). Only recently have these taxonomies been evaluated for their applicability in organizations engaged in knowledge-based competition. In one such analysis, Pulakos, Dorsey, and Borman (2003) set out to identify key task performance dimensions to use as input into the design of staffing decisions. Their expert judgment led them to conclude that three aspects of task performance seem to be central to the performance of knowledge-based work:

> *Building and applying knowledge.* Includes gathering and sifting through information to gain an understanding of the situation; analyzing and integrating data to develop solutions or create new knowledge; developing new approaches, tools, strategies to increase competitive advantage; exploiting technology to enhance productivity.
>
> *Sharing knowledge.* Includes sharing knowledge and expertise freely in written and oral form; collaborating with others to arrive at solutions; developing networks with other experts to facilitate knowledge exchange; packaging and presenting information that is on-point and persuasive.
>
> *Maintaining knowledge.* Includes demonstrating enthusiasm and curiosity for learning and advancing knowledge; developing and maintaining specialized knowledge, skills, and expertise; staying abreast of new methods and content areas.

Clearly, the Pulakos et al.'s list of task dimensions overlaps with our list of six knowledge-centered activities. A major difference is that their definitions of the three knowledge-based task domains are defined by individual-level behaviors only. The objective of Pulakos et al. was to use this list of task domains to develop a list of employee characteristics needed for such work. Again, their focus was at the individual-level of analysis.

In order to identify the employee characteristics required to perform knowledge-based work effectively, Pulakos et al. asked 15 experienced selection experts to judge the relevance of several potentially important attributes. This small study yielded a list of 17 possible predictors (competencies) of performance in knowledge-based jobs. Cognitive skills and abilities (e.g., reasoning, critical thinking, information gathering, problem-solving, domain-specific knowledge, content-relevant experiences, reading

comprehension) dominate the list Pulakos et al. developed; social skills and abilities (e.g., active listening, interpersonal flexibility, cooperativeness) play a secondary role. While cognitive skills and technical knowledge are undoubtedly important for performance of many knowledge-based tasks, KITwork is likely to require a variety of interpersonal skills that facilitate collaboration among diverse people who work together as members of teams and fuzzy, boundary-spanning networks (cf., Morgeson, Reider, & Campion, 2005).

The work of Pulakos et al. was grounded in traditional approaches to conducting job analysis and competency modeling, which were developed in the context of traditional, bureaucratic organizations. Reflecting their heritage, they presume individuals are the appropriate unit of analysis, emphasize commonalities among individuals, and rely heavily on self-reports from employees. These features of traditional task analysis may lead organizations to underestimate the social nature of knowledge-based work, and overemphasize the cognitive elements. New approaches to conducting activity analysis are needed to overcome these weaknesses.

Toward Describing Social Systems

Task analysis methods that focus on individuals are problematic if they fail to capture the social systems through which work gets done. KITwork activities are embedded within social systems of myriad types. Consider, for example, the variety of forms that work teams can take: Some have stable membership, others rotate membership; some have relative autonomy, others are interdependent; some teams have members with relatively similar knowledge and expertise, while others have members who were chosen because they have quite diverse skills (e.g., see Mohrman, Cohen, & Mohrman, 1995). Similarly, the KITwork networks come in many forms: Some networks include primarily members of the same organization, but others include members who work in different organizations. The linkages among people in some networks are dense and reciprocal, while other networks loosely link together people who have little direct interaction with one another. Increasingly, KITwork also varies along the dimensions of virtuality, geographic dispersion, and cultural diversity.

In addition to analyzing the tasks of individuals, it is appropriate to analyze the activities of project teams, task forces, committees, collaborative networks, and so forth. Accurate activity descriptions require methods that identify not only the individual behaviors required to complete work, but also the social roles performed in doing the work (e.g., see Ancona & Caldwell, 1992). Methods that engage KITwork collaborators in describing

their work as a *collective* may yield more accurate descriptions of KITwork activities.

A shift from individual-focused task analysis to methods that focus on larger social units can have major implications when drawing conclusions about which tasks are most prevalent. To illustrate, suppose a work unit is comprised of 15 collectives (teams/groups/networks) each having an average of 15 members. Every collective requires one and only one person to act as a liaison to the unit's suppliers. An analysis conducted at the individual level of analysis would indicate that the majority of employees in the unit do not act as liaisons. It might further show that even those who do act as liaisons spend only ten percent of their time on that task. If the organization builds its HR practices around the individual-level results, the HRM system may not ensure that every team/group/network understands the importance of the liaison role for their effectiveness. Because the importance of liaison activities is underestimated, some collectives (teams, networks) may have no one who can perform the liaison role effectively and/or no one who is motivated to treat this activity as a key responsibility. When collectives are treated as the unit of analysis, the results would show that every collective requires someone to perform the role of liaison. If the organization builds its HR practices around the collective-level results, the HRM system is more likely to ensure that every collective recognizes the importance of this role, includes the competencies needed for the role, and ensures that the role is performed effectively even as particular members of the collective change over time.

Toward Understanding Tacit Knowledge, Skills, and Abilities

The bedrock of most task analysis and competency modeling techniques is self-descriptions. People are asked to describe how they spend their time and the competencies they use in their work. Such methods assume that employees are aware of and able to describe what they do, how they do it, and the personal characteristics required to perform effectively. To the extent that tacit knowledge, skills, and abilities are needed to perform effectively, self-descriptions are clearly inadequate. By definition, tacit knowledge is knowledge that employees cannot easily articulate.

Just as individuals have tacit knowledge, social groups or collectives develop tacit skills that facilitate their collective efforts. Thus, in addition to identifying the important tacit knowledge of individuals, organizations face the challenge of identifying the most important tacit knowledge and skills that enable collectives to perform effectively. Again, simply asking people to provide descriptions of the tacit knowledge that is important to their

collective performance may not be effective. Observational techniques, such as producing maps of electronic communications to identify the flow of information through networks, analyzing project management behaviors over time, and observing *in situ* group behavior may be more effective methods for identifying the tacit knowledge embedded in the routines that guide social interactions among people engaged in KITwork (e.g., see Edmondson, Bohmer, & Pisano, 2001).

Communicating the Desired Knowledge-Centered Activities

Assuming an organization can identify its most important knowledge-centered activities, it must communicate this information to employees. A strong HRM system can promote a climate that supports KITwork by communicating and signaling the knowledge-centered activities that contribute toward the achievement of the company goals (Bowen & Ostroff, 2004).

To illustrate how HR practices send messages about the importance of knowledge-centered activities, consider the signals sent by the process of activities analysis. If employees are asked to describe critical incidents related to knowledge sharing, knowledge creation, and so on, it signals the importance of these activities in the organization. Asking individuals to answer these questions with a focus on their own behavior sends a message that is different from the signal sent by conducting focus groups with members of teams, task forces, and communities of practice. Asking a team to describe only its internal functioning sends a different message than asking the team to describe how it learns from its clients and how it shares what it learns with others in the organization. In other words, the method that an organization uses to identify which knowledge-centered activities are most important has two major consequences. First, as described above, it influences the technical results, and second (perhaps unintentionally), it sends signals about the types of knowledge-centered activities that are most valued by an organization.

Toward Improved Methods for Identifying Knowledge-Centered Activities

Understanding the knowledge-centered activities that contribute to gaining competitive advantage is the essential first step in developing an HRM system that supports KITwork. Unfortunately, most task analysis and competency modeling techniques were not developed to comprehensively describe the knowledge-based activities of work teams, communities of practice, professional networks, and other collaborative structures that support KITwork. During the next decade, research is needed to develop analytic

tools that are sensitive to the unique concerns of knowledge-intensive organizations. Ideally, these new tools will expand beyond the traditional focus on individuals as the unit of analysis and in doing so provide a more complete picture of the frequency and importance of the knowledge-centered activities required for a particular organization's effectiveness.

Managing Competencies for KITwork

For organizations that rely on KITwork, managing knowledge-centered competencies presents several special challenges. These include addressing the dynamic nature of KITwork, managing competencies of collectives, managing tacit competencies, and balancing short-and long-term needs. Several elements of an organization's HRM system can be used to address these challenges, including practices related to training and development, staffing, and compensation.

The Dynamic Nature of Knowledge-Based Competition

Studies of knowledge-based organizations highlight the fact that managing knowledge competencies is a dynamic process (e.g., see the Special Issue on the Knowledge-Based View of the Firm published in *Strategic Management Journal*, 1996). The value of extant knowledge erodes quickly over time, and the search for new knowledge is never-ending. Rapid and often discontinuous environmental changes may require changes in a firm's profile of knowledge-centered activities. The dynamic nature of knowledge-based competition means that the value of competencies held by an organization will diminish unless they are continually updated, putting pressure on the workforce to continuously learn, adapt, and change. For knowledge-intensive organizations, a major challenge is ensuring that the competencies present in the workforce evolve to meet changing environmental conditions (Lepak & Snell, 2003).

Cognitive skills, personality, and task knowledge are among the competencies associated with creative and innovative behavior (e.g., see Mumford, 2000; Ree & Caretta, 1998; Taggar, 2002), and it is likely that staffing a workforce with people who have these competencies will facilitate knowledge-based competition (see Pulakos et al., 2003). To assist employees in building their cognitive skills and abilities, knowledge-intensive organizations are likely to offer traditional on-site or off-site training as well as web-based learning opportunities (e.g., see Noe et al., 2003). Such programs are grounded in a traditional, top-down view of learning; they assume that the

knowledge needed by employees can be identified in advance and then delivered when and where it is needed. Responsibility for building the knowledge base of employees resides with outsiders (e.g., HRM professionals), not with the employees themselves.

While helpful, top-down approaches to training and development are likely to be inadequate, for they underestimate the dynamic, problem-driven nature of KITwork. KITwork consists of "real-time" knowledge-centered activities that unfold in a dynamic context. Employees cannot rely on others to determine in advance the knowledge they will need and then deliver it to them – they must be able to access knowledge when they need it, recognize potentially useful knowledge when they encounter it, and understand that the knowledge they have may be outdated. "Spoon-feeding" knowledge *content* ("know what") to employees is likely to be inefficient and ineffective.

Employees engaged in KITwork are likely to benefit more from HR practices that help them develop and continuously update the "know how" needed for KITwork. Employees with KITwork "know how" are able to take responsibility for their own learning and development on an as-needed, just-in-time basis. Two types of know-how required for KITwork are technological know-how and interpersonal know-how.

During the past decade, changing information technologies have created new opportunities for employees to easily acquire information whenever and wherever they need it. Employees with *technological know-how* – conducting effective internet searches, using electronic bulletin boards to communicate with experts, and participating in webcasts – can quickly acquire up-to-date information on almost any topic. Similarly, if collaborators know how to use intranets, groupware, and myriad other information technologies, it makes it easier to perform their work despite their being geographically distributed. Yet our research suggests that some employers fail to provide KITworkers with the technologies they need to communicate effectively; other employers provide their employees with access to the latest electronic equipment and software but fail to train them in how to use it for knowledge-centered activities.

Interpersonal know-how refers to competencies that facilitate effective interactions among collaborators. Organizations are complex social systems, which can be difficult for KITworkers to navigate. HR practices that help KITworkers develop an understanding of the social context within which their activities are conducted could smooth interactions and reduce the process losses that often plague group work. For effective teamwork, interpersonal skills that appear useful include conflict resolution, collaborative problem-solving, and communication (Stevens & Campion, 1999).

For example, in their analysis of talent contracting situations, Davis-Blake and Hui (2003) reported that contracting relationships typically require a manager who is adept at managing the interface between contract employees and regular employees. These managers should build mutual trust and engender feelings of identification with the contracting firm in order to encourage the flow of knowledge between contract and regular employees.

Managing the Competencies of Collectives

In our discussion above, we focused primarily on the KITwork competencies of individuals. Managing the competencies required for effective KITwork also involves ensuring that the collectives in which people work have the required competencies. For individuals, KITwork competencies constitute knowledge stocks. For groups and other collectives, KITwork competencies include the accumulated knowledge held by individuals in the group as well as group-level competencies. Although individual- and group-level competencies are closely related, the competencies of a collective are not perfectly correlated or isometric with the individual competencies of its members.

To illustrate, consider a group of individuals who come together and share their knowledge with each other. It is likely that the personal knowledge stocks of several individuals will increase as a consequence of their interactions. However, unless the interaction process also produces some new knowledge, the group's stock of knowledge will remain unchanged. If members of the group engage in joint problem-solving, however, new knowledge is likely to be created (Levine & Moreland, 1999; Liebeskind, Oliver, Zucker, & Brewer, 1996). In that case, the group-level knowledge stock increases. Note, however, that a gain in group-level knowledge does not guarantee that every individual in the group gains knowledge; knowledge gains may be unequal across individuals. Conversely, individual knowledge stocks can increase without any concurrent change in the knowledge stock of the collective. The task of managing competencies requires recognizing the distinction between managing individual competencies and managing the competencies of larger social units, such as teams and networks.

Using activities analysis to identify the competencies needed by collectives is an essential step toward developing knowledge-based competencies. A considerable body of research on team performance provides insights into the competencies needed by collectives engaged in knowledge work. For example, research on conflict within teams suggests that effective teams are skilled at constructive controversy; that is, they are able to air and discuss

opposing views while maintaining positive personal relationships (Jehn, 1995; Tjosvold & Tjosvold, 1995). When creative solutions are needed, team competencies such as non-evaluative brainstorming, goal setting, the appropriate use of breaks, and scheduling of iterative team and individual idea sessions may contribute to team performance (Paulus, Larey, & Dzindolet, 2001). In volatile environments such as those in which KITwork is found, the adaptation skills of a collective may also be central to their success (cf., LePine, Colquitt, & Erez, 2000). Adaptation occurs when members of the collective recognize changes in task demands and reevaluate and perhaps reformulate their approach in response to the changes.

Assuming that collective competencies such as constructive controversy, creative problem-solving, and adaptation contribute to the success of KITwork, HR practices should seek to build these competencies, and practices that treat collectives as the fundamental unit of analysis may be most appropriate. For example, rather than providing technological and interpersonal skills training to individuals, training of intact collectives may prove more effective. In addition to providing incentives for individuals to develop their competencies, it may be useful to also provide incentives for collectives to develop their competencies. Finally, effectively managing the competencies of collectives involves recognizing that the competencies of a collective are not equivalent to a simple aggregation of individual competencies.

Managing Tacit Competencies

While a great deal is known about how to manage competencies (at least at the individual level), most principles of effective HRM address the management of explicit competencies – that is, competencies that can be articulated and codified. Explicit competencies are amenable to formal and systematic management; they can be measured and transferred with relative ease. Technical knowledge and interpersonal skills are examples of explicit competencies. In comparison, tacit competencies are difficult to articulate and measure and thus are more difficult to manage. At the individual level, creative thinking and political savvy are examples of tacit competencies. At the level of collectives, building consensus, managing changes in membership, and maintaining network ties may be examples of tacit competencies. Typically, HR practices ignore the tacit competencies of collectives, and they often undermanage the tacit competencies of individuals.

Knowledge management scholars have argued that extensive interpersonal contact between teachers and learners provides the best means for transferring tacit knowledge (e.g., see Fiol, 2003). HR practices that support the development of extended networks of people from diverse backgrounds

may facilitate the flow of tacit competencies. If tacit competencies are transferred and learned informally, then the development of these competencies should occur more quickly when employees are embedded in strong social networks that place them in contact with people who have the desired tacit competencies. Further, team-based training and development of a shared mental model facilitate problem-solving by improved communication and group decision-making ability (Hollenbeck, DeRue, & Guzzo, 2004). Research that illustrates effective approaches to measuring and managing tacit competencies clearly is needed.

Balancing Short- and Long-Term Needs

The dynamic nature of knowledge-based competition means that organizations must be adept at quickly changing the competencies of their workforce. Short-term employment contracts and increased use of outsourcing are one approach to addressing the need for rapid and frequent changes in required competences. But the foregoing discussion suggests that this approach may have hidden drawbacks. Clearly, contract labor can help meet short-term needs and allows employers to quickly shed competencies that are no longer needed. However, this staffing model implicitly assumes that competencies are attributes of individuals and ignores the emergent competencies of collectives.

In the long term, policies that increase workforce turnover and volatility may restrict the development of valuable social and intellectual capital. Employees who do not intend to remain with the organization may be less likely to share their ideas and insights with collaborators (Oldham, 2003). Furthermore, because contract workers usually are present in the organizations for relatively short periods of time, there is less time for core employees to learn from them. Increased turnover among regular workers is another possible unintended consequence of using contract labor. Regular workers may feel that highly paid contract workers are viewed as more valuable to the firm. For this or other reasons they may be attracted to the alternative form of employment and decide to seek employment elsewhere. Thus, firms that acquire the competencies they need by contracting for talent may find that they need a variety of HR practices designed specifically to manage the unique issues that arise in contracting situations (for a more complete discussion, see Davis-Blake & Hui, 2003).

While short-term employment contracts may be effective for an organization's immediate competency needs, the long-term return to the organization may be less than anticipated. When KITwork is involved, the effective use of contract employees requires HR practices that maximize the

flow knowledge into the firm and minimize the leakage of knowledge out of the firm.

The same issues that bedevil employers who rely on contract workers may also play out among KITworkers, even if they all are "permanent" employees of the same organizations. The project-based work assignments of some KITworkers share some similarities with the short-term contract work of temporary employees. Like contract employees, members of a project team may have been enlisted because they have unique knowledge or skills. Often, project participants do not know each other when a project begins, so they must work through issues of trust. Like contract employees, project members may have split or dual loyalties – e.g., to other projects or to a "*home*" *department*.

Managing Motivation for KITwork

Motivational forces influence which behaviors employees choose to engage in as well as the effort invested in those behaviors. Most psychological theories of motivation recognize that decisions about how to behave and how much effort to exert are influenced by both employee characteristics (including their competencies) and the work environment. In the preceding section, we noted that many elements of an HRM system can be used to ensure that an organization's workforce has competencies needed for knowledge-centered activities. In this section, we consider how HR practices can influence the likelihood that employees *will* engage in knowledge-centered activities. Our discussion is organized around three key themes: the decision to participate in the organization and in knowledge-centered activities, rewards and recognition practices, and motivating learning processes.

The Decision to Participate

The decision to work for an organization is essentially voluntary for all employees, but descriptions of knowledge-based competition often highlight the ability of knowledge workers to exercise their free will when deciding which organizations to join, which projects to work on, whether to participate in various informal communities of practice, and whether to share their ideas. Tight labor market conditions for knowledge workers reinforce the belief that knowledge workers have considerable freedom to choose where, when, and how they work (see Maurer, Lee, & Mitchell, 2003).

When KITwork is central to an organization's effectiveness, employers need to understand how employees decide which project teams to join,

whether to accept informal leadership and advocate roles, whether to participate as an instructor or mentor, and so on. In making decisions such as whether to participate in training programs and how much of their knowledge to share, employees shape the development of their own portfolio of knowledge competencies as well as those of others in the organization.

Research that enhances our understanding of participation decisions in KITwork settings is needed in order to design HRM systems that encourage it. As Arthur and Kim (2005) pointed out, research on HR practices to support knowledge-centered activities should take into account the political nature of organizations and the perspectives of multiple constituents. For example, organizations that use financial incentives to reward employees for contributing ideas should not expect the incentives to be effective unless employees trust managers to protect employees from potential harmful side effects of implementing the ideas (e.g., job loss).

Rewards and Recognition

Rewards and recognition often are assumed to be the most powerful HR tools for managing motivation, yet scholars hold differing views about the effects of rewards. For example, Lawler (2003) argued that contingent rewards should be used to support knowledge-centered activities because they are effective in directing employees' attention to the most important aspects of their work and motivating them to exert maximal effort. His arguments are consistent with research showing that organizations are more likely to achieve their stated goals when employees are rewarded for results that are consistent with those goals (e.g., Montemayor, 1996; Shaw, Gupta, & Delery, 2002). Others have argued that tying rewards to the achievement of creative outcomes may reduce creative output (e.g., Amabile, 1979; Shalley, 1995; Oldham, 2003). To address the organization's desire for accountability while providing room for individuals to take the risks associated with creating new knowledge, Oldham (2003) recommended offering only small rewards and giving them after considerable time had elapsed.

In addition, rewards that focus attention on quality over quantity may be more consistent with knowledge-centered activities (e.g., see Zenger & Marshall, 2000). Although some field studies have reported that monetary rewards are not the main motivators of collaborative behavior (e.g., Jassawalla & Sashittal, 1999; Swart & Kinnie, 2003), research also shows that people tend to underestimate the importance of pay due to social desirability considerations and lack of self-insight (Rynes, Brown, & Colbert, 2002). Research that yields practical suggestions for how to develop effective

reward systems for employees engaged in knowledge-centered activities is needed to resolve this ongoing debate.

Motivating Learning

Individuals, teams, and organizations learn through the KITwork processes of knowledge acquisition, sharing, application, and so on. Thus, when employees engage in knowledge-centered activities, learning is one outcome. Such learning requires more than mere access to information, however; employees also must be motivated to learn.

Motivation to learn is likely to be greatest when the value of learning is apparent and the cost of learning is small. Too often, the cost of learning is more apparent than the value of learning. Costs are perceived to be relatively great when people view learning as a remedy for knowledge deficiencies and see it as a remedial process for correcting inaccurate or obsolete knowledge. Admitting that one's knowledge is inadequate may threaten one's self-esteem and create resistance. This problem seemed to hobble the "lessons learned" review sessions that one drug company established to improve their clinical testing of new products. The scientists were reluctant to participate in discussions about past drug development failures. Managers concluded that the scientists felt threatened by such discussions because they cast doubt on the scientists' competencies (Jackson & Erhardt, 2004). Performance postmortems such as that company's "lessons learned" reviews (sometimes called After Action Reviews), which focus on diagnosing the reasons for past failures, invite finger pointing and defensive self-protection.

To motivate employees to critically evaluate and perhaps revise existing knowledge, organizations may need to reframe learning activities. Rather than dissecting the past, employees may be more motivated by practices that emphasize improving the future. Action learning techniques embody this approach. For example, Siemens University offers in-house corporate training that requires participants to engage in knowledge-centered activities such as knowledge acquisition, sharing, combination, and application to solve real business problems. Analysts and engineers from around the world work together in "student" teams. Instead of teaching students about what others already know, action learning at Siemens encourages teams to develop new knowledge that can be applied immediately.

The emotions experienced during action learning are likely to be quite different from the emotions associated with performance postmortems. Action learning projects may be (and perhaps should be) stressful, but participants finish the projects feeling a sense of accomplishment and pride.

They feel good about their learning and the collaborators who facilitated it, and this helps build social capital. In contrast, postmortems may elicit more negative emotions, including feelings of failure and embarrassment.

Clearly, research is needed to improve our understanding of how to use HR practices to motivate employees to engage in specific KITwork activities – i.e., knowledge acquisition, sharing, combination, creation, application, and revision. New research on the use of goals may prove particularly useful. The motivational effectiveness of specific and difficult goals is well established for tasks that are simple and routine (Locke & Latham, 1990). Similarly, studies of innovation processes indicate that specific and difficult project goals enhance the performance of R&D teams, and regular feedback from customers is associated with effective product development (Zirger & Madique, 1990). Findings such as these suggest that tying incentives and rewards to the achievement of specific knowledge-centered goals may be an effective HR practice. But other evidence indicates that individual creativity is impeded by productivity goals and excessive workloads (Amabile et al., 1996). For complex tasks that involve knowledge work, specific performance goals may interfere with experimentation and learning (see Dweck & Leggett, 1988). When innovation is the objective, motivation seems to be enhanced by challenging work and freedom in how to carry out the work, so perhaps "do your best goals" are more effective for the complex tasks found in knowledge-based organizations, which require people to learn – and perhaps invent – effective performance strategies (Earley, Connolly, & Lee, 1989; Kanfer & Ackerman, 1989; Winters & Latham, 1996).

Applying accepted goal-setting principles to collectives rather than individuals may also prove to be an effective solution for motivating employees engaged in KITwork. The size and complexity of many knowledge-intensive projects can be so immense that employees find it difficult to identify with the project as a whole. Like assembly line workers, knowledge workers may find it difficult to see how their efforts contribute to the organization's success. Team goals may prove useful to establish a "line of site" between work activities and the success of the organization, while at the same time permitting considerable freedom and autonomy for individuals.

Research is needed to improve our understanding of how to motivate individual employees to learn from their engagement in knowledge-centered activities – which involve high degrees of interdependence, uncertainty, ambiguity, learning, and creativity. Also needed is research that improves our understanding of the motivational forces that prompt learning in teams and other social units. It is not clear, for example, that motivating individuals to engage in individual learning results in team-level learning.

Managing Opportunities for KITwork

If a workforce understands that KITwork activities are essential and has both the motivation and the competencies needed for KITwork, is it possible that KITwork will fail to flourish? Yes, because they also need the right opportunities. Considerable research on creativity and innovation documents the importance of having contact with people who have information, perspectives, and experiences that are dissimilar to one's own. The HRM system can help create opportunities for such interactions in a variety of ways. Here we comment on culture management and staffing practices that can be used to create opportunities for KITwork.

Managing the Culture

During the past decade, electronic knowledge management systems have become a popular way to provide opportunities for employees to engage in KITwork. The systems are intended to make it easier for employees dispersed throughout an organization to recognize that they face similar challenges, discover each other, discuss common problems, and collaborate in finding solutions. In practice, however, electronic systems appear to be more useful for knowledge storage and passive knowledge distribution. Providing electronic opportunities to communicate does not necessarily stimulate employees to search for new knowledge. Nor does it encourage serendipitous knowledge exchange and learning.

Opportunities for knowledge-centered activities often arise beyond the boundaries of work teams, and even beyond the boundaries of the organization. Often, employees in different parts of an organization are working on the same challenge, but are completely unaware of each other. They do not discuss common problems as they try to solve them, and they do not share solutions once they have been discovered because they have no opportunities to do so. Yet, when knowledge flow and innovation are the objectives, meaningful conversations appear to be invaluable (Hansen, Nohria, & Tierney, 1999).

An organization's culture – i.e., its norms and rituals – can create opportunities for people to cross or span boundaries that might otherwise be barriers to information flow (Bouty, 2000). Such opportunities should pervade organizational life. In addition to the structure of work itself, events such as meetings, celebrations, training programs, conferences, and myriad other occasions for social contact can all be designed with the goal of encouraging contact and learning among employees with different perspectives.

Recognizing the need for more serendipitous conversations, a consulting firm adopted the practice of setting aside the third Friday of each month as

a day when everyone would get together. Typically, the consultants worked at their clients' offices. People who worked for different clients seldom saw one another. To increase social contact and make it easier for knowledge to flow among consultants, the firm instituted the practice of hosting monthly gatherings. Consultants were expected to free their calendars from travel and client visits for the third Friday of each month. That day was to be spent at the home office. These monthly gatherings provided the consultants with more opportunities to build personal relationships, establish greater trust, and share their knowledge (Jackson & Erhardt, 2004). This is just one example of how thoughtful culture management can increase the opportunities for knowledge-centered activities. The principle of designing events that bring together people for conversations and dialogue is one that can easily be adapted by any organization.

Likewise, an organization's culture can create opportunities for employees to engage in knowledge-centered activities with people outside the organization, and thereby speed the flow of new knowledge into the organization. Examples of HR practices that create such opportunities include short-term leaves for employees who wish to provide community service or explore other non-employment activities, paying the costs associated with professional memberships and conference travel, staffing practices that draw in a *broad* pool of external applicants, maintaining positive relationships with "alumni" and supporting alumni-centered events that encourage current employees to mingle and learn from former employees, and supporting mentoring relationships that cross organizational boundaries (e.g., seasoned employees serving as mentors for college students).

Staffing

Parties, social outings, and other informal events can encourage knowledge flow, but more formal solutions may also be needed in large organizations. One company approached the challenge of creating linkages among employees by creating a network of "knowledge integrators;" their role was bringing together people from different areas of the company to share knowledge. If a project manager needed a subject matter expert for assistance with an acute problem, the knowledge integrator located the right person. In selecting people for the role of knowledge integrator, the company looked for employees with deep knowledge of the business and the organization's social fabric.

Placement and promotion decisions also can create opportunities for knowledge-centered activities. At Colgate–Palmolive, best practices are shared and applied to new situations by managers who routinely accept

transfers to unfamiliar functions, divisions, and countries en route to higher-level positions.

Staffing practices that attend to team and network *composition* also can create opportunities for knowledge acquisition, sharing, and creation. Despite their increasing popularity, cross-functional teams do not always achieve their objectives. Staffing practices that ignore the composition of teams and other collaborating groups are a possible explanation for this problem. For example, a study of R&D teams found that high amounts of functional diversity interfered with the teams' technical innovativeness as well as their performance against schedules and budgets (Ancona & Caldwell, 1992). Other studies have found that diversity increases conflict and turnover rates (see Jackson et al., 2003). When collaborators share too little common ground, the effective communication required for knowledge-centered activities is difficult. Conversely, familiarity and friendship among team members may promote group learning (see Argote, Gruenfeld, & Naquin, 2001). Organizations that allow employees to participate in decisions about how to staff project teams and who to include as collaborators may benefit from improved knowledge flows and the learning that such knowledge flows promote.

Finally, staffing decisions should attend to the issue of social capital. Effective knowledge exchange is more likely when a social network exists to facilitate the exchange (Nahapiet & Ghoshal, 1998). Connections between team members and others inside and outside the organization (i.e., external social capital) create opportunities for knowledge-centered activities (Joshi & Jackson, 2003; Tsai, 2002). Diverse teams appear to be most effective when team members have connections to external collaborators (Keller, 2001; Ancona & Caldwell, 1992; Reagans, Zuckerman, & McEvily, 2004). Thus, when staffing teams, the question of who is *not* in a team may be as important as the question of who *is*. Because a team's social capital may be related to the demographic characteristics of team members (e.g., their age, tenure, gender, and ethnicity), attending to the team's social capital is fraught with difficulties. Nevertheless, HR practices that ignore the enabling role of social capital may inadvertently diminish opportunities for knowledge sharing.

CONCLUSION

We have argued that knowledge-centered activities are more likely to occur when they have been identified as valuable *and* the required competencies

are present *and* the workforce is motivated *and* opportunities for knowledge-centered activities are plentiful. In order to leverage the knowledge of its workforce, an organization must make it easy for knowledge to flow into and through the organization. KITwork processes are the primary vehicle driving knowledge flows, and HR practices are among the tools organizations can use to promote and support KITwork.

For organizations that compete on the basis of knowledge, an effective HRM system serves to specify the knowledge-centered activities most critical to success, ensure that the competencies needed for these activities are present in the organization, motivate the workforce to engage in knowledge-centered activities, and create opportunities for knowledge-centered activities to occur. We have argued that all available HR practices can and should be used in unison to achieve these four major HR tasks.

Our description of KITwork highlighted three key issues that have major implications for managing it effectively: First, our description recognized that knowledge can be explicit or tacit. Second, we argued that the HRM system should be used to manage both knowledge stocks and knowledge flows. And third, we argued that HR practices can be used to shape the knowledge-centered activities of individuals as well as the activities of teams, networks, task forces, and other collaborative groups found throughout organizations. Our discussion of HR practices to support KITwork emphasizes managing social systems and is presented as one of two prongs that should comprise a knowledge-driven HRM system. A comprehensive HRM system would also include HR practices that build knowledge stocks, i.e., the explicit and tacit knowledge held by individual employees. The knowledge-centered activities that comprise KITwork are the means through which explicit and tacit knowledge flow through an organization. These activities allow knowledge to move among and between individuals, teams, networks, departments, divisions, and even organizations and industries. Managing these activities should be a primary objective (but not the sole objective) of HRM systems in firms that compete on the basis of knowledge.

To date, HRM research and theory have emphasized explicit knowledge over tacit knowledge, managing knowledge stocks over managing knowledge flows, and developing the knowledge resources of individuals over managing more complex social and organizational knowledge-centered activities. A broader view of the challenges and opportunities that knowledge management poses for the field of HRM recognizes the need to manage both explicit and tacit knowledge. It also disentangles the twin objectives of building knowledge stocks and supporting knowledge flows. Finally, it

views the HRM system as contributing to a key objective of knowledge-intensive firms, namely, ensuring that valuable individual knowledge becomes embedded in organizational processes and routines. In adopting this broader perspective, we hope to stimulate new thinking about how HRM systems can be used by organizations to achieve sustained competitive advantage.

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