EXAMINING STRATEGIC FIT AND MISFIT IN THE MANAGEMENT OF KNOWLEDGE WORKERS

CHRISTOPHER COLLINS AND REBECCA KEHOE*

This study advances research on strategic human resource management by examining whether better firm performance depends on the alignment between an organization's human resources (HR) system and its innovation strategy. The authors argue that the unique problems underlying exploration innovation strategies and exploitation innovation strategies require core workers to engage in different types of knowledge-search and -combination behaviors. Alternative HR systems theoretically produce different knowledge-search and -combination behaviors by way of their effect on employees' ability, motivation, and opportunity structures at work. Drawing on a field study of 230 software firms, the authors demonstrate that alternative HR systems support either an exploration or exploitation strategy and that alignment between a firm's HR system and innovation strategy results in firm performance gains and misalignment results in performance penalties.

Knowledge exchange and combination are essential for innovation and firm survival in fast-paced industries (Smith, Collins, and Clark 2005), but not all formal arrangements for managing workers are equally effective in managing required knowledge outcomes (Nickerson and Zenger 2004). Because alternative innovation strategies require the application of different knowledge (March 1991; Benner and Tushman 2003), the question of how firms can foster the required employee knowledge-search and -integration activities for a given innovation strategy is a critical area in need of further research (Gupta, Smith, and Shalley 2006). Human resources (HR) systems may be key to understanding this question in that extant research suggests that firms can gain a competitive advantage when they achieve alignment between the behavioral requirements of their strategies and the role behaviors engendered by the HR systems they use to manage core employees (Schuler and Jackson 1987; Collins and Smith 2006). We argue that firms

*Christopher Collins is an Associate Professor in the ILR School and Director of the Cornell Center for Advanced Human Resource Studies (CAHRS), Cornell University. Rebecca Kehoe is an Assistant Professor in the School of Management and Labor Relations, Rutgers University. Additional results and copies of the computer programs used to generate the results provided in the article are available from the authors at cjc53@cornell.edu.

Keywords: HRM, human capital, high-performance work practices, high-performance work system, organizational performance

that choose an HR system that fits with the knowledge requirements of their innovation strategy will achieve higher firm performance whereas those that choose a poor-fitting HR system will suffer performance penalties.

Theoretical work in the strategic human resource management (SHRM) literature has argued for the importance of vertical fit, the notion that an HR system is more likely to positively contribute to firm performance when the system is aligned with an organization's business strategy (Delery 1998; Becker and Huselid 2006). Prior empirical studies, however, found mixed support for this fit hypothesis (e.g., Delery 1998). Furthermore, the extant empirical research testing the fit hypothesis is lacking on a number of dimensions. First, prior studies have tended to focus on manufacturing or low-end service firms or on frontline employees (e.g., Arthur 1994; Fu et al. 2015), ignoring knowledge workers and industries in which innovation is at a premium. Second, prior work has tended to compare the effects of a high-investment HR system oriented toward employee development (e.g., the high-commitment or high-performance HR system) to a lower-investment HR system that limits resource allocations directed to attracting and developing employees (e.g., a transactional approach) (e.g., Arthur 1994; Delery and Doty 1996; Ichniowski, Shaw, and Prennushi 1997; Tsui, Pearce, Porter, and Tripoli 1997). Alternatively, extant empirical research has focused on the relative effects of a single strategic HR system in different strategic or industry contexts (e.g., Youndt, Snell, Dean, and Lepak 1996; Chadwick, Way, Kerr, and Thacker 2013). Unfortunately, although this body of research helps to establish boundary conditions associated with the appropriateness and effectiveness of a *particular* investment-oriented HR system,[1] these prior studies have ignored the idea that organizations have the strategic choice among multiple different investment-oriented HR systems, each comprising HR practices that support the development of unique abilities, motivations, and opportunities (AMOs) by core knowledge workers (Kehoe and Collins 2008). As a result, this research has offered no insights regarding the relative effectiveness of a high-commitment approach relative to other strategic HR systems.

We contribute to the literature on SHRM in several important ways. First, we explicitly adopt the idea of strategic choice in HR by comparing three alternative systems of HR practices and their effectiveness in satisfying the knowledge requirements of exploration and exploitation innovation strategies. Second, our approach sheds light on the fit hypothesis by assessing a wider range of HR systems and examining the effects of both alignment and misalignment of these HR systems with the knowledge-search and -combination behaviors required for the effective pursuit of alternative innovation

[1]For example, such research has established that high-investment HR practices may have diminishing positive effects on establishment performance as implementation levels increase (Chadwick 2007); that the effect of high-performance HR practices on labor productivity may be more positive in firms that are not pursuing a differentiation strategy, when capital intensity is high, when industry dynamism is high, and when industry growth is high (Chadwick et al. 2013); and that a human capital–enhancement HR system may be more positively related to performance under a quality manufacturing strategy (Youndt et al. 1996).

strategies. Significantly, we articulate how the three HR systems build on alternative philosophical approaches for managing core knowledge workers in terms of attachment, selection, and coordination and control and how these choices should theoretically result in different arrays of employee AMOs to carry out the knowledge-search and -combination behaviors required for alternative innovation strategies. In this article, we develop theoretical arguments regarding the fit between alternative HR systems and innovation strategies. We start by outlining two alternative innovation strategies—exploration and exploitation—and exploring the unique knowledge-search and -combination requirements of each. We then present three alternative HR systems (engineering, bureaucratic, and commitment HR systems) and detail how each may be aligned or misaligned with the unique knowledge requirements of exploration and exploitation. We test our model with data collected from core knowledge workers and managers from a sample of 230 software firms.

Theory and Hypotheses

Exploration and Exploitation

Exploration and exploitation represent distinct alternative strategies for innovation that enable firms to adapt to changing environments (Gupta et al. 2006); they differ in the scope and nature of required learning activities and desired outcomes (Levinthal and March 1993). Previous research has highlighted that the unique learning and knowledge requirements of these two strategies warrant distinct organizational investments, structures, and work environments (March 1991). Building on this prior work, we articulate the unique characteristics of the knowledge-search and -exchange behaviors required of core knowledge workers for successful exploration and exploitation.

Exploration has been broadly conceptualized as innovation with a goal of shifting or expanding a firm's technological paradigm and often creating new products or entering new markets (Levinthal and March 1993; Benner and Tushman 2003). Exploratory learning is characterized by the search for and combination of diverse and unique knowledge, risk-taking, experimentation, discovery, and frequent change (March 1991; Katila and Ahuja 2002). Exploration involves tasks that depart from the existing expertise of the focal organizational unit, requiring the organization to expand its base of knowledge and competence (Benner and Tushman 2003; Taylor and Greve 2006). Extending this logic, firms successfully pursuing exploration depend on core knowledge workers with the AMOs that enable them to search for, acquire, and integrate diverse distal knowledge from unique sources (Rodan and Galunic 2004; Beckman 2006). Employees' knowledge-search and -combination behaviors must also involve challenging the status quo through experimentation with novel alternatives that may vary widely from the firm's current technological direction (Benner and Tushman 2003).

In contrast, exploitation has been defined as innovation with the goal of improving or reinforcing a firm's current technological direction (Benner and Tushman 2003); it is oriented toward the refinement and extension of existing products (Levinthal and March 1993; He and Wong 2012). In targeting innovation around existing technologies, firms pursuing exploitation require deep (rather than broad) searches for knowledge and benefit from the recombination of local or similar (rather than novel) information (Baum, Li, and Usher 2000; Taylor and Greve 2006). Firms pursuing exploitation thus benefit from narrow overlapping knowledge and localized searches (either inside the organization or through other firms in the industry) for knowledge that can be readily connected to refine and extend existing products, technologies, and routines (Benner and Tushman 2003; He and Wong 2012). The knowledge-search and -combination behaviors that are likely to best support an exploitation strategy involve the application of knowledge that is more similar to and/or related to an organization's existing knowledge domain (Katila and Ahuja 2002; Rodan and Galunic 2004) and that supports more incremental change consistent with a firm's current technological trajectory (March 1991; Gupta et al. 2006).

The Behavioral Perspective of SHRM and an Examination of Alternative HR Systems

Early SHRM theory suggested that an organization can achieve a competitive advantage when the firm's HR system aligns with the requirements of the organization's strategic goals (Dyer 1985; Schuler and Jackson 1987). Following the AMOs framework, employees' contributions to performance are a function of their combined AMOs to achieve desired outcomes (Appelbaum, Baily, Berg, and Kalleberg 2000; Jiang, Lepak, Hu, and Baer 2012). Integrating these insights at the organizational level, the behavioral perspective of SHRM suggested that an HR system can aid in the creation of competitive advantage for an organization to the extent that its HR practices elicit the specific role behaviors required by a firm's strategy (Schuler and Jackson 1987; Jackson, Schuler, and Jiang 2014).

A key implication of the behavioral perspective is that HR systems composed of different HR practices are likely to foster the AMOs of different employees to support the different role behaviors required of alternative organizational strategies (Kehoe and Collins 2008). Prior SHRM research, however, adopted a narrow focus on a single HR system (the high-commitment HR system), assessing its potential to support performance across a range of strategic and organizational contexts requiring a variety of employee role behaviors. We suggest this approach may be problematic because it provides a limited perspective on what may constitute a high-investment HR system, particularly because a multitude of alternative HR systems may exist that follow different philosophies for investing in employees and developing unique employee AMOs (Kehoe and Collins 2008). Moreover, a focus on a single HR system prevents scholars from

determining the unique HR management investments that differentiate organizations and enable a competitive advantage in different strategic contexts (Becker and Huselid 2006).

We seek to overcome this critical limitation of prior SHRM research with an examination of the fit of different HR systems with alternative innovation strategies as a function of the knowledge-search and -combination behaviors that each HR system is likely to support. This represents an important point of departure, not only from the broader SHRM literature but also from prior SHRM work that specifically examined HR management and innovation, which has, to date, focused on the extent to which variations of the high-commitment HR system positively influence firms' innovation performance (e.g., Collins and Smith 2006; Chen and Huang 2009; Patel, Messersmith, and Lepak 2013; Chuang, Jackson, and Jiang 2016). This body of research has also failed to distinguish the differential behavioral and HR management requirements of alternative innovation strategies, leaving a gap in our understanding of different AMO requirements across alternative innovation strategies and, consequently, the potential effectiveness of alternative HR systems in different contexts.

In reality, firms vary in their choice of HR systems (Ichniowski et al. 1997; Tsui et al. 1997). Even in knowledge-based firms that face high institutional pressures to develop similar HR systems, researchers have found considerable variability in the HR approaches for managing core employees (Sherer 1995; Baron, Burton, and Hannan 1999). Prior research has demonstrated that different systems of HR practices can shape firms' performance outcomes, not only with respect to performance levels but also by differentially influencing the specific behaviors and interactions underlying employees' completion of work (Ichniowski and Shaw 2003). Therefore, researchers can expand our understanding of how firms can systematically and effectively use HR management to support different strategies by simultaneously examining multiple systems that pursue unique avenues for investing in employee AMOs. We draw on the work of Baron and colleagues (Baron, Burton, and Hannan 1996; Baron and Hannan 2002) to identify three specific HR systems, each composed of a set of HR practices characterizing a distinct underlying philosophy for managing knowledge workers: engineering, bureaucratic, and commitment. Baron et al. (1996) found that the HR systems employed in the technology firms they studied varied on three key components: selection, attachment, and coordination and control. Firms adopt HR practices to support the underlying basis on which they would like each of these three components to be enacted. These three components are consistent with other researchers' descriptions of the elements underlying firms' approaches to managing and shaping the AMOs of a workforce through HR practices (Tsui et al. 1997; Batt 2002).

The selection component captures whether an organization employs a buy or build approach with respect to employee capabilities, with firms varying in whether they hire employees based on their 1) skills and abilities to perform specific tasks right away, 2) broad capabilities to perform a range of

tasks that will evolve over time, or 3) fit to the culture of the firm with a focus on developing employees as they stay with the firm (Baron et al. 1996). The attachment component reflects the basis on which a firm attracts, retains, and motivates employees. Baron et al. (1996) noted that knowledge-based firms differ in whether they build employees' attachment through the development of 1) a long-term relationship based on employee commitment to the organization itself, 2) a market-based relationship focused on providing interesting and challenging work, or 3) a market-based relationship emphasizing individual pay.

Finally, coordination and control captures the mechanisms through which a firm manages employee performance, and structures work to ensure that essential tasks are completed effectively. Baron et al. (1996) noted that two broad approaches to coordination in knowledge-based firms were characterized by autonomy or tight control, and that each of these approaches could be employed through two alternative paths. Firms can motivate high employee task performance through autonomy and empowerment based on 1) organizational culture and pressure from peers or 2) professional socialization tied to the academic and industry standards of professionally trained employees (Baron and Hannan 2002). Firms pursuing a path of tight control and coordination can do so through 1) formal processes and systems or 2) consistent direct oversight by managers and supervisors (Baron et al. 1996).

Although the variation across the three components could lead to 36 unique HR systems, Baron and colleagues (Baron et al. 1996; Baron and Hannan 2002) found that most firms clustered into a small number of patterns. Important for our study is that three HR systems—engineering, bureaucratic, and commitment—were by far the most consistently followed patterns for firms that had moved past the startup stage (Baron et al. 1999). The work of Baron and colleagues is helpful in identifying the key components of HR systems and how the three systems differ from one another; nevertheless, previous research did not examine the impact of these systems on firm performance in the context of different innovation strategies. The three components (the bases for selection, attachment, and coordination and control) underlying each HR system are summarized in Table 1, and the specific AMOs and the ultimate role behaviors that they elicit are summarized in Table 2.

The engineering, commitment, and bureaucratic HR systems explored here represent three distinct philosophies regarding HR management investments that are likely to foster different knowledge-worker AMOs based on the unique HR practices in each system. We emphasize that these three HR systems represent not variations in organizations' levels of investment but, rather, variations in the types of investments that organizations make in managing the employment relationship, and they are likely to be more or less effective in supporting the knowledge-search and -combination requirements of alternative innovation strategies. Thus, in building and testing our theoretical model, we not only build on the SHRM research specifically

Table 1. Comparison of Three Components underlying the Engineering, Bureaucratic, and Commitment HR Systems

HR system	*Attachment*	*Selection*	*Coordination and control*
Engineering HR system	Interesting, challenging work	"Buy" approach; selection for broad capabilities to perform a range of tasks that will evolve over time	Professional socialization
Bureaucratic HR system	Competitive individual pay	"Buy" approach; selection for abilities to perform specific tasks right away	Formal processes and systems
Commitment HR system	Commitment to the organization	"Build" approach; selection for fit to organization's culture	Organizational culture and pressure from peers

Table 2. HR Systems; Role Behaviors; and Abilities, Motivation, and Opportunities

HR system	*Ability*	*Motivation*	*Opportunity*	*Role behavior supported*
Engineering HR system	Diverse, specialized knowledge	Motivation to navigate diverse viewpoints to achieve novel solutions	Ongoing access to diverse, distal knowledge in firm's external environment	Novel integration and recombination of diverse, distal knowledge
Bureaucratic HR system	Deep, narrow knowledge of industry standards and routines	Motivation to contribute to goals espoused by supervisor	Access to local knowledge related to current industry standards and routines	Integration and application of local, related knowledge in pursuit of incremental change
Commitment HR system	Deep familiarity with organizational knowledge	Commitment to achieving current goals of organization	Opportunities for reinforcement of shared or related knowledge and commitment to status quo through close contact with colleagues	Integration and application of local, related knowledge in pursuit of incremental change

examining HR management and innovation but we also make a significant contribution to the broader SHRM literature by looking beyond the high-commitment HR system to assess the effectiveness of alternative HR systems that may be more likely to contribute to competitive advantage in different strategic contexts.

Engineering HR System

The engineering HR system has been identified as the default approach in the high-technology sector, with a focus on attracting diverse external talent with a broad range of specialized knowledge and fostering an environment in which employees test and challenge one another's ideas (Baron and Hannan 2002). The philosophical approach to HR practices underlying the engineering HR system is 1) selection based on a "buy" approach to hiring for diverse skills and knowledge rather than building them internally; 2) attracting and motivating employees (attachment) by providing interesting and challenging work, as well as personal development opportunities; and 3) an autonomous approach to coordination and control relying on professional standards and socialization. Specifically, firms employing the engineering HR system tend to foster a market-based employment relationship with employees; these firms implement a "buy" approach to recruitment and selection with a focus on acquiring external talent with a broad array of expertise and diverse experience at all levels of the organization (Kehoe and Collins 2008). In addition, the engineering HR system elicits employee motivation and attachment by providing ample opportunities for employees to pursue interesting and challenging work, and by motivating employees to stay current with new advances in knowledge and technologies in the firm's external environment. The engineering HR system relies on professional control to guide individual performance and discretion (Baron et al. 1996).

We argue that the combination of HR practices in the engineering HR system promote unique knowledge-worker AMOs that support knowledge-search and -combination behaviors that are aligned with the exploration strategy and misaligned with the exploitation strategy. First, employee selection practices in the engineering HR system are likely to support behaviors that lead to the continuous infusion of new and unique knowledge into the firm. For example, a focus on the external selection of top candidates with broad skills helps to increase the likelihood of these firms attracting diverse talent with specialized and often unique knowledge from top universities and organizations outside the industry (Kehoe and Collins 2008). A market-based approach to selection ensures the perpetuation of inflows of new and unique knowledge through the hiring process at all levels of the organization (Song, Almeida, and Wu 2003). This particular market-based approach also creates opportunities for incumbent knowledge workers to access new, unique, and diverse knowledge by drawing on their broad and diverse networks outside the organization and its immediate industry (Smith et al. 2005).

Second, the HR practices within the engineering HR system are also likely to motivate knowledge workers to enact the requisite knowledge-search and -combination behaviors for exploration. For example, firms following the engineering HR system provide general directions and end goals, but leave immediate decisions and paths to solve challenges up to the discretion of employees. In such an environment, which encourages the self-guided and creative search for knowledge and ideas rather than following standard

routines and protocols, knowledge workers will be more likely to conduct novel searches for relevant knowledge within and outside the firm (Amabile 1996). Further, coordination and control based on professionalism and empowerment decreases status hierarchies and creates a climate in which employees believe no one person's knowledge is more relevant to every problem or goal, probably increasing employees' willingness to challenge the status quo (Weick and Westley 1996). Knowledge workers under this HR system will, therefore, be more likely to challenge previous assumptions, offer new ideas, and follow novel search directions to solve problems. The engineering HR system's focus on adhering to professional standards and the selection of skilled specialized talent is likely to increase feelings of trust among employees in the firm, increasing the motivation to share unique knowledge with one another (Collins and Smith 2006).

Overall, the engineering HR system fosters many of the knowledge-search and -combination behaviors required for an exploration strategy. Through its combination of HR practices, the engineering HR system supports knowledge workers' AMOs to conduct a broad search for diverse and unique knowledge that can be absorbed and combined to drive new technological directions. Further, the practices in this system help to increase access to additional unique knowledge from outside the firm through diverse knowledge networks in the professional community. The practices in the engineering HR system foster a climate in which core knowledge workers are more likely to experiment, connect knowledge in new ways, and challenge the status quo—all essential knowledge-search and -combination behaviors for success in exploration.

In contrast, many of the knowledge behaviors elicited by the engineering HR system are likely to be inefficient—and potentially counterproductive—in firms pursuing an exploitation strategy. For example, attracting a broad range of specialized knowledge to the organization is costly, both in terms of the immediate labor cost associated with the talent and the longer-term costs of socialization and retention. Firms seeking to merely extend existing technological directions through exploitation are unlikely to recover these costs or generate returns through this selection approach because such firms have little need for unique and non-overlapping knowledge (Smith et al. 2005). In addition, the engineering HR system is likely to cause significant waste in terms of employees' time and efforts because employees under this system use their individual discretion to follow new search strategies, pursue new paths, and question current directions and the status quo—activities that are likely to detract from the goals of refining existing processes and making predictable incremental advances along current paths (Nickerson and Zenger 2004).

Hypothesis 1: The engineering HR system will be positively related to firm performance for firms pursuing an exploration strategy and negatively related to firm performance for firms pursuing an exploitation strategy.

Bureaucratic HR System

The philosophical approach underlying the bureaucratic HR system emphasizes the employment of a workforce with a narrow range of skills and experience equipped to fill specific task requirements governed by formal rules and performance management (Baron and Hannan 2002). Specifically, selection decisions support a "buy" approach to hiring external applicants who have a tightly defined range of abilities to immediately perform in specified roles (Baron et al. 1996). Firms following the bureaucratic HR system seek to attract and motivate employees by providing competitive compensation relative to industry rivals and by closely tying pay to individual performance. Formal coordination and control are achieved through tight controls by management in the form of rigorous documentation, reporting structures, and regularly scheduled performance evaluations conducted by management (Baron and Hannan 2002). The HR practices in the bureaucratic HR system foster a formal structured work environment that rewards employees' mastery of institutionalized routines and use of relevant knowledge within the boundaries of well-defined job roles and expectations.

We argue that the bureaucratic HR system promotes unique knowledge-worker AMOs that support knowledge-search and -combination behaviors that are aligned with the exploitation strategy and misaligned with the exploration strategy. First, the practices in this HR system work together to support the exchange of knowledge stocks that are local and/or related to the organization's existing knowledge base in the pursuit of incremental change. By hiring for the immediate fit to organizational tasks and focusing on employees with relevant industry experience, firms employing the bureaucratic HR system are likely to assemble a workforce with strong external network ties to other firms or relevant actors (e.g., customers and suppliers) in their industry (Hitt, Bierman, Shimizu, and Kochhar 2001). These external ties create the opportunities for knowledge workers to gain access to new knowledge on process and technological improvements at competitor and peer organizations that, based on industry-specific standards, are likely be closely related to the firm's existing technological direction (Song et al. 2003).

Formal structural control tied to managerial direction and feedback in the bureaucratic HR system increases the importance of managers for identifying exchange opportunities in this context and leads to knowledge-search and -combination behavior that is oriented toward solving moderately complex problems (Nickerson and Zenger 2004) such as the improvement and modification of current technology. Further, organizations employing the bureaucratic HR system encourage employees to complete their work within the boundaries defined by formal organizational rules and under the close guidance and support of a designated superior. Because of this direct supervision and oversight, employees are likely to be motivated to accomplish supervisor-espoused goals (i.e., as opposed to disparate goals identified and embraced by individual employees), which is likely to reinforce the standardization of routines and formalization of roles in which existing organizational knowledge becomes embedded (Benner and Tushman 2003).

Overall, these arguments suggest that the bureaucratic HR system is positively aligned with the requirements of an exploitation strategy. The selection practices in the bureaucratic HR system create a core of knowledge workers with stocks of knowledge that are highly overlapping in terms of education, training, and work experience. Further, the external focus on talent acquisition constrained to tightly defined capabilities supports knowledge flows that help the organization gain access to new knowledge that is highly related to existing knowledge in the organization. These practices contribute to knowledge workers' advanced knowledge of industry standards, familiarity with the industry's products, and an understanding of common industry routines. Knowledge that is deep and narrow facilitates employees' abilities to integrate knowledge that is likely to be closely related to the current technological directions of the firm and promote incremental improvements and innovations in existing product lines (He and Wong 2012). Finally, practices in this system motivate employees to engage in knowledge-search behaviors that follow current routines, ensuring that employees contribute their knowledge to the improvement of current technological pursuits rather than focusing on new paradigms (Burns and Stalker 1994).

By contrast, the HR practices within the bureaucratic HR system are likely to lead to knowledge-search and -combination behaviors that are misaligned with the knowledge requirements of the exploration strategy. For example, a focus on hiring talent from the external market with tightly overlapping knowledge and experience reduces the introduction of the broad and unique knowledge required to create novel combinations of knowledge for exploratory innovation. In addition, the direct linkage of pay to individual performance decreases trust and decreases employees' motivation to share unique knowledge with one another (Collins and Smith 2006). Control through tight process and managerial oversight is less useful for solving complex problems because this formal hierarchy reduces the horizontal communication and exchange that facilitate the use of diverse perspectives and approaches to solving complex problems (Nickerson and Zenger 2004). Finally, tight controls and processes also reduce the likelihood of employees' pushing against the status quo or challenging industry standards because employees are likely to receive negative feedback for breaking standard procedures or protocols under a bureaucratic HR approach.

Hypothesis 2: The bureaucratic HR system will be positively related to firm performance for firms pursuing an exploitation strategy and negatively related to firm performance for firms pursuing an exploration strategy.

Commitment HR System

The philosophical approach underlying the commitment HR system is to create a work environment characterized by employee loyalty, close-knit internal ties, and a long-term employment relationship with the organization. In prior studies of high-technology firms, authors have articulated that

the commitment HR system is composed of three distinct groups of HR practices: 1) selection based on a "build" approach to hiring individuals who fit the organization's culture and who can grow with the firm over time, 2) attracting and motivating employees based on building a strong internal community and family-like environment, and 3) autonomous coordination and control through peer feedback and strong cultural norms and individual employee discretion (Baron et al. 1996; Collins and Smith 2006). Specifically, the commitment HR system includes external selection practices oriented to assess individuals' fit to the organizational values and culture and a focus on the internal labor market for promotions (Collins and Smith 2006). This system emphasizes peer and cultural control, relying on cultural norms to provide guidance for individuals who have high discretion in completing tasks (Baron et al. 1996). Finally, the commitment HR system creates greater attachment and embeddedness through a family-like environment, internal growth opportunities, and pay and rewards tied to organizational performance (Collins and Smith 2006).

We argue that the commitment HR system promotes unique knowledge-worker AMOs that support knowledge-search and -combination behaviors that are required for effective exploitation but detrimental for exploration. First, the HR practices in the commitment HR system are likely to create a context that encourages employees to build high levels of firm-specific and overlapping knowledge. Specifically, the commitment HR system focuses on fostering a long-standing employee-employer relationship, resulting in greater commitment and a much lower turnover than alternative HR systems. This increased commitment and incentive to maintain the employer-employee relationship increase employees' willingness to develop firm-specific knowledge (Tsui et al. 1997). Low turnover rates over a sustained period are likely to result in overlapping knowledge stocks and beliefs about work processes among long-tenured workers (Schneider, Goldstein, and Smith 1995). Finally, internal labor markets and job rotations in this system reinforce a narrow range of overlapping knowledge among core knowledge workers because they build new knowledge by training under more experienced employees and through experiences working on the organization's existing products.

The attachment and control components of the commitment HR system further shape the knowledge-search, -exchange, and -combination behaviors of the core knowledge workers. For example, the high levels of organizational commitment resulting from this system of practices increases employees' willingness to invest effort to support the strategic direction of the organization (Tsui et al. 1997). Because employees are hired based on their fit to the firm's culture and values, they are more likely to direct this effort toward incremental change rather than toward significant transformation that could change the firm and their employment relationship (Schneider et al. 1995). The commitment HR system's reliance on fostering a family-like environment and peer feedback to maintain coordination and control are likely to further increase employees' motivation to follow existing rules and norms. In particular, the strong ties that develop among actors in close proximity can lead to emotional convergence (Anderson, Keltner,

and John 2003) and a climate of continuing the status quo because individuals hesitate to challenge one another for fear of jeopardizing their relationships (Granovetter 1973).

Based on this, we argue that the commitment HR system is aligned to promote the knowledge-search and -combination behaviors that are required to successfully support the exploitation strategy. First, employees' overlapping and deep firm-specific knowledge is likely to aid in creating knowledge-recombination opportunities for the incremental improvement of existing products (He and Wong 2012). Extensive organizational experience is also likely to foster knowledge workers' understanding of existing routines, best practices, and technological knowledge that already exists in the organization (Kehoe and Collins 2008), increasing the efficiency of incremental improvements required for exploitation. The investment in internal development and an internal labor market are likely to increase knowledge search based on existing internal knowledge because this HR system increases employees' reliance on internal network ties when they seek to understand a problem, seek new knowledge, or gain new perspectives (Collins and Smith 2006). Because of the overlapping nature of this knowledge, employees are likely to be able to absorb the knowledge and information shared with other internal employees easily, and the resulting recombination of knowledge is likely to lead to incremental changes in the technological direction of the organization (Baum et al. 2000).

In contrast, the role behaviors supported by the commitment HR system are likely to be counterproductive for an exploration strategy. First, low turnover and a focus on employees' internal networks are likely to result in reduced flows of new and diverse knowledge into the organization, reducing the likelihood that core knowledge workers will have access to broad, diverse knowledge in their search activities. Further, because core knowledge workers will be more motivated to develop higher levels of firm-specific knowledge, they may find absorbing and integrating different and unique external knowledge challenging even if it were brought into the organization (Cohen and Levinthal 1990). Strong cultural norms and attachment to the organization are likely to decrease the likelihood of employees' challenging the status quo because they will be unwilling to disrupt their status in the organization or risk backlash from other employees (Barker 1993); thus, employees under this system will be unlikely to challenge the current technological direction of the organization.

Hypothesis 3: The commitment HR system will be positively related to firm performance for firms pursuing an exploitation strategy and negatively related to firm performance for firms pursuing an exploration strategy.

Methods

Overview of the Research Process

We collected data from knowledge-based organizations in a single industry—software—to reduce error variance based on systematic differences across

industries. We chose the software industry because firms in this context are likely to use a variety of approaches for managing core employees (Baron et al. 1996), and managing these knowledge workers effectively can have a significant impact on firm performance (Collins and Smith 2006). To test our hypotheses, we measured four broad sets of variables: HR practices, innovation strategy, firm performance, and controls. To limit problems associated with common method variance, we collected measures of our variables from three data sources: surveys from a sample of core knowledge workers to assess HR practices, interviews with chief executive officers (CEOs) to collect background data for control variables and to assess innovation strategy, and publicly available corporate financial performance records for the one-year period following our collection of data on HR practices and innovation strategy.

Sample and Research Procedures

We collected data from 230 software firms in four high-technology regions (Austin, Texas; Boston, Massachusetts; Seattle, Washington; and northern Virginia). We limited our focus to firms with public financial information who employed at least 100 employees to target firms that were likely to have formally established HR systems. Of the 439 firms that met our sample criteria, 251 agreed to participate. From these, we obtained usable data from 230 organizations, representing a 52.4% response rate. The organizations that participated did not differ from nonparticipating firms in reported sales (t_{439} = 0.89 [not significant (n.s.)]), profit growth (t_{439} = 1.41 [n.s.]), return on equity (t_{439} = 1.26 [n.s.]), or number of employees (t_{439} = 1.04 [n.s.]). The mean firm size was 260.45 employees, with a standard deviation of 109.07 and a range of 152 to 689 employees.

Our communication with each sample firm began with a brief phone interview with the CEO to provide details on the study's purpose and procedures, collect background information on the organization, and build the CEO's commitment to participating in the study. We asked the CEO to provide us with the e-mail addresses of 20 core knowledge workers, defined as employees "who are critical for creating software and product innovations within your organization." We then sent each of the identified employees an initial request and one reminder, with a link to a secure website and a request to complete a survey. To increase participation in the firms, we asked the CEO of each participating firm to send the identified employees an e-mail encouraging their participation. We provided CEOs with information on the total number (but not the names) of the employees who responded. An average of 12.3 core knowledge workers completed surveys at each organization, with a range of 6 to 18 respondents and an overall internal participation rate of 64%. Respondents held the following job titles: 37% were software engineers, 31% were software developers, 29% were software programmers, and 3% were new-product project managers. The job titles suggest that our respondents held jobs directly related to knowledge creation.

Variables

Firm Performance

We employed two separate measures of financial performance and obtained financial performance measures through publicly available sources. First, because the goal of most publicly traded firms is year-over-year profit growth, we measured the one-year profit growth as the net profit for the firm one year after we collected the survey data ($t + 1$) minus the net profit for the year concurrent with the survey data collection (t) and then divided this total by the net profit for the year concurrent with the survey data collection (t). Second, to evaluate firms' abilities to provide value to their shareholders through effective innovation, we measured the return on equity (ROE), defined as the net income divided by shareholder equity, for the one-year fiscal period following the collection of our survey data. To make the results easier to read in our tables and easier to interpret, we transformed each performance measure into percentages by multiplying each by 100.

HR Practices

We used previous research on high-technology firms and developed or adapted 23 items to assess HR practices reflecting the three components—attachment, selection, and coordination and control—underlying the differences among the engineering, bureaucratic, and commitment HR systems (Baron et al. 1999; Collins and Smith 2006). Employees were asked the extent to which they agreed that survey statements matched the HR practices of their organization on a 5-point scale ranging from 1 ("totally disagree") to 5 ("totally agree"); see Table 3 for all survey statements. For attachment, the statements focused on 1) challenging work, 2) growth opportunities and social and monetary connections to the organization, and 3) high pay and pay tied to individual performance. For selection, statements focused on attracting employees based on 1) fit to the organization's culture and values as opposed to an immediate fit to the job and task requirements and 2) focus on external as opposed to internal labor markets. For coordination and control, statements focused on 1) professional standards and personal discretion, 2) feedback from peers, and 3) tight monitoring and control by direct supervisors.

To provide evidence of the discriminant validity of our three systems, we performed a principal components analysis with a varimax rotation to examine the factor structure of the 23 items representing HR practices. In our preliminary analysis, two of the items failed to cleanly load on any of the three factors that emerge and were dropped from further analyses. The second principal components analysis on the remaining 21 items yielded three components with eigenvalues greater than 1 (see Table 3 for details). Items in each of the three factors closely mapped to our descriptions of the HR practices tied to each of the three systems, providing evidence of the

discriminant validity of three separate HR systems.[2] Although a few HR practices demonstrated modest factor loadings across the three systems, this is not cause for concern for two reasons: First, all primary factor loadings were at the 0.50 level or greater, and second, HR-system measures can be better understood as additive indices than as scales reflecting underlying constructs (e.g., Batt and Colvin 2011; Chadwick et al. 2013). A factor analysis is useful in demonstrating the tendency for practices in a system to be used together and for establishing discriminant validity of the three systems, but we would not necessarily expect item factor loadings to reach conventional levels. Items for each of the three scales showed good reliability: engineering HR system, $\alpha = 0.76$; bureaucratic HR system, $\alpha = 0.78$; and commitment HR system, $\alpha = 0.71$. Following standard practice in the SHRM literature (e.g., Delery 1998; Batt 2002; Collins and Smith 2006), we created HR-system measures by averaging the HR-practice items separately for each of the HR systems.

Innovation Strategy

As previously noted, firms may pursue different innovation strategies and tend to focus primarily on either exploration or exploitation (March 1991; Baum et al. 2000). We captured each firm's innovation strategy by asking the CEO to identify whether the firm more closely followed a strategy of exploration (focusing on trying to create new products) or exploitation (focusing on incrementally improving current products) (He and Wong 2012). To create meaningful interaction terms in our moderated regression analyses, we coded firms that CEOs identified as explorers as 1 and those that CEOs identified as exploiters as 2. To provide some evidence of validity for this approach, we also asked the CEO to provide an assessment of the percentage of the total revenue sourced in prior years from 1) existing products, 2) a new version of an existing product, and 3) brand-new products. We then created a ratio of innovativeness by dividing the percentage of revenue listed in source 3 by 100. We found a correlation of 0.65 with our coded firm-strategy variable based on a subsample of 197 companies for which the CEO was willing to provide this additional information. Thus, those firms that were CEO-identified as explorers appear to have obtained a larger percentage of their revenue from new products in prior years.

---

[2]Confirmatory factor analysis (CFA) provided similar evidence of the validity of the three separate HR systems. Specifically, we found that a three-factor model (items consistent with our principal components analysis) showed a good fit to the data: $\chi^2 = 826.2$ (degrees of freedom [df]) = 189, $p < 0.01$), RMSEA (root mean square error of approximation) = 0.07, CFI (comparative fit index) = 0.85, IFI (incremental fit index) = 0.86. Further, a three-factor model showed a significantly better fit to the data than did a one-factor model (all HR items loading on a single higher-order factor): $\chi^2 = 2224.6$ (df = 189, $p < 0.01$), RMSEA = 0.18, CFI = 0.39, IFI = 0.38. Also, the three-factor model showed slightly better fit than a three-factor model in which the three factors were allowed to correlate with one another: $\chi^2 = 917.4$ (df = 186, $p < 0.01$), RMSEA = 0.07, CFI = 0.82, IFI = 0.84. The standardized factor loadings in the CFA model with the three uncorrelated HR system factors were similar in nature to what we found in the pattern matrix after rotation using the principal components analysis.

Table 3. Exploratory Factor Analysis for HR Practices

HR practices	*Engineering HR system*	*Commitment HR system*	*Bureaucratic HR system*
A. Selection			
We focus on external hiring for employees based on the fit of their skills to the requirements of specific jobs.	0.438	0.347	**0.637**
We tend to hire people who can contribute immediately in their job without extensive training.	0.441	0.297	**0.597**
We select individuals based on their overall fit with the company's values.	0.382	**0.704**	0.344
When interviewing for new employees, the company focuses on how well the individual fits our culture.	0.357	**0.698**	0.378
In this company, we focus on hiring from within as the primary way to fill higher-level jobs.	0.298	**0.741**	0.435
This company uses elite sources (e.g., top universities, head hunters) to find the best available talent in the country.	**0.631**	0.381	0.344
Higher-level positions are filled primarily through a broad external search for the best and brightest employees.	**0.587**	0.297	0.386
B. Attachment			
We attract and retain employees primarily by paying higher wages than our competitors.	0.348	0.297	**0.597**
We primarily rely on pay raises and individual bonuses to motivate employees.	0.423	0.311	**0.565**
We motivate employees by creating a strong social environment at work.	0.404	**0.631**	0.288
We motivate employees through company performance-based bonuses (e.g., profit sharing or gain sharing).	0.397	**0.578**	0.304
We motivate employees by providing interesting and challenging work.	**0.687**	0.321	0.299
We retain employees by challenging them to stay on the cutting edge of technology.	**0.669**	0.314	0.298
We provide opportunities for employees to grow and learn in their jobs.	**0.561**	0.487	0.118
C. Coordination and control			
We ask managers to closely monitor the day-to-day activities of their employees.	–0.114	0.297	**0.588**
Managers follow a regular schedule in completing performance evaluations on employees.	0.346	0.208	**0.556**
This company has formal job duties and descriptions so that employees know their roles and responsibilities.	0.241	0.311	**0.602**
Employees in this company are expected to track one another's work, effort, and compliance with the company culture.	0.408	**0.523**	0.211
We expect employees to provide informal feedback to one another in an effort to improve performance.	0.423	**0.597**	0.148
We believe that employees are experts who will get the job done right the first time without direct oversight.	**0.622**	0.404	0.206
Employees in this company are given the opportunity to complete their work however they see fit.	**0.623**	0.451	–0.118
Eigenvalue	3.72	3.08	4.28

Notes: Boldface numbers show best alignment to the different HR systems and practices.

Control Variables

We sought to account for the differences in challenges or advantages that firms might experience in managing their workforce, responding to changes in the environment; successfully leveraging employee knowledge and capabilities; and, more broadly, driving profits and creating returns for shareholders by controlling for organizational size (measured as the total number of employees), prior firm performance (measured as the total sales the year of the survey data collection) and age of firm (measured as the total number of years the organization had been operating as an independent company). We divided the firm size by 100 to ease the interpretation of relevant findings, and we multiplied sales growth by 100 to create a percentage. Further, prior research suggested that software/technology firms may seek to co-locate geographically to share resources, build local labor markets, or collaborate. To control for potential differences in resources, HR practices, labor markets, or performance based on co-location, we added three dummy controls for the regions of the organizations that participated (comparing the firms based in Austin, Boston, and Seattle to those in northern Virginia).

Results

We provide descriptive statistics and correlations for the key variables in Table 4. As we can see in this table, the three HR systems are all significantly and negatively correlated with one another, providing evidence that firms choose to implement one of the three HR systems to manage their core knowledge workers. We tested our model using ordinary least squares regression analysis by entering the variables in three steps: the control variables, the independent and moderator variables, and the interaction terms. In Table 5, models 1 to 3 display the results for regression analyses predicting profit growth, and models 4 to 6 display the results for regression analyses predicting ROE. As shown in Table 5, models 2 and 5, the main effects of all three HR systems are nonsignificant in predicting firm performance, which is consistent with our expectation that the effectiveness of any HR system in driving performance depends on its alignment with an organization's strategy.

In Hypothesis 1, we predict that the engineering HR system is positively related to firm performance in firms pursuing an exploration strategy and negatively related to performance in firms pursuing an exploitation strategy. In Table 5, model 3, the Engineering HR system*Strategy interaction term is significantly related to profit growth ($\beta = -6.83$; $p < 0.01$). A simple slopes analysis reveals that the underlying relationship is consistent with our prediction. Specifically, the engineering HR system is positively related to profit growth in firms pursuing an exploration strategy ($\beta = 2.94$; $p < 0.05$) and negatively related to profit growth in firms pursuing an exploitation strategy ($\beta = -4.10$; $p < 0.01$). A plot of this interaction appears in Figure 1. Model 6 reflects that the Engineering HR system*Strategy interaction term is also significant

Table 4. Descriptive Statistics and Bivariate Correlation Matrix

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Firm size divided by 100									
2. Firm age	0.13*								
3. Sales	0.02	0.06							
4. Engineering HR system	−0.07	0.14*	0.05						
5. Commitment HR system	0.05	−0.14*	0.06	−0.32**					
6. Bureaucratic HR system	0.04	−0.12	−0.16*	−0.22**	−0.43**				
7. Exploitation dummy[a]	−0.04	−0.03	−0.15*	−0.09	0.02	0.13			
8. Profit	−0.03	−0.03	0.29**	0.03	−0.03	−0.04	−0.08		
9. ROE	−0.05	−0.02	0.24**	0.02	−0.02	−0.02	−0.02	0.64**	
Mean	2.60	12.12	10.09	3.27	3.32	3.24	1.51	13.62	14.32
SD	1.09	5.05	6.39	0.60	0.60	0.51	0.50	8.07	7.81

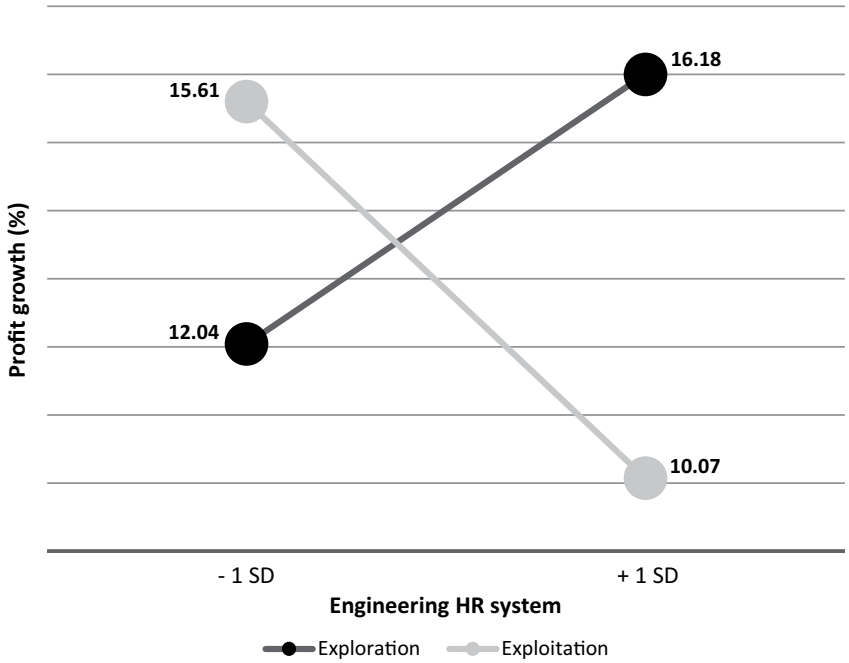
Notes: $n = 230$. ROE, return on equity; SD, standard deviation.
[a]Takes a value of 2 for firms pursuing exploitation and a value of 1 for firms pursuing exploration.
*$p < 0.05$; **$p < 0.01$.

Table 5. Results of Regression Analyses Predicting Profit Growth and ROE

	Profit growth						*ROE*					
	Model 1		*Model 2*		*Model 3*		*Model 4*		*Model 5*		*Model 6*	
Variable	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Constant	11.50**	1.91	16.58	9.24	26.44*	10.85	12.50**	1.81	12.96**	1.96	24.17*	11.07
Firm size	−0.58	0.10	−0.56	0.49	−0.59	0.44	−0.38	0.47	−0.37	0.48	−0.41	0.45
Firm age	−0.01	0.10	−0.08	0.11	−0.05	0.10	−0.05	0.10	−0.05	0.11	−0.03	0.10
Sales	0.37**	0.08	0.36**	0.08	0.15	0.08	0.30**	0.08	0.31***	0.08	0.13	0.08
Location 1	0.96	1.33	1.04	1.35	1.17	1.22	0.40	1.31	0.47	1.33	0.65	1.26
Location 2	0.20	1.37	0.43	1.40	0.15	1.27	0.51	1.35	0.58	1.39	0.36	1.30
Location 3	1.96	1.51	2.08	1.53	1.94	1.39	0.81	1.49	0.91	1.51	0.82	1.42
Engineering HR			−0.17	1.00	9.67**	2.83			0.09	0.99	7.40*	2.89
Commitment HR			−0.94	1.10	−3.89	2.99			−0.41	1.09	−3.97	3.05
Bureaucratic HR			−0.30	1.27	−15.92**	3.70			0.14	1.26	−14.04**	3.77
Exploitation dummy			−0.60	1.05	−21.06	16.40			0.20	1.04	−24.13	16.73
Engineering HR*Exploitation dummy					−6.83**	1.87					−5.07**	1.91
Commitment HR*Exploitation dummy					2.97	2.03					2.60	2.03
Bureaucratic HR*Exploitation dummy					10.41**	2.37					8.29**	2.67
ΔR^2	0.09		0.01		0.17		0.06		0.00		0.13	
F change	4.08**		0.30		16.92**		2.54*		0.94		11.55**	
Total R^2	0.09		0.10		0.27		0.06		0.06		0.20	

Notes: $n = 230$. Unstandardized regression coefficients are shown. ROE, return on equity; SE, standard error.
$^*p < 0.05$; $^{**}p < 0.01$.

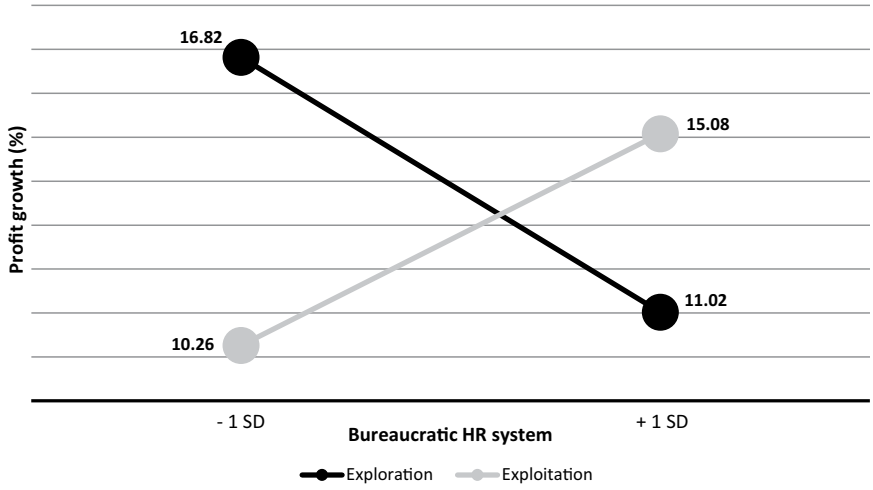
Figure 1. The Interactive Effect of Strategy and the Engineering HR System on Profit Growth



in predicting the ROE (β = −5.07; $p < 0.01$). A simple slopes analysis suggests that the positive relationship between the engineering HR system and ROE is marginally significant in the context of an exploration strategy (β = 2.37; $p < 0.10$), whereas a negative relationship between the engineering HR system and ROE is significant in the context of an exploitation strategy (β = −2.82; $p < 0.05$). These findings provide support for Hypothesis 1.

In Hypothesis 2, we predict that the bureaucratic HR system is positively related to profit growth and ROE in the context of an exploitation strategy and negatively related to profit growth and ROE in the context of an exploration strategy. In Table 5, model 3, the Bureaucratic HR system*Strategy interaction term is significantly related to profit growth (β = 10.41; $p < 0.01$). A simple slopes analysis reveals that the underlying relationship is consistent with our prediction. Specifically, the bureaucratic HR system is positively related to profit growth in firms pursuing an exploitation strategy (β = 4.62; $p < 0.01$) and negatively related to profit growth in firms pursuing an exploration strategy (β = −5.55; $p < 0.01$). A plot of this interaction appears in Figure 2. Table 5, model 6 shows that the Bureaucratic HR system*Strategy interaction term is also significant in predicting the ROE (β = 8.29; $p < 0.01$), and a simple slopes analysis confirms that the underlying relationship conforms to our predictions. The bureaucratic HR system has a positive effect on ROE in firms pursuing an exploitation strategy (β = 4.84; $p < 0.01$) and a negative effect on ROE in firms pursuing an exploration strategy (β = −4.52; $p < 0.01$); thus, we find strong support for Hypothesis 2.

Figure 2. The Interactive Effect of Strategy and the Bureaucratic HR System on Profit Growth



In Hypothesis 3, we predict that the commitment HR system is positively related to firm performance in firms pursuing an exploitation strategy and negatively related to performance in firms pursuing an exploration strategy. As shown in Table 5, models 3 and 6, the Commitment HR system*Strategy interaction term is not significantly related to profit growth ($\beta = 2.97$ [n.s.]) or ROE ($\beta = 2.60$ [n.s.]). In combination with the lack of significant main effect of the commitment HR system on profit growth and ROE, these results suggest that, relative to the engineering HR system and bureaucratic HR system, the commitment HR system is not well aligned with the strategic requirement of *either* an exploration or an exploitation strategy. These results provide no support for Hypothesis 3.

We conducted several additional sets of analyses to examine the robustness of our initial findings.[3] First, we examined the robustness of our findings when using an alternative measure of innovation in which we captured a firm's relative pursuit of exploration (not exploitation) as the CEO-reported percentage of revenue from brand-new products in prior years. Results of regression analyses in which we interacted our measures of the three HR systems and this alternative innovation strategy measure produced results that are similar to our reported findings in terms of direction, effect size, and significance for each of the three interactions. Second, to further examine the idea that firms tend to choose one of the three HR systems to manage their core knowledge workers, we conducted a cluster analysis on the HR-practice items and found that the companies in the sample clustered into one of three clusters. The HR practices for each cluster matched our theorized HR systems and the practice groupings that we identified when we performed the principal components analysis. Further, results

[3]The full results of the additional analyses are available upon request.

from regressions in which we interacted the innovation strategy with dummy variables representing these HR clusters (i.e., the engineering cluster compared to the commitment and bureaucratic clusters, the bureaucratic cluster compared to the engineering and commitment clusters) produced results similar to our original regression analyses. That is, the engineering cluster (compared to the other two HR-system clusters) is positively and significantly related to firm performance under exploration, and is negatively and significantly related to performance under exploitation. In contrast, the bureaucratic cluster (compared to the other two HR-system clusters) is positively and significantly related to firm performance under exploitation, and is negatively and significantly related to performance under exploration. Thus, both additional sets of analyses provide evidence of the robustness of our initial findings.

Discussion

Overall, our study makes substantive contributions to the SHRM literature. First, we have brought forward the idea of strategic choice in managing core knowledge workers and examined the use and relative effectiveness of three alternative strategic HR systems. Despite repeated calls for researchers to examine alternative systems for managing talent (e.g., Becker and Huselid 2006; Kehoe and Collins 2008), most prior research in this vein has focused on a single, best practices approach to HR management. At best, prior research seeking to address the fit hypothesis compared the effectiveness of a strategic HR approach against a nonstrategic approach that simply eliminates investment in employees (e.g., Arthur 1994; Delery and Doty 1996). Based on the earlier work of Baron and colleagues (Baron et al. 1996; Baron and Hannan 2002), we identified three HR systems that align with alternative philosophies for how firms seek to select, attach, coordinate and control core knowledge workers. Significantly, results from a principal components analysis suggest that organizational respondents see these HR systems as separate approaches for how their firm manages core knowledge workers. Our measures of alternative HR systems are significantly negatively correlated with one another, suggesting that firms primarily choose to manage core knowledge workers using one strategic HR approach. By examining the relative effectiveness of these three alternative approaches simultaneously, our work advances SHRM research by providing evidence that firms do seem to make choices among strategic approaches to managing core knowledge workers; this suggests that the assessment of multiple HR systems in different strategic and industry contexts is necessary in future SHRM scholarship.

We also add to the SHRM literature by theorizing about and finding support for the idea that the choice of HR systems by firms is important for understanding competitive advantage and performance under alternative strategies. Our work sheds light on the role of the fit between HR systems and organizational strategies in predicting firm competitive advantage. SHRM scholars have argued that HR systems lead to higher firm performance when

they elicit the employee outcomes that are required to effectively execute a firm's strategy; however, extant empirical research has provided little in the way of evidence to support this hypothesis, with most research finding that a best practices HR system works better than a nonstrategic set of low-investment practices across generic business strategies. In contrast, we argue that the choice of HR systems matters for shaping the knowledge behaviors required by specific innovation strategies. We find that the engineering HR system is the best fit for firms pursuing exploration because it is the only system that interacts positively with the exploration strategy in predicting performance. We also found that the bureaucratic HR system is the best fit for firms pursuing an exploitation strategy because it is the only system to interact positively with exploitation in predicting performance.

Furthermore, much of the earlier work on fit in SHRM has focused solely on the positive fit between HR systems and strategy and has largely ignored the consequences of negative fit or misalignment. In contrast, we also proposed and found empirical support for the notion that misalignment of HR systems with the behavioral needs of an innovation strategy can lead to performance penalties. As hypothesized, we find that the high use of the engineering HR system is negatively related to performance for firms pursuing exploitation, and the use of the bureaucratic HR system is negatively related to performance for firms pursuing exploration. The combination of theorizing and empirical results suggest that careful choice of HR systems is also important because misalignment seems to result in performance penalties.

Interestingly, in our regression analyses, we do not find significant interactions between innovation strategy and the commitment HR system in predicting performance, and we also do not find a significant main effect in the relationship between the commitment HR system and firm performance. These results are particularly surprising given the many studies that have found a positive and significant relationship between a commitment HR system and firm performance across a wide range of industries. Possibly the other HR systems that we examine here are simply better strategic fits in the context of exploration and exploitation. That is, the commitment HR system is not negatively related to performance under either innovation strategy; however, the engineering and bureaucratic HR systems are better fits for exploration and exploitation, respectively, and firms pursuing these HR strategies under the right innovation strategy are the ones likely to achieve competitive advantage. Or perhaps the software industry, with its high degree of volatility and rapidly changing competitive landscape, may not be a fit for commitment-orientated practices that focus on internal labor markets and building a long-tenured employee base. Possibly, the practices in this HR system limit the flow of new knowledge and employee willingness to challenge the status quo in a way that makes keeping pace with competitors in an effective way difficult for software companies.

As with all research, our study should be considered in light of its limitations. First, we examined these relationships over a relatively short period of time in smaller firms that were probably pursuing only a single innovation

strategy. Thus, our research is not able to address questions of alignment between HR systems and innovation strategy for firms that are changing their innovation strategy or for larger multidivisional firms seeking to achieve ambidexterity through the simultaneous pursuit of exploration and exploitation. Prior research has suggested that quickly changing HR systems and control structures is difficult for firms (Baron et al. 1999; Nickerson and Silverman 2003), increasing the potential for misalignment for firms or industries subject to frequent or rapid changes in strategic directions. Further, some research has suggested that firms may employ multiple HR systems simultaneously across different employee groups (e.g., Lepak and Snell 1999). Future research may seek to determine whether firms can successfully support multiple innovations strategies in different parts of the organization through both structural and HR-system choices (e.g., splitting the organization into multiple units to pursue different innovation strategies and aligning HR systems to drive the required knowledge behaviors in each unit).

Second, unmeasured exogenous variables may affect the relationships we studied. For example, other organizational characteristics (e.g., attributes of the firms' founders or current leadership) may explain the differences in firms' choice of innovation strategy and HR system. We did control for a number of firm characteristics that could potentially affect choice of strategic direction and HR philosophy and systems (e.g., prior financial performance, firm size, and firm age), thereby reducing some of these concerns. Alternatively, we may be violating assumptions underlying ordinary least squares regression analysis (e.g., normality of errors) if a leader has chosen an HR system based on the earlier selection of an innovation strategy. Our correlation analysis suggests that no significant correlation exists between the innovation strategy and HR system, suggesting that firms in our sample probably chose these strategies independently, providing some mitigation of this concern. Future research will benefit from the inclusion of additional firm characteristics in comparisons of the effectiveness of different HR systems or from following an instrumental variables approach to reduce concerns regarding endogeneity between innovation and HR strategies. Similarly, future research can further explicate the relationships among HR systems, innovation strategies, and firm performance by measuring and evaluating the impact of employee ability, motivation, opportunity outcomes, and resulting knowledge behaviors that we identified in this study.

Despite these limitations, our study's contributions are bolstered by several key strengths. First, we collected data on HR systems, innovation strategies, and firm performance from independent sources, including knowledge workers, CEOs, and corporate records. This research design buffers our results against common method bias, lending additional credence to our findings. Second, our use of lagged performance data reinforces the causal direction specified in our model. Finally, in the context of extant SHRM scholarship, which has focused primarily on the effects of the high-commitment HR system, our assessment of alternative HR systems provides guidance for future SHRM research as the field forges ahead, beyond the traditional best practices approach.

In conclusion, our study pushes theorizing and thinking on the knowledge-based view and SHRM to better understand how firms may foster the knowledge-search and -combination behaviors required by alternative innovation strategies. Our findings suggest that multiple HR systems exist across knowledge-based firms in the same industry and that the alignment or misalignment of these systems with the knowledge requirements of exploration and exploitation strategies can lead to performance gains or penalties. In light of these findings, leaders of software and other knowledge-based firms that depend on innovation should carefully choose an HR system that elicits the knowledge behaviors that fit the requirements of their innovation strategy. Although the leaders of knowledge-based firms probably spend a great deal of time thinking about external market opportunities and developing an innovation strategy that they feel best takes advantage of these opportunities, many of these leaders may not spend as much time thinking about crafting an HR system that effectively shapes the capabilities and behaviors of their workforce. Indeed, as firms grow larger, CEOs tend to pass this responsibility on to HR executives, potentially increasing the chances that the organization will implement an HR strategy that fails to elicit the knowledge-search and -combination behaviors that best align with the requirements of the business (innovation) strategy. As such, our study sheds light on the choices that HR executives or CEOs may consider in determining how to best align the characteristics of their workforce with the strategic innovation goals of the organization.

References

Amabile, Teresa. 1996. *Creativity in Context.* Boulder, CO: Westview Press.

Anderson, Cameron, Dacher Keltner, and Oliver John. 2003. Emotional convergence between people over time. *Journal of Personality and Social Psychology* 84: 1054–68.

Appelbaum, Eileen, Thomas Bailey, Peter Berg, and Arne Kalleberg. 2000. *Manufacturing Advantage: Why High-Performance Work Systems Pay Off.* Ithaca, NY: Cornell University Press.

Arthur, Jeffrey. 1994. Effects of human resource systems on manufacturing performance and turnover. *Academy of Management Journal* 37: 670–87.

Barker, James. 1993. Tightening the iron cage: Concertive control in self-managing teams. *Administrative Science Quarterly* 38: 408–37.

Baron, James, M. Diane Burton, and Michael Hannan. 1996. The road taken: The origins and evolution of employment systems in emerging high-technology companies. *Industrial and Corporate Change* 5: 239–76.

———. 1999. Building the iron cage: Determinants of managerial intensity in the early years of organizations. *American Sociological Review* 64: 527–47.

Baron, James, and Michael Hannan. 2002. Organizational blueprints for success in high-tech start-ups: Lessons from the Stanford project on emerging companies. *California Management Review* 44(3): 8–36.

Batt, Rosemary. 2002. Managing customer services: Human resource practices, quit rates, and sales growth. *Academy of Management Journal* 45: 587–610.

Batt, Rosemary, and Alexander Colvin. 2011. An employment systems approach to turnover: Human resources practices, quits, dismissals, and performance. *Academy of Management Journal* 54: 695–718.

Baum, Joel, Stan Li, and John Usher. 2000. Making the next move: How experiential and vicarious learning shape the location of chains' acquisitions. *Administrative Science Quarterly* 45: 766–801.

Becker, Brian, and Mark Huselid. 2006. Strategic human resource management: Where do we go from here? *Journal of Management* 32: 898–925.

Beckman, Christine. 2006. The influence of founding team affiliations on firm behavior. *Academy of Management Journal* 49: 741–58.

Benner, Mary, and Michael Tushman. 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review* 28: 238–56.

Burns, Tom, and G. M. Stalker. 1994. *The Management of Innovation*. Revised edition. Oxford: Oxford University Press.

Chadwick, Clint. 2007. Examining non-linear relationships between human resource practices and establishment performance. *Industrial and Labor Relations Review* 60: 499–521.

Chadwick, Clint, Sean Way, Gerry Kerr, and James Thacker. 2013. Boundary conditions of the high-investment human resource systems—small-firm labor productivity relationship. *Personnel Psychology* 66: 311–43.

Chen, Chung-Jen, and Jing-Wen Huang. 2009. Strategic human resource practices and innovation performance—the mediating role of knowledge management capacity. *Journal of Business Research* 62: 104–14.

Chuang, Chih-Hsun, Susan Jackson, and Yuan Jiang. 2016. Can knowledge-intensive teamwork be managed? Examining the roles of HRM systems, leadership, and tacit knowledge. *Journal of Management* 42: 524–54.

Cohen, Wesley, and Daniel Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35: 128–52.

Collins, Christopher, and Ken Smith. 2006. Knowledge exchange and combination: The role of human resource practices in the performance of high technology firms. *Academy of Management Journal* 49: 544–60

Delery, John. 1998. Issues of fit in strategic human resource management: Implications for research. *Human Resource Management Review* 8: 289–309.

Delery, John, and D. Harold Doty. 1996. Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions. *Academy of Management Journal* 39: 802–35.

Dyer, Lee. 1985. Strategic human resources management and planning. In Kendrith M. Rowland and Gerald R. Ferris (Eds.), *Research in Personnel and Human Resources Management*, Vol. 3, pp. 1–30. Greenwich, CT: JAI Press.

Fu, Na, Patrick Flood, Janine Bosak, Denise Rousseau, Tim Morris, and Philip O'Regan. 2016. High-performance work systems in professional service firms: Examining the practices-resources-uses-performance linkage. *Human Resource Management*, in press. DOI: 10.1002/hrm.21767.

Granovetter, Mark. 1973. The strength of weak ties. *American Journal of Sociology* 78: 1360–80.

Gupta, Anil, Ken Smith, and Christina Shalley. 2006. The interplay between exploration and exploitation. *Academy of Management Journal* 49: 693–706.

He, Ze-Lin, and Poh-Kam Wong. 2012. Reaching out and reaching within: A study of the relationship between innovation collaboration and innovation performance. *Industry and Innovation* 19: 539–61.

Hitt, Michael, Leonard Bierman, Katsuhiko Shimizu, and Rahul Kochhar. 2001. Direct and moderating effects of human capital on strategy and performance in professional service firms: A resource-based perspective. *Academy of Management Journal* 44: 13–28.

Ichniowski, Casey, and Kathryn Shaw. 2003. Beyond incentive pay: Insiders' estimates of the value of complementary human resource management practices. *Journal of Economic Perspectives* 17: 155–80.

Ichniowski, Casey, Kathryn Shaw, and Giovanna Prennushi. 1997. The effects of human resource management practices on productivity: A study of steel finishing lines. *American Economic Review* 87: 291–313.

Jackson, Susan, Randall Schuler, and Kaifeng Jiang. 2014. An aspirational framework for strategic human resource management. *Academy of Management Annals* 8(1): 1–56.

Jiang, Kaifeng, David Lepak, Jia Hu, and Judith Baer. 2012. How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms. *Academy of Management Journal* 55: 1264–94.

Katila, Ritta, and Gautarn Ahuja. 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal* 45: 1183–94.

Kehoe, Rebecca, and Christopher Collins. 2008. Exploration and exploitation strategies and the equifinality of HR Systems. In Joseph Martocchio (Ed.), *Research in Personnel and Human Resources Management*, Vol. 27, pp. 149–76. Greenwich, CT: JAI Press.

Lepak, David, and Scott Snell. 1999. The human resource architecture: Toward a theory of human capital allocation and development. *Academy of Management Review* 24: 31–48.

Levinthal, David, and James March. 1993. The myopia of learning. *Strategic Management Journal* 14: 95–112.

March, James. 1991. Exploration and exploitation in organizational learning. *Organization Science* 2: 71–87.

Nickerson, Jack, and Brian Silverman. 2003. Why firms want to organize efficiently and what keeps them from doing so: Inappropriate governance, performance, and adaptation in a deregulated industry. *Administrative Science Quarterly* 48: 433–65.

Nickerson, Jack, and Todd Zenger. 2004. A knowledge-based theory of the firm—the problem solving perspective. *Organization Science* 15: 617–32.

Patel, Pankaj, Jake Messersmith, and David Lepak. 2013. Walking the tightrope: An assessment of the relationship between high-performance work systems and organizational ambidexterity. *Academy of Management Journal* 56: 1420–42.

Rodan, Simon, and Charles Galunic. 2004. More than network structure: How knowledge heterogeneity influences managerial performance and innovativeness. *Strategic Management Journal* 25: 541–62.

Schneider, Benjamin, Howard Goldstein, and Brent Smith. 1995. The ASA framework: An update. *Personnel Psychology* 48: 747–73.

Schuler, Randall, and Susan Jackson. 1987. Organizational strategy and organizational level determinants of human resource management practices. *Human Resource Planning* 3: 125–41.

Sherer, Peter. 1995. Leveraging human assets in law firms: Human capital structures and organizational capabilities. *Industrial and Labor Relations Review* 48: 671–91.

Smith, Ken, Christopher Collins, and Kevin Clark. 2005. Existing knowledge, knowledge creation capability and the rate of new product introduction in high technology firms. *Academy of Management Journal* 48: 346–57.

Song, Jaeyong, Paul Almeida, and Geraldine Wu. 2003. Learning by hiring: When is mobility more likely to facilitate interfirm knowledge transfer? *Management Science* 49: 351–65.

Taylor, Alva, and Henrich Greve. 2006. Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of Management Journal* 49: 723–40.

Tsui, Anne, Jone Pearce, Lyman Porter, and Angela Tripoli. 1997. Alternative approaches to the employee–organization relationship: Does investment in employees pay off? *Academy of Management Journal* 40: 1089–121.

Weick, Karl, and Frances Westley. 1996. Organizational learning: Affirming an oxymoron. In Stewart Clegg, Cynthia Hardy, and Walter Nord (Eds.), *Handbook of Organization Studies*, pp. 440–58. London: Sage.

Youndt, Mark, Scott A. Snell, James Dean, and David Lepak. 1996. Human resource management, manufacturing strategy, and firm performance. *Academy of Management Journal* 39: 836–66.