

Information technology and the autonomy–control duality: toward a theory

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Abstract We examine the relationship between firms' human resources (HR) practices and their information technology (IT) practices, focusing on the dichotomy between autonomy and control. We define *facilitating HR practices* as those that exhibit the following characteristics: worker autonomy, connectedness, learning, valuing individuals, trust, and flexibility in business processes. We then characterize *facilitating IT practices*, which are practices that facilitate employee collaboration, autonomy, and wider access to information. We contrast these categories of practice to *traditional HR* and *monitoring IT*, respectively. Drawing from theories of complementarities and configuration, we propose that alignment between HR and IT strategies originates at the level of individual practices. We consider the effects of this alignment on worker performance. We then ground our discussion in exploratory empirical and qualitative results.

Keywords Human resources (HR) · Autonomy · Control · Complementarities · Alignment · Configuration theory · Worker performance · Work practices

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1 Introduction

Information technology (IT) has dramatically improved workers' ability to collaborate, access information, and make decisions autonomously, and this has coincided with the increasing importance of knowledge work in today's economy [20, 40]. Zuboff [87] argues that the use of IT to empower workers offers organizations more transformative and value-adding potential than the use of IT to exert control over workers. However, empowerment has its own risks because firms are also concerned about the potential drains on productivity posed by employees surfing the Web, chatting excessively over e-mail or instant messages (IM), and accessing peer-to-peer networks for music or games. The loss of employee time and resources due to such activities has been estimated at approximately \$50 billion annually in the United States [3]. Increasingly, firms are using IT to exert managerial control over workers by means of detailed time tracking, proficiency assessment, and the monitoring of IT use [24, 53]. However, such monitoring may undermine human resources (HR) practices that are intended to empower workers, give them a greater sense of autonomy, and encourage collaboration or information sharing. This suggests that firms should consider the implications of alignment between HR and IT practices.

Understanding the HR–IT alignment is critical because IT has transformed the nature of work. Work has become more information intensive, and “knowledge work” has become central to the economy. Firms are becoming interested in the use of IT to measure and enhance knowledge workers' performance [2, 20]. Drucker [23] was among the first to recognize the enhancement of knowledge work as one of the foremost challenges of the current century. Davenport [20]

points out that traditional techniques of command and control fail with knowledge workers. There is a general need for careful thinking about how to help knowledge workers perform optimally and how technology can be used to this end. Organizational practices have not yet evolved to take full advantage of technologies that enable collaboration [54, 55]. There is a need to understand how an organization's non-IT policies and practices interact with the IT-related policies in enhancing worker performance.

In this article, we build on previous work to provide insights into the mechanisms that drive the HR–IT complementarities by considering the individual practices on a greater level of detail. We examine the relationship between firms' HR practices and two diametrically opposed uses of IT. We make two arguments: First, we posit that *facilitating IT practices*, which enhance worker autonomy, are both associated with and complementary to *facilitating HR practices*. Second, we argue that *monitoring IT practices*, which enhance employers' control over workers, are both associated with and complementary to *traditional HR practices*. The approach we suggest draws on previous research on the alignment of competitive strategy and IT strategy. Researchers have used strategic alignment frameworks to conceptualize how firms are differentiated in their IT investment decisions, how IT investments align with competitive strategies, and the conditions under which this alignment contributes to firm performance [34, 69, 77]. Much of this work is at the firm level. We extend this work by focusing on a specific aspect of alignment, namely, the duality of autonomy and control, which has received little attention in the information systems (IS) literature.

In Sect. 1, we present a review of the pertinent literature. In Sect. 2, we develop a taxonomy of HR practices and IT practices as they pertain to autonomy and control, and we present a set of propositions that relate the two dimensions of firm strategy. In Sect. 3, we present some qualitative findings, and in Sect. 4, we offer some concluding thoughts and provide suggestions for further work.

2 Background literature

In this section, we provide a brief review of the prior literature on the HR–IT relationship.

2.1 The effect of HR on IT

We begin with the effect of HR practices on IT. Previous research on the effect of employer–employee

relationships on technical innovation provides some implications for the effect of HR on IT. Daft [19] argues that core employees are closer than administrators to the day-to-day operations of the firm and asserts that employees, not managers, are responsible for most of the technical innovation within a firm. Zmud [86] finds that managers influence technical innovation more than they influence administrative innovation. Leonard-Barton and Deschamps [49] report that employees' skill levels, competence, motivation, and performance levels determine whether they or their managers are more likely to be the drivers of technical innovation. For example, they find that managerial advocacy and support (i.e., the provision of cues in support of technical innovation) have a greater effect on lower-performing or lower-skilled employees than on higher-performing or higher-skilled employees [49]. Ahuja and Thatcher [5] study the effects of worker autonomy, gender characteristics, and other HR-related workplace variables on employees' propensity to innovate with IT. These studies provide initial support for the view that HR policies influence IT innovation or adoption within organizations. Furthermore, HR policies influence not only firms' decisions about which technologies to adopt but also the way in which firms ultimately use these technologies.

2.2 The effect of IT on HR

The relationship between HR and IT is not unidirectional. Because IT affects the flow and availability of information within firms, it also affects the HR practices that firms use. One way of understanding the effect of IT is to consider how organizations adapt to take advantage of new technological capabilities. Orlikowski et al. [66] and Orlikowski and Robey [67] explain this as a process of “structuring.” When a new technology is introduced into an organization, not only do employees adapt the technology for use, but in doing so, they also change their organizational routines, work processes, and work habits [66].

IT facilitates horizontal coordination and helps shape interpersonal networks, making it easier for people to form ties. Such ties are often weak in that they require little in terms of emotional commitment [31]. Research has shown that when weak ties are prevalent among employees, a firm is more likely to generate innovations. However, “hyperconnectivity” within organizations carries the potential consequences of “alienation” and “issues of equity, trust, commitment, and conflict-resolution” [28, p. 345]. Therefore, it is conceivable that firms will require new HR policies to deal with the new types of challenges or issues that

arise in such an environment. In this environment, HR policies may need to be more flexible [28], giving employees the autonomy and decision-making power necessary to take full advantage of the capabilities that IT provides, such as data- and information-gathering potential, the utilization of analysis tools, and collaboration across departments.

2.3 Perspectives on HR–IT alignment

Delery and Doty [21] present three theoretical perspectives that may be useful in framing a discussion of alignment between HR and IT strategy. First, the *universalistic perspective* identifies a direct relationship between HR practices and financial performance without accounting for other dimensions of organizational strategy. Second, the *contingency perspective* posits that HR practices should conform to other aspects of organizational strategy, and the degree of this conformance determines financial performance. Third, the *configurational perspective* attempts to identify “unique *patterns* of factors that are posited to be maximally effective,” emphasizing higher-order interactions among different aspects of firm strategy and positing multiple possible routes to optimal performance [21, p. 808].

Of the three perspectives, we draw from the configurational perspective because it considers how various practices interact as complementary components of a system. We take the view that strategy, which is understood as a coherent framework that guides a set of decisions and actions [60], applies also to the way that firms organize and manage their HR and IT. In other words, IT strategy should not be developed in isolation but rather with consideration of other aspects of firm strategy. This perspective, which is helpful in understanding the relationship between HR and competitive strategy, can also be helpful in understanding the relationship between HR and IT strategy. As is the case with competitive strategy, IT strategy comprises many interdependent and interacting decisions or policies [56]. Therefore, it is necessary to think beyond a universalistic perspective and to allow for the possibility that these aspects of firm strategy might not have a direct or deterministic relationship to one another. In other words, the various components of a strategy can come together, cohere, and configure in “thematic and interesting ways...that have important conceptual, evolutionary, and normative implications” [60, p. 507]. The configurational perspective implies that strategy is a complementary system of practices, and hence we use the terms *strategy* and *practices* interchangeably. Although previous researchers have used the

configurational perspective to study the effects of HR practices on the turnover rates of IT personnel [4, 6, 27], we use this lens to examine the complementarities between specific HR- and IT-related practices.

Previous research on complementarities has either focused exclusively on HR practices or has been conducted at a high level of aggregation, making it difficult to pinpoint the mechanisms that drive the complementarity between HR and IT practices. For example, Ichniowski and Shaw [44, 45] demonstrate the complementarity of specific HR practices. Their studies show that HR practices are mutually reinforcing, each increasing the effectiveness of other HR practices in a complementary bundle. Other empirical studies demonstrate the complementarity of HR and IT practices on firm-level performance variables [15, 72]. Bresnahan et al. [15] use annual spending on computer hardware in their analysis of IT complementarities with work organization practices. Powell and Dent-Micallef [72, p. 378] use qualitative measures of more specific IT-related variables and take the perspective that IT is a technological resource that can meet the “resource-based criteria for strategic competitive advantage” by virtue of complementarities with HR and other business resources. Powell and Dent-Micallef [72] consider IT primarily a means for attaining process efficiencies through automation, though they include measures of interoffice communication.

We refer to two case studies that illustrate the interrelationship between IT and HR strategies. First, Orlikowski [65] describes an attempt by senior managers of a large consulting firm to adopt Lotus Notes, a groupware system that enables users to share information and coordinate activities. However, the firm’s employees did not use the groupware capabilities of Lotus Notes; instead, they used it only as a personal productivity tool. The reason was that the firm’s system of promotion rewarded highly individualistic behavior over teamwork; thus, the employees had little incentive to learn how to use the technology for information sharing.

Second, Kohli and Kettinger [47] describe how the nonclinical wing of a hospital administration was able to influence physicians to adopt an IS to monitor their costs, quality, and productivity outcomes. Despite the inherent difficulties in measuring or specifying physicians’ work, it was possible to influence the physicians through a process of socialization referred to as the “clan.” In this case, because the nonclinical wing of the hospital lacked the knowledge or the legitimacy to influence physicians’ actions directly, the administrators were able to leverage the strong peer influence that existed among the physicians to motivate them to

use the productivity-tracking system. The clan-based arrangement in this context was an HR practice that successfully complemented the hospital administrators' IT-related objectives.

Next, we discuss the interrelationship among IT practices, HR practices, and performance outcomes. We focus specifically on IT because it is related to workers in its capacity to either (1) monitor/control workers or (2) empower/facilitate worker activities.

3 Theory and propositions

Organizational theory [21, 57, 79] and the economics of HR [10–12, 44, 45] suggest two distinct forms of HR management practices: (1) traditional HR management, in which managers are viewed as controllers and monitors of workers, and (2) innovative HR management, in which managers are viewed primarily as facilitators, in that their role is to remove “the constraints that block organization members' search for ways to contribute meaningfully to their work roles” [57, p. 560]¹. Facilitation implies the removal or reduction of barriers, such as barriers to sources of information or knowledge, or barriers between people or functional units within a firm. We choose the term “facilitating” to represent this form of HR management because of the way in which it casts the role of managers and its implication for the distribution of decision-making power in the firm. In contrast, researchers have used the term “traditional HR management” to denote a sense of hierarchical or imperative control [44, 57, 79]. We present a taxonomy of HR practices (facilitating vs. traditional) and IT practices (facilitating vs. monitoring), and relate these two distinct taxonomies with a set of propositions.

3.1 Characterizing facilitating HR practices

We identify the following characteristics of facilitating HR management: (1) It encourages worker autonomy, (2) it fosters connectedness among workers through collaboration and information sharing, (3) it fosters a culture of learning in the organization, (4) it fosters a culture of valuing individuals, (5) it fosters an environment of trust, and (6) it promotes greater flexibility in business processes. On the basis of previous findings, we argue that policies are most effectively implemented as complementary bundles [11, 44]. Next, we

elaborate each of these elements and discuss their interdependence.

First, autonomy is an important component of a facilitating HR policy. Autonomy can be defined as the extent to which workers have control over their own schedules or control over the specific procedures in which they carry out their schedules [5, 14, 35]. Less formally, it is the feeling that employees can work without having a supervisor look over their shoulders. Autonomy allows workers to “engage in activities that are more exploratory in nature,” which results in more innovations by workers [5, p. 429]. Empirical findings regarding the complementarities among facilitating HR practices suggest that worker autonomy can reduce barriers among workers and among functional units, thus enabling workers to collaborate across organizational boundaries and to develop an understanding of processes beyond their narrowly defined job descriptions. Worker autonomy is a feature of management strategies that espouse flexibility of business processes [22, 36, 51, 78, 84]. Therefore, we consider worker autonomy a central feature of a facilitating HR strategy.

Second, promoting collaboration and information sharing among workers is an important characteristic of a facilitating HR strategy because such an environment helps create synergies among the talents of people in a firm and encourages creative problem solving. When people face a challenge with a particular project or technical task, their primary source of information is not the Internet but rather their coworkers [20, p. 143]. Firms can encourage collaboration and information sharing by using self-managed teams, by providing formal cross-training programs that also enable workers in different functional groups to meet and exchange ideas, and by developing communities of practice that help employees locate people in the organization who have skill sets or expertise in specific areas [20].

Third, the implementation of a facilitating HR strategy requires a firm to promote a culture of learning within the firm. In the “learning organization,” employees are actively encouraged to grow professionally and to learn new skills, including those that extend their capabilities beyond the boundaries of a narrow job description [78]. Firms can provide mentoring programs that match employees according to their knowledge-related needs. Later, we discuss examples of such programs in Intel, Grumman, and Rolls-Royce. Firms also accomplish this by providing formal training programs. Firms can adopt practices or policies that encourage employees to learn from one another and to reach out across functional boundaries. This enables workers to gain new insights into and new

¹ In the context of Miles et al. [57] work, the human resources model was considered the more innovative form of HR in comparison to the more traditional human relations model.

perspectives on their own work processes in a way that helps them apply their creative talents and to initiate improvements in those processes. Ideally, the learning organization becomes an evolving entity, absorbing the expertise of employees over time as the more experienced workers pass their knowledge on to the less experienced. Because every firm has internal politics and competitive conflicts, it is a challenge to create this type of environment. It requires the mind-set that employees are long-term resources. To create such a mind-set, employers need to foster an environment of trust in which employees are valued for the long-term value they can bring to the firm. This mind-set enables firms to develop the core competencies that lead to strategic competitive advantage [73]. Encouraging employees to share knowledge, reducing barriers between various business units, implementing cross-training of skills, and providing employees access to potentially useful information (e.g., technical reports, educational materials) are additional steps that firms can take to prevent the “fragmentation of core competencies” in the firm [73, p. 89].

Fourth, a facilitating HR strategy also fosters a culture that values individuals. A firm that fosters creativity and learning is more likely to place a higher value on the potential contribution of individual employees, which translates to better treatment of employees through such means as improved worker benefits. Benefits can include, but are not limited to, (1) flextime, on-site day care, and extended leaves; (2) improvement of ergonomics for workers; and (3) boosting pay above the cost of living. Research suggests that reducing the levels of stress and strain on employees is conducive to worker performance: “Individuals who feel greater conflict or overload perform at lower levels” [5, p. 432]. Therefore, providing such worker benefits is an integral part of a facilitating HR strategy. Implementing the learning organization requires a commitment on the part of the firm to retain the key skills and knowledge of its employees. Employee training is a considerable expense that should coincide with a firm’s incentive to ensure employee retention. This also entails making extensive efforts to screen employees during the hiring process to ensure that they will fit well with their new organizations [44, 48]. Most important, managers need to solicit feedback from their employees and provide an environment in which employees feel free to voice their opinions [44].

Fifth, the culture of trust is an integral part of the facilitating HR strategy because worker autonomy requires that workers be trusted to allocate their time wisely and to make decisions that are good for the firm.

In addition, the expense that is spent on training workers entails a sense of trust that workers’ performance and loyalty to the company will make such investments pay off in the long run. Furthermore, trust is a condition for successful collaboration [18] and is a critical part of learning and teaching. By definition, trust is a condition in which “one exhibits behavior that makes one vulnerable to someone else” [63, p. 168], a precondition for suspending prior beliefs for the sake of learning. The steps taken to increase employee retention will also increase the sense of trust between employers and employees. Handy [37] identifies interpersonal trust as a key issue, especially in light of the increasing prevalence of telecommuting. There has been an increase in long-distance collaborative work as firms expand globally and form offshoring partnerships [40]. An inherent challenge, then, is how to manage people effectively from a distance because the traditional mechanisms of worker monitoring (i.e., supervisory oversight through physical presence of the manager around workers) are often unavailable in such circumstances [37]. Creating an environment of trust is critical to managing at a distance and thus is an integral part of a facilitating HR strategy.

Sixth, a facilitating HR strategy involves flexibility of business processes. By giving employees the resources to learn new skills and opportunities to apply these skills to different business functions, firms can respond more quickly to changes in their market environment by realigning their internal operations. This is related to the concept of the “lean enterprise” [84], in which the firm mobilizes its employees’ skills and knowledge across the enterprise in response to its changing needs. This also requires the firm to commit to cross-functional training, to provide a sense of assurance that individuals are valued, and to make every effort to retain employees during volatile market conditions. “When individuals and functions feel threatened by streamlined processes, these processes won’t be streamlined for long,” because employees will place self-preservation over the interests of the firm [84]. When a sense of security and opportunity for cross-functional learning exist, employees will find ways to increase their productivity in the firm and will find opportunities for innovation in business processes. Such innovations are more likely when a firm allows flexibility in protocols and business processes, and gives employees a level of autonomy and authority to make decisions [9]. Excessive process management can hinder innovation [9]. Therefore, the flexibility of business processes is an inherent part of a facilitating HR strategy. Bob Carniaux, senior vice president of Hasbro, summed up this concept as follows: “Where

HR and IT will probably exert the most influence over the next three to five years is how we work together in terms of making our organization more flexible and adaptable, how fluid we can make our resources be to go to the place where the need is the greatest within the organization. The original organizational models that we all grew up with are going to have to change” [83, p. 75].

It is especially crucial for firms to choose a facilitating HR strategy when creative labor, innovation, and nonroutine knowledge work serve as a primary means of a firm’s survival. Nonroutine tasks that involve tacit knowledge tend to be difficult to monitor; the outcomes are not quantifiable on a minute-by-minute basis, and tight tracking of behaviors tends to be of little help or can even be detrimental. Davenport [20] discusses how knowledge workers require a greater degree of autonomy than workers whose tasks are routine, programmable, and directly observable. Facilitating HR strategies are important in situations in which competitive pressures demand flexibility in firm processes and when a firm needs employees to initiate innovations in business processes. Table 1 categorizes HR practices in a manner that is consistent with the framework of Ichniowski et al. [44] and several other sources.

3.2 Characterizing facilitating IT practices

IT can be used to facilitate employee collaboration, autonomy, and wider access to information. We argue that facilitating IT practices are complementary to facilitating HR practices. The attempt to implement a facilitating IT strategy in an environment that lacks facilitating HR practices would be self-defeating. For

example, we mentioned previously Orlikowski’s [65] account of a groupware technology that failed to gain acceptance by employees in a consulting firm, largely because the HR policies of the firm rewarded competitive behavior over collaborative behavior. Likewise, the attempt to sustain a facilitating HR environment while using IT primarily as a tool to monitor workers rather than to facilitate collaboration and information access can have a demoralizing effect on workers that could lead to a disruption or breaking down of the facilitating HR environment.

Facilitating IT includes the use of mobile access to business applications or data, which supports cooperation in the sense that employees can connect with one another and collaborate at a distance. Facilitating IT includes the support of IM applications. Researchers have found that IM technologies help build connectedness and trust among employees, especially those who use IM to engage in informal conversation while doing substantive work of a collaborative nature [13, 62, 85]. This can facilitate knowledge sharing across functional units. Other collaborative software tools, such as collaborative issue-tracking tools, distributed project software, and document source repositories, also facilitate knowledge sharing and information access [33].

Blogs, collaborative online databases (called Wikis) and open-source software development all use the Net to handle much of the coordination among people rather than relying on top-down command and control. Such a shift to a digital spine could eventually lessen bureaucratic time burdens on overworked professionals, especially

Table 1 Traditional versus facilitating HR practices

	Traditional HR	Facilitating HR
Compensation and evaluation	Compensation that rewards quantity rather than quality of output	Multiattribute incentive pay plan
Monitoring and discipline	Emphasis on managerial control	Emphasis on worker autonomy
Work organization	Less utilization of work teams	High levels of employee involvement in multiple problem-solving teams
Job assignment	Narrowly defined job assignments	Flexible job assignments; job duties covering a wide range of tasks with workers often rotating between jobs
Skills training	Fewer off-line or formal training opportunities for workers	Extensive off-line or formal training opportunities for workers
Labor-management communication	Limited or no sharing of financial information; no practice of meeting regularly off-line with workers	Regular information sharing between workers and management; managers solicit the opinions and suggestions from employees

Sources: Ichniowski et al. [42, 44, 45], Black and Lynch [10–12], Miles et al. [57], Kristof-Brown et al. [48], Handy [37], Hackman and Oldham [35], and Breugh [14]

Notes: Traditional HR practices correspond to HR management Systems 3 and 4, and facilitating HR practices correspond to HR management Systems 1 and 2 in Ichniowski et al. [44]

those in such high-cost industries as health care. [55, p. 60]

Knowledge management tools can be instrumental in enabling knowledge sharing across a company. However, employees do not always use such tools to their fullest extent. Making thoughtful contributions to a knowledge management database requires a certain amount of slack from routine demands on time. Therefore, firms must be willing to reward or encourage creative or exploratory behavior [5]. Furthermore, employees sometimes feel more replaceable when their knowledge is codified and made readily available to others. To mitigate this, firms should also reward knowledge-sharing behavior [70].

IT plays a role in developing the key knowledge resources and core capabilities of the firm. Employee intranet sites have increasingly taken on the role of facilitating the allocation and development of human capital across functional business units. Many of these sites include HR management modules that enable firms to keep track of employees' key skill sets and knowledge areas. This enables firms to allocate human capital efficiently across functional units and helps firms manage their progress in building core capabilities as employees cultivate key expertise. Employees also use intranet sites to keep informed of new developments throughout the firm, enabling them to seek opportunities to contribute their unique skill sets and knowledge in projects across the firm, and to understand how their skill sets and knowledge contribute to the overall firm objectives. Table 2 categorizes the specific IT practices.

On the basis of the foregoing discussion, we expect to observe a significant, positive correlation between the utilization of facilitating HR strategies and the utilization of facilitating IT strategies.

Proposition 1 (facilitating HR–IT association) *Firms that have facilitating HR strategies are likely to have facilitating IT strategies.*

3.3 Implications of facilitating HR and IT on worker performance

The use of a facilitating IT strategy together with a facilitating HR strategy should be complementary in having a positive effect on worker performance. Firms are likely to vary in their degree of alignment between IT and HR strategies. Although an optimal alignment of organizational structure and IT portfolios or strategies may exist for each firm, the firm's realized actions may be far from optimal. Efficiencies dictated by the

market cannot fully explain firms' internal organizations [74]. The number of decision variables makes the achievement of optimal alignment complex [26]. Given such complexity, it is reasonable to expect that strategic decision making is not always fully rational or optimal. However, performance indicators, such as productivity, can be used to discern whether strategic alignment has been achieved. We suggest that worker performance should be the appropriate measure of outcomes of HR–IT alignment. However, worker performance has many different manifestations, depending on the particular type of work. In knowledge work settings, worker performance may be expressed in terms of creative output or rates of innovation; in manufacturing, worker performance may be expressed in terms of precise, quantifiable units of production output; and in sales call centers, worker performance may be expressed in terms of sales revenue per employee. (We do not address the specifics of measurement of worker performance in this article).

Theoretical arguments from previous literature, as well as some practical or anecdotal examples, support the idea of complementarities among HR and IT strategies. Theoretically, this idea corresponds with theories of configuration, fit, and complementarities, in which “elements interrelate and complement each other to produce the driving characteristics of an enterprise” [60, p. 507]. The idea of a fit among orthogonal systems of decision variables has been studied widely in the corporate strategy literature (i.e., studies of the fit between strategy and structure) [30, 59, 80], in IS (i.e., the fit between task and technology) [29], and in organizational behavior (i.e., the fit between employer and employee) [48]. This notion is also expressed in the literature as alignment between IT and organizational strategy [69, 77]. Milgrom and Roberts [58] provide some of the analytical underpinnings of strategic complementarities.

Empirical support for the notion of complementarities is provided by Ichniowski and Shaw [44], who find complementarities in firms' HR practices. In their process-level studies at steel plants, they find that innovative HR practices implemented as bundles show a significant positive effect on worker productivity, whereas individual HR practices implemented in isolation show little or no positive effect on productivity. Black and Lynch [11] find complementarities between HR practices that promote joint decision making and incentive-based compensation, leading to higher productivity in unionized manufacturing plants. In a firm-level study, Bresnahan et al. [15] show that IT investments are complementary to workplace

Table 2 Monitoring IT versus facilitating IT practices

	Monitoring IT	Facilitating IT
Information access	<ul style="list-style-type: none"> • Greater restrictions on Internet access. • Policies that forbid or restrict Internet browsing other than for tasks that are closely related to the job. 	<ul style="list-style-type: none"> • Fewer restrictions on Internet access. • Employees encouraged to use online resources for job-related learning or research • Permission to use Internet for personal tasks within stated or implicit limits that are flexible and reasonable to workers and management.
Collaboration	<ul style="list-style-type: none"> • Restrictions on IM. • Less support for collaborative tools, such as IM and video conferencing. • E- mails are closely monitored for content and well as security. 	<ul style="list-style-type: none"> • Employees are encouraged to utilize IM and video conferencing to collaborate with one another or to contact superiors. • Electronic directories are transparent and are not hierarchically restricted, enabling employees to form connections across divisional, departmental, or hierarchical boundaries. • Employee privacy is protected in e-mails; e-mails are not monitored or restricted, other than for security/compliance.
Knowledge management	Limited utilization of knowledge management.	Extensive utilization of knowledge management.
Proficiency tracking and assessment	Use of proficiency-tracking software for worker productivity metrics, such as hours per day or per week on the job, customer transactions per day or per hour, or factory output or units per employee.	Integration of proficiency assessment with knowledge management and employee recruitment, job assignment, or project management software; this is used to evaluate employee knowledge levels and expertise and to help cultivate employee capabilities.
HR management technologies	Use of HR management technologies to manage the organizational chart and to define narrow roles for each employee.	Utilization of technology that promotes flexible job assignments, such as a database of employee skills and knowledge areas.
E-learning	Electronic training resources limited in scope to learning standard procedures.	Employees are provided with broad e-learning resources. Training touches on relevant areas of interest above and beyond the job, and is used as an integral part of employee development.
Intranet	Little utilization of companywide intranet for communication to workers of financial or firmwide developments.	Extensive use of intranet to communicate events and news to employees enables employees to keep abreast of developments and innovations across the firm.

Sources: Zuboff [87], Orlikowski [66, 67], Olson [64], Grudin [33], Ahuja [5], Bos [85], and Davenport [20]

reorganization and the demand for skilled labor. They argue that IT makes firms more productive to the extent that firms implement policies and practices that encourage worker autonomy, team-based structures, and a wider distribution of decision-making power within the firm. They find that when IT is accompanied by work reorganization investments and a more highly skilled workforce, increased firm-level productivity results. Autor et al. [7] explain these findings by arguing that IT is a lower-cost substitute for routine labor, thus freeing resources and increasing the demand for nonroutine labor and a more educated workforce.

The practical argument for the complementary effect of facilitating HR and facilitating IT practices on performance outcomes is relatively straightforward. Organizations that distribute decision-making authority widely within the firm are best served by using technologies that facilitate employees' collaboration and access to information. Likewise, organizations that have such technological capabilities will extract more value from the technology and from the talents of their employees if they distribute decision-making authority more widely among their employees. IT can make information and data, as well as the tools used to analyze this data, widely accessible

within the organization. However, the benefits of this technology are more likely to be realized when employees have enough autonomy and decision-making power to make use of such capabilities. Therefore, a facilitating HR strategy should be complementary to a facilitating IT strategy in its effects on worker performance.

A recent *BusinessWeek* [55] article emphasizes the importance of HR practices as complements to IT; technology alone cannot increase worker performance. The article suggests that when IT is unsupported by HR reforms and reorganization, it can leave workers feeling overwhelmed because the digitization can cause the amount of inefficient administrative work to multiply, thus hindering workers' ability to attend to core value-adding tasks:

Globalization and the Internet create great new opportunities, but they also ratchet up the intensity of competition and generate more work—especially with the existing corporate structure still hanging on tightly. “Nobody wants to give up their territory or their control,” says Shoshana Zuboff, a former professor at Harvard Business School. Adds Lowell Bryan, a McKinsey & Co. director: “Professionals are still being managed as if they were in factories, in organizations designed to keep everybody siloed. At less well-run companies, you're struck by how frustrated people are. They work like dogs and are wasting time.” [55, p. 60]

On the basis on foregoing discussion, we propose the following:

Proposition 2 (facilitating HR–IT complementarities) *Facilitating HR and facilitating IT practices are complementary. The use of facilitating HR practices along with facilitating IT practices has a positive effect on worker performance.*

3.4 Characterizing traditional HR practices

The term “traditional HR” reflects the historically dominant view of the hierarchical system of management [44, 57, 79, 87]. The emphasis is primarily on managerial control. Managers are viewed as enforcers rather than as facilitators; their primary role is to control and monitor workers. Job assignments are narrowly defined. Opportunities for employees to find meaningful roles in the firm are relatively scarce. There is less utilization of work teams. Decision making is centralized, and orders come unilaterally from the top of the organization down through the ranks of the

organization. Workers tend to have less autonomy. Compensation rewards quantity rather than quality of output [44]. Typically, there are fewer formal training opportunities for workers. There is less frequent sharing of financial information or meeting off-line with workers [44] and less sharing of information across functional boundaries. As the name implies, traditional HR strategy might be viewed as somewhat of a remnant of the past [43, 87]. Ichniowski and Shaw explain that traditional HR practices were much more common in US firms before the 1980s [42]. However, this began to change when US firms sought ways to compete more effectively with Japanese manufacturers [42, p. 157].

Firms may engage in traditional HR practices for several reasons. First, these practices may reflect the habits or tendencies of individual managers rather than deliberate firm-level strategies. Managers may find it burdensome to accept employee autonomy, given that employees may talk back or question some of their decisions. Maintaining authority in a facilitating HR environment may prove challenging and requires subtle interpersonal skills. A natural recourse is to use any mechanism of power or control at hand to get employees in line with short-term objectives: “Techniques of control are used for monitoring, surveillance, detection, and record-keeping. They can be a source of comfort and relief to those in a position of authority because they offer ways to shore up or circumvent the imperfections of imperative control” [87, p. 313]. For some managers, it might take a great deal of effort to be able to trust and provide autonomy to workers: “The manager's world is an interpersonal vortex of relentless demands upon personality, ego strength, and empathy” [87, p. 323].

Second, agency theory suggests that traditional HR techniques are more likely to be used in situations in which precise measurability matters [25, 68] or in which labor is easily monitored for behaviors or outcomes. The monitoring of behaviors is more prevalent for jobs that are highly programmable, such as assembly-line work, which is highly programmable because the steps of performing the job can be codified or specified explicitly. The assembly-line worker can be held responsible for a set of prespecified actions. Conversely, the job of a securities trader in a financial firm is not as programmable, because the behaviors of the trader are more difficult or counterproductive to monitor or control. The complex and dynamic demands of the job require the trader to have autonomy in his or her own minute-by-minute actions. However, the outcomes for the securities trader may be more easily measurable because they manifest in

well-documented profits or losses at the end of any trading day. Therefore, the assembly-line worker will more likely be subject to behavior-based monitoring, and the securities trader will more likely be subject to outcome-based monitoring. Traditional HR practices involve the monitoring of either behaviors or outcomes, particularly for tasks that are highly programmable or measurable.

Traditional HR practices would be more prevalent in firms that employ a substantial amount of routine labor or whose worker outputs are measured in quantitative units. Examples include a customer-service call center, in which productivity is measured in terms of the number of calls the center handles in a unit of time, or a paper-packaging plant, in which the aim is to generate as large a volume of packaged product as possible for a given unit of input. However, traditional HR systems are also used in information-intensive industries, such as the pharmaceutical industry—particularly for data-intensive, rather than knowledge-intensive, clinical trials. As Azoulay [8] points out, clinical trials in pharmaceutical firms can be either data intensive or knowledge intensive. Data-intensive clinical trials involve routine work in which outputs are quantifiable [8]. In contrast, knowledge-intensive clinical trials involve creative and nonroutine work, in which outputs are not easily quantified and behaviors are not easily monitored [8]. Therefore, data-intensive work is much easier to monitor than knowledge-intensive work. In theory, firms that rely on data-intensive work would be more inclined to employ traditional HR strategies than firms that rely on knowledge-intensive work.

Finally, firms might use a traditional HR strategy because it aligns more naturally with a “defender” competitive strategy, as Miles et al. [57] describe. Defender firms, which focus on their preservation within a niche in a stable market environment, tend to emphasize gaining greater efficiency from their existing operations rather than making potentially disruptive changes to their processes [77]. The traditional HR strategy entails less tolerance for ambiguity. However, worker autonomy requires tolerance for ambiguity on the part of managers because it means giving up some control. The traditional HR strategy entails top-down directives supplemented by processes or surveillance to track worker productivity levels, to monitor worker activities, and to control behavior.

3.5 Characterizing monitoring IT practices

Researchers have not devoted much attention to the use of IT as a means to monitor employees. However,

an exception exists in the organizational theory literature. Sewell [79] points out that the use of IT for monitoring has been on the increase, despite the popularity of progressive management strategies that advocate worker autonomy. This assertion is supported by many reports in the managerial press [24, 53]. We argue that a monitoring IT strategy reinforces many elements of a traditional HR strategy by effectively extending managers’ ability to control and monitor workers.

A monitoring IT strategy uses IT to track worker activity and productivity at high levels of precision. What defines this IT strategy is not just the selection of particular technologies but also the way that the technologies are used. In many cases, the technologies are similar to those used in facilitating HR firms. For example, as Zuboff [87] points out, video-conferencing technology could potentially be used as a way to empower workers by enabling them to form collaborative relationships across distances. However, video conferencing also has the potential to serve as a surveillance tool for managers, who could use it to impose a presence at will on any meeting that takes place between employees. More recently, the use of e-mail has often been considered an empowering tool for workers; however, it has also been reported that the increased prevalence of e-mail has actually resulted in greater managerial surveillance of worker communication [53]. Practices such as monitoring e-mails, restricting or prohibiting the use of IM, and using proficiency assessment software extend managerial control over workers. Although restricting usage of the Internet has the effect of restricting workers’ access to information, it also has the advantage eliminating a potential diversion from tasks. On the basis of the foregoing discussion, we propose the following:

Proposition 3 (traditional HR–monitoring IT association) *Firms that have traditional HR strategies are likely to have monitoring IT strategies.*

3.6 Implications of traditional HR and monitoring IT on worker performance

Next, we examine whether traditional HR and monitoring IT are complementary in their effect on worker performance. E-mail, IM, and Internet access are often considered potential drains of worker productivity and risks to security (because of computer viruses or the possible leakage of company secrets). In such cases, the benefits of information access and interconnectivity may be outweighed by the costs or risks of providing that access.

We have proposed that firms that use a traditional HR strategy are more likely to be concerned with monitoring and controlling worker activities rather than with facilitating employee-initiated innovations. Because employees tend to dislike working under conditions of tight managerial monitoring [17], they may use Internet access, e-mail, and IM as opportunities to shirk discreetly from their job responsibilities. Problems pertaining to moral hazard persist under conditions of tight monitoring because workers often conform to the “specifics of what is being monitored ... rather than perhaps what the real goal is” [64, p. 11]. However, IT that aids in the tracking of worker productivity, along with policies that restrict the use of Internet access, e-mail, and IM, is likely to complement a traditional HR strategy in its effects on worker performance. Therefore, we propose the following:

Proposition 4 (traditional HR–monitoring IT complementarities) *Traditional HR and monitoring IT strategies are complementary. The use of traditional HR practices along with monitoring IT practices has a positive effect on worker performance.*

Table 3 provides a summary of the propositions.

4 Qualitative evidence

In this section, we present some preliminary qualitative and small-sample empirical evidence, using a combination of primary and secondary sources. Our intent is to provide some illustrative examples of how firms engage in the HR and IT practices we have discussed and how these practices may be complementary.

4.1 Primary sources

The primary data come from a survey of IS executives who participated in the Information Systems Executive Forum, an annual or biannual meeting of IS executives and faculty members held at the University of Michigan. At a recent forum, attendees included 16 IT executives at the level of vice president or chief information officer (CIO). We were primarily interested in how firms are differentiated along their HR practices and in how their IT practices complement their HR practices. What specifically are firms doing along these lines? We administered a brief, nonidentifiable survey to the executives, inquiring about the attitudes toward management that predominate in their firms and the technology practices of monitoring and control. Participants rated their responses on a

Table 3 Alignment of HR and IT practices

HR Practices	IT Practices	
	Facilitating IT	Monitoring IT
Facilitating HR	<p>Proposition 1 (facilitating HR–IT association): Firms that have facilitating HR strategies are likely to have facilitating IT strategies.</p> <p>Proposition 2 (facilitating HR–IT complementarities): Facilitating HR and facilitating IT practices are complementary. The use of facilitating HR practices along with facilitating IT practices has a positive effect on worker performance.</p>	<p>Proposition 3 (traditional HR–monitoring IT association): Firms that have traditional HR strategies are likely to have monitoring IT strategies.</p> <p>Proposition 4 (traditional HR–monitoring IT complementarities): Traditional HR and monitoring IT strategies are complementary. The use of traditional HR practices along with monitoring IT practices has a positive effect on worker performance.</p>
Traditional HR		

five-point Likert scale, ranging from “completely disagree” to “completely agree.” Eleven of the 16 executives returned the questionnaire. The limited survey results and interviews are revealing. Table 4 presents summary statistics.

More than half of the firms in our sample monitor employee Web site visits, and slightly less than half monitor employee e-mails. Approximately one-third of respondents indicated that they monitored each of the following activities: telephone calls, IM use, file transfer protocol (FTP) use, and time spent in the office. In the roundtable discussions, several executives stated that monitoring for security and compliance to government regulations is also leading to the increased use of IT to monitor worker performance. The executives observed that IT departments in firms are increasingly in the position of being the “policemen” or the “enforcers” of employees’ adherence to regulatory, security, and productivity standards.

We also conducted personal interviews with executives from a major financial/accounting consulting firm, a major hospital, a regional utility company, and an auto parts manufacturer. To protect the identity of these firms, we refer to them using pseudonyms. Next, we present examples of facilitating HR and IT practices at these firms. Table 5 provides a summary of our observations from these four cases.

4.1.1 Alpha Corp: culture of learning

Alpha Corp, a major financial/accounting consulting firm, appointed a “national learning partner” who oversees employee training. Alpha holds extensive training sessions in classroom environments on many topics. Conducted on a regional basis, the sessions enable employees across a region to network and exchange ideas. Alpha cultivates expertise among its

Table 4 Summary statistics: survey of 11 CIOs or technology vice presidents

Attitudes that reflect HR practices	Mean	SD	Min	Max
Managers are expected to monitor the work of employees.	3.5	1.5	1	5
The role of managers is to facilitate employees’ search for meaningful work roles.	3.5	1.3	2	5
We actively promote the breaking down of barriers between various business units or business functions.	4.2	1.0	2	5
When in disagreement, employees openly express their opinions with their superiors.	3.6	1.0	2	5
The firm’s success depends on the creativity of its employees.	4.3	0.6	3	5

employees along vertical industry lines and horizontal “service lines,” such as specialty technical subjects, resulting in a hierarchical matrix structure of employee expertise. This enables Alpha employees to be recognized throughout the firm for their expertise in specific topics or vertical markets. It also enables Alpha to identify consultants who are best suited for a particular project or client engagement and thus to capitalize quickly on new business opportunities. Alpha supplements classroom training with online tutorials and exams. In addition, Alpha consultants use “e-rooms,” or online document-sharing tools. Alpha also has a centralized knowledge repository, in which employees can submit generally applicable lessons learned about cases and client experiences and on which employees can do Google-type searches. Employees also make use of online user groups, in which they can post questions and share knowledge.

The Alpha case demonstrates how integral both work organization and technology practices are to the culture of learning. These practices enable Alpha to leverage the knowledge of its own employees in building its internal capabilities. It requires information to flow efficiently in the firm. Complementary HR and IT practices that facilitate collaboration and information sharing enable this.

4.1.2 Beta Hospital: valuing individuals

Beta Hospital, a recipient of numerous local and national awards for excellence in health care, has undertaken massive efforts to reorganize and reengineer its processes to deliver high-quality health care. Doing so effectively requires each of its 16,000 employees to understand why the organization makes certain changes in its structures or processes. Each employee needs to be informed on how he or she can contribute to the effective execution of the change. As the CIO of Beta Hospital stated, “in the health care environment, putting a bunch of suits in front of the room” is not an effective way to persuade a staff of physicians and nurses to buy into a common vision. With the assistance of a consulting firm, Beta Hospital conducted open informational sessions and meetings across the organization to engage its staff and to solicit their thoughts and ideas in a risk-free environment.

Beta is implementing an integrated electronic health record system that will enhance the flow of information among physicians, patients, and hospitals. Beta’s approach is instructive. “We view our e-health system as a collaborative tool,” says the CIO. A difficulty that many hospitals face is that implementing e-health record systems requires physicians to alter or adjust

Table 5 Interviews with CIOs or technology vice presidents who attended the information systems executive forum

Firm	Industry	HR Practices	Technology practices
Alpha Corp	Audit, tax, consulting, and financial advisory	<ul style="list-style-type: none"> • Has a national “learning partner” who oversees training • Classroom-oriented training • Has a matrix organization with vertical industry leaders and horizontal “service line” leaders or subject matter experts • Office partners redirect and connect people who are seeking specific expertise 	<ul style="list-style-type: none"> • Online surveys to document employee experiences • Video conferencing • Instant messaging (IM) • Online courseware and examinations • A centralized knowledge repository, on which users can do Google-type searches • Online user groups, where employees can post questions and answers on specific topics • “E-rooms” for document sharing • Highly integrated a patient e-health care record system that connects physicians, hospitals, and patients
Beta Hospital	Health care provider	<ul style="list-style-type: none"> • Encourages employees to voice opinions • Emphasis on communication as an integral part of any reengineering effort • Collocated teams • Communities of practice 	<ul style="list-style-type: none"> • Cell phones, blackberries, pagers for “rapid mobilization” in case of power outages • Uses Wikis to allow open communication regarding how to interpret/understand technology standards • Web-conferencing capabilities • Global collaboration in product design via collaborative CAD tools • Emphasis on compliance/security, and records management; archiving of more than 100,000 e-mails per day
Delta Energy	Utility	<ul style="list-style-type: none"> • Emphasis on “singleness of purpose” to unify various company divisions • Empowers employees and gives them autonomy by not overspecifying <i>how</i> to do things • Tolerant of multiple ways to do things 	
Lambda Corporation	Auto parts		

routines of their own work practices. However, physicians may resist doing this when they believe that the outcome will lead to increased scrutiny of their own work. This incentive-alignment problem has hindered the adoption of e-health record systems. By engaging its staff to share ideas and concerns, Beta has been able to influence the staff's perception of how the new technology will be used as a facilitating rather than a monitoring system.

4.1.3 Collaboration and information sharing: Delta Energy

Delta Energy is a regional utility company that emphasizes standards of practice that its staff of technicians and programmers are to follow. Delta Energy is notable for the way that it uses collocated teams and Wikis in support of communities of practice in which these standards are discussed. In technically complex settings, how to interpret or apply certain standards properly is often ambiguous. Therefore, it is helpful for employees to have a forum in which they can pose questions, express concerns, and resolve ambiguities. Furthermore, standards often require a consensus of interpretation, and the online forum discussions can help provide this. The Wikis also provide a channel for employees to raise concerns that can lead managers to reevaluate standards when it becomes apparent that they are no longer helpful to the organization. Because there is also a tacit component in technical work, employees also learn from one another by working in physical proximity in collocated teams. In Delta Energy, there is a climate of dialogue and information sharing that is created by the complementary use of collocated teams and electronically enabled communities of practice, thus enabling the effective deployment of standards in a highly technical setting.

4.1.4 Autonomy: Lambda Corporation

How does Lambda Corporation, an auto parts design/manufacturing company, motivate its employees to do their best work and leverage their creativity and expertise, while keeping employees in line with the company's vision and objectives? According to the vice president of information technology at Lambda, the trick is to communicate objectives clearly but not to overspecify *how* people should meet them. Managers at Lambda learn not to get upset when employees complete an assignment in a manner that was different from what was envisioned, as long as the goals have been communicated well. Unique or unconventional solutions are encouraged. Mistakes are tolerated.

According to the vice president, this creates an environment that encourages employees to think for themselves. Lambda's success depends on innovative products. Lambda has product design teams in offices across the globe, and engineers use collaborative computer aided design (CAD) software to share product designs across these offices. When engineers have sophisticated design tools and the ability to collaborate with a wide network of other engineers, the creative possibilities are tremendous. To leverage these possibilities, a climate that encourages innovation must accompany the technologies that facilitate such networks of expertise. This requires, among other things, worker autonomy. The Lambda case illustrates the importance of worker autonomy as a complement to technical tools that enable collaboration.

4.2 Secondary sources

We conducted searches of archived articles dating back to 2001 in *InformationWeek*, *CIO Magazine*, and *BusinessWeek*, among other managerial periodicals. These articles describe combinations of HR and IT practices. We now use the breakdown of our HR/IT framework (see Tables 1 and 2) to construct the grid in Table 6. We use this grid to categorize the combination of HR and IT practices documented in the articles. Although few of these articles reported specific performance metrics, most of the articles mention worker performance or some manifestation of it (e.g., sales force efficiency, cost savings, knowledge worker productivity).

Next, we present an overview of these cases. We show how some of the cases embody a few of the characteristics we outlined for facilitating HR: culture of learning, collaboration and information sharing, and valuing individuals. We then describe an example of traditional HR and monitoring IT documented in the articles.

4.2.1 Facilitating HR and IT practices

Culture of learning. Innovative mentoring programs were documented in several of the articles. Traditional mentoring in firms often arises informally among workers in proximity, whereas programs that are more formal match employees according to seniority. In contrast, Intel has used technology to create mentoring networks that span geographic distances and match employees according to specific knowledge needs [32]. Intel formed this program in the 1990s when it was aggressively opening new plants throughout the world

Table 6 Archived minicases documenting HR and IT practices

IT Practices								
	Information access	Collaboration	Knowledge management	Proficiency tracking and assessment	HRM technologies	E-learning	Intranet	Not specified
HR Practices	Compensation and evaluation	• Nortel [81]						
	Monitoring and discipline	• Hosokawa • Micron [82] • KB Toys [24]	• US Steel [82] • Presidio [24] • Potomac Hospital [24]	• Quinlan [24]				
	Work organization		• Proctor & Gamble [16] • Dresdner [52]	• MWH Global [71]			• Intel [32]	• Aztec [1]
	Job assignment			• Sysco [83] • IBM [83]	• Eastman Chemical [83]			
	Skills training		• Mars [71]	• Grumman [70]			• Century 21 [41] • Cendant [41]	• Rolls-Royce [70]
	Labor-management communication	• Mahle Inc. [82]	• Hasbro [83]	• Whirlpool [2]				• United Airlines [38]

and had sent many of its New Mexico plant managers to lead the new plants, resulting in a sudden vacuum of expertise in that plant [32]. A new batch of managers needed to be trained quickly. To facilitate matchmaking, Intel developed an intranet-based match-making system that computes the optimal match between employees along any of various topics that employees want to master. Another article documents IBM's use of a sophisticated skills-matching system for employees [83].

Grumman and Rolls-Royce have also taken aggressive measures to retain critical technical expertise [70]. Employees cultivated tremendous tacit expertise in the development of the B-2 bomber, in the case of Grumman, and in the development of the jet engine used in Concorde planes, in the case of Rolls-Royce [70]. As the engineers who developed these technologies are nearing retirement age and are beginning to leave their firms, both Grumman and Rolls-Royce have developed formal mentoring programs that are supported by knowledge management systems [70]. The objective is to ensure that the engineers' knowledge is retained in the firm. In both cases, the firms' leaders believed that the technical knowledge may be useful in future product opportunities. The cases also illustrate successful utilization of online courseware by Cendant and Century 21; the latter reported increased sales performance by employees who had taken the online courses [41].

Collaboration and information sharing among workers. The cases highlight numerous instances of firms using complementary technology and nontechnology practices to encourage collaboration and information sharing. The case studies document specific nontechnology efforts to encourage collaboration among workers and to remove boundaries between business units [16, 52, 71, 83]. For example, MWH Global has engaged in reorganization efforts to create teams based on functional areas rather than on regions, and it has conducted team-building sessions to bring people together from disparate parts of the organization [71]. MWH used social network analysis (SNA) techniques to help in the formation of the teams, identifying top experts and "strategic knowledge communities" [71]. Mars Corporation used SNA as a result of concerns that their 300 research scientists were not networking enough with colleagues inside and outside of the firm, thus hampering innovation [71]. Mars conducted online surveys that asked scientists to identify the peers with whom they closely work or correspond; then, it conducted social networking exercises in which scientists wore radio frequency identification (RFID)-enabled name tags to help them

get acquainted with new peers [71]. Mars's SNA revealed that scientists with more extensive social networks were outperforming scientists with fewer active contacts [71]. The data were shared with individual scientists in a nonpunitive way to encourage them to do more networking. Mars has also used SNA to discover gaps in communication between divisions. For example, Mars found a lack of communication between its divisions in New Jersey and Los Angeles that led to unnecessary duplications of efforts [71]. The case studies also documented the use of Web-conferencing software (XRT Group, Proctor & Gamble, IBM) [16, 52, 83], online user groups or Wikis that enable the sharing of best practices (Intel, Sysco, Hasbro, Dresdner) [32, 52, 83], and document-sharing portals (Proctor & Gamble) [16].

Valuing individuals. Encouraging employees to voice their ideas is a significant element of the facilitating HR strategy and demonstrates to employees that they are valued as individuals. Whirlpool has a staff of more than 240 innovation consultants (I-consultants) who review product innovation suggestions that employees post in a knowledge management system. The I-consultants work to facilitate product development efforts for ideas that are deemed to be promising. For the selected projects, employees who provided the suggestions are recognized by their peers, and in many cases, they lead the new development efforts [2].

We mentioned that providing worker benefits and reducing strain on employees is an integral part of a facilitating HR strategy. Richard Ricks, CIO of Nortel, is an advocate of well-defined policies to keep employees from feeling overburdened. Whenever possible, Nortel provides flextime and telecommuting privileges to its employees [81]. According to Ricks, 30% of Nortel employees are full-time telecommuters, and they are "among the most productive in the company" [81].

"Technology has to be an enabler," Ricks said. "If you do that you don't create 'slaves.' You're creating a freer society to operate more effectively. Our teleworkers work the hours they want to work. If you don't create that dynamic, top performers will leave." [81]

4.2.2 Traditional HR and monitoring IT practices

As we mentioned previously, the use of IT to monitor worker productivity is on the rise. Although security concerns and regulations (e.g., the Sarbanes-Oxley

Table 7 Percentage of companies that monitor each of these employee activities ($N = 2540$); *InformationWeek* Survey, adapted from [24]

E-mail use	56%
Web site visits	44%
Telephone calls	41%
IM use	33%
Opening of e-mail attachments	33%
Time in office	30%
FTP use	28%
Content of outbound e-mail	23%
Productivity of telecommuters	10%
Keystrokes per hour	2%
We don't monitor	24%

Act) have also led to the increased monitoring of employees' IT-related activities, the use of IT to monitor worker productivity has coincided with these efforts. In Table 7, we present the percentages of companies that reported monitoring specific employee activities in a survey conducted by *InformationWeek* [see 24].

Quinlan Publishing Company was already providing commissions-based incentives to its telephone sales force staff, but it decided that further steps needed to be taken to increase worker productivity [24]. In particular, managers believed that employees, whose jobs required them to be on the telephone, were spending significant amounts of time making personal telephone calls. To ensure that workers minimize personal telephone calls, "Quinlan installed the Proteus Enterprise telephone-management system from CTI Group," a Web-based program that provides "real-time analysis of all calls, measuring the number, length of time spent on each call, and the phone number called" [24, p. 64]. As a result of this additional monitoring of employee activities, Quinlan reported a 30–40% improvement in sales efficiency from the telephone sales force. Other firms, such as KB Toys, have been more interested in putting limits on rather than banning employee use of the Internet for personal tasks and have instituted daily quotas on employee Internet use [24].

5 Conclusion

The purpose of this study was to develop a more detailed understanding of the mechanisms of HR–IT alignment at the level of individual practices. We build on the literature on complementarities and configuration theory to open the "black box of IT," tying the theoretical constructs to real-world settings as we consider the specific mechanisms of alignment. Furthermore, we draw attention to the dual capability of

IT to exert control over and monitor workers and to increase the empowerment and autonomy of workers, a duality that has not been well explored in the IS literature. We also provide a typology along the dimensions of HR and IT that can serve to categorize specific IT-enabled work practices.

To demonstrate that HR and IT are complementary at the level of individual work practices, we provide a set of illustrative examples. For example, Alpha Corp's extensive training programs and knowledge-sharing practices are complementary to systems that enable information to flow efficiently throughout the firm. Beta Hospital's practices of encouraging employees to voice their opinions help shape the perception and adoption of its e-health record system as a facilitating rather than a monitoring system. We observe such complementarities in the form of both facilitating HR/IT and traditional HR/monitoring IT, in interviews and articles in the managerial press.

Although this study provides a theoretical and qualitative basis for future empirical studies, we note several limitations that present specific directions for further research. First, our study does not provide quantifiable metrics for the constructs of facilitating HR/IT or for traditional HR/monitoring IT. However, by defining the typologies of HR and IT in terms of individual work practices, we have paved the way for the development of metrics for these constructs. This would entail the use of survey instruments to assess firms' engagement in the specific work practices we have discussed and the application of various scaling techniques to the survey instruments. Such scaling procedures are rooted in data theory, which provides guidance in determining the subset of data that is useful for analysis, and in dimensional analysis, which provides guidance in identifying the "separate and interesting sources of variation" among constructs [46, pp. 4 and 27]. In terms of the effects of process-level complementarities on worker performance, an empirical model that incorporates the interactions between the HR and the IT constructs we have developed would be valuable. Because worker performance affects firm performance, measuring worker performance may be a useful intermediate step in assessing the broader implications of HR–IT alignment on firm performance.

Second, the typology we have presented pertains to a relatively narrow dimension of HR, namely, autonomy and control. Employee sourcing practices, hiring and retention practices, incentives, and employee development are other aspects of HR that merit further study. Future studies could extend our framework to examine the role of IT in these

additional dimensions of HR practice and could perhaps provide further insight into how these various dimensions of work practice are related. For example, because of its direct bearing on the way that information and directives spread throughout the firm, HR–IT alignment has a significant role in making the work environment suit different types of employees. In light of our framework, it would also be helpful to consider the various ways in which employees match or fit their work environments. Because employees vary in their underlying needs and objectives, they exhibit different degrees of fit to different work environments [48]. Accounting for this would make a discussion of HR–IT alignment more complete.

Third, it is important to consider the skills that are becoming increasingly important in today's economy. The continued expansion of the services and technology sectors of the economy, as well as the digitization of business processes, has influenced the nature of work and the necessary skill sets. A recent study by Mithas and Krishnan [61] suggests that for IT professionals, employers value business skills more than technical skills. It would be important to study workers in other professions as well and to consider communication skills, customer interaction skills, behavioral skills, and complex problem solving skills [39, 50, 75, 76]. Given that IT is transforming the nature of desirable employee skill sets, it is important to understand what forms of HR–IT alignment would be most effective at leveraging the capabilities of workers in the knowledge economy. Furthermore, it would be useful to understand how these patterns of alignment differ across various industrial sectors and organizational contexts and to understand how this alignment differs for various combinations of employee types, profiles, or skills.

Finally, it is important to consider how other elements of corporate strategy, such as strategies of competition or innovation, shape firms' IT and HR practices. The differences in firms' HR and IT practices may reflect variations in corporate culture, values, structure, or strategy, and it is possible to extend our framework to account for this. Because HR practices permeate all areas of an organization, HR–IT alignment at the level of individual practices can be a foundation for an extended framework that incorporates competitive strategy. The ideas developed in the work of Benner and Tushman [9], who examine the strategies of exploration and exploitation in relation to process management, may be instrumental to such an extended framework.

To conclude, this article develops a theory of alignment between firms' IT and HR strategies. We

suggest that such a theory should consider specific aspects of alignment and build from the level of individual practices. We focus on the alignment between HR and IT practices, using the duality of autonomy versus control as our lens. Understanding the complementarities between HR and IT practices is critical to a theory of alignment that can guide managerial decision making and that will have broader implications for firm performance.

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