

TECHNOLOGICAL CHANGE AT WORK: THE IMPACT OF EMPLOYEE INVOLVEMENT ON THE EFFECTIVENESS OF HEALTH INFORMATION TECHNOLOGY

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The link between employee involvement (EI) and organizational performance is not clear-cut, and the diffusion of information technology (IT) in the workplace complicates this relationship. The author argues that new technologies offer an important avenue by which EI can improve firm performance. He also contends that those studies that do consider EI in the context of technological change may be focusing exclusively on workplace-level features of the employment relationship, ignoring variation in functional- and strategic-level aspects of employment relations. To test this hypothesis, he uses Kaiser Permanente Northwest Region's patient scheduling module as an exemplar to investigate the extent to which this particular technology interacts with EI to affect clinic-level improvements in patient satisfaction. He studies the impact of the technology over the period October 2004 to August 2007 across 16 clinics to identify variation across sites. Measuring outcomes from a dataset that includes employee and patient surveys, interviews, archival data, and clinic observations, he finds that the use of IT is associated with performance increases and that these effects are greater in those clinics achieving higher mean levels of EI. This study presents the first empirical evidence of the potential of EI to enhance the effectiveness of health IT.

Those new to the study of work and employment might be surprised to learn that the link between employee involvement (EI) and organizational performance is more elusive than it appears. In fact, though scholars from a number of management subdomains including organizational behavior (OB), human resources (HR), and even Information Systems (IS) have long been inter-

ested in the connection between EI and performance, their agreement about the strength of the link is far from universal. Nevertheless, the widespread diffusion of information technology (IT) since the 1980s has heightened our need to understand how human and technological capital interact in production. Since it has been shown, for example, that many of the benefits once

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assumed to arise from IT actually arise through the interplay of IT and features of the employment relationship (Bresnahan, Brynjolfsson, and Hitt 2002; Brynjolfsson, Hitt, and Yang 2002), could the converse be true—that some of the productivity gains anticipated of EI are actually channeled through the effective implementation of new technologies?

The extent to which EI, in the implementation of IT, tightens the link between each of these inputs and measures of productivity has immediate implications for both policy and research. From a policy perspective, nowhere is the need to answer this question more acute than in the healthcare sector. In the United States, where the industry has recently been the target of contentious and controversial legislative reform, there is near (and rare) universal agreement that the diffusion of health IT is critical to improving efficiency and service quality—a belief backed up by billions of dollars in government incentives to those adopting electronic health records (EHRs). For example, the Health Information Technology for Economic and Clinical Health (HITECH) Act—part of the economic stimulus package passed and subsequently referred to as the American Reinvestment and Recovery Act—allocated \$46 billion of economic stimulus funds towards advancing EHR technologies. Reformers justify the allocation of these resources by blaming the slow diffusion of health IT for the poor performance of the healthcare industry, marked by skyrocketing costs and poor quality outcomes relative to other countries (Kaiser Family Foundation 2007). The Obama administration, citing a RAND Corporation study (Hillestad et al. 2005), points to a projected annual savings of \$81 billion from the effective deployment of health IT systems.

To date, however, policymakers have little or no empirical evidence to support their optimistic expectations, nor do they have data on the organizational or employment conditions needed to translate these new technologies into improved performance outcomes. What they do have are a number of careful studies of employment practices from other

industries that, though not explicitly focused on the interplay of EI and IT, imply that technology investments return more to the investing firm when complemented with EI structures and processes (Batt 1999; MacDuffie and Krafcik 1992). If one accepts these implications, then there is reason to question whether a “technology-alone” strategy will realize policymakers’ expectations. These findings, however, must be reconciled with a more ambiguous set of studies from the IS literature, which, I argue, is focused too narrowly on workplace-level manifestations of EI, failing to hold constant important employment relations features at the functional and strategic levels. Indeed, if the theorized complementarity obtains, the results could help piece together what has been a theoretical and empirical puzzle by revealing a common situation in which EI can be a positive driver of performance. This would explain why managers maintain this belief and continue to rely on EI despite the dearth of empirical evidence in its favor (Freeman and Kleiner 2000). That is, beneficial effects of EI may come in part through the implementation of new technologies. This makes sense if EI structures and processes allow for two-way communication between the frontlines and strategic-level decision-makers higher up in the organizational structure as well as for frontline involvement in training and optimization around the new technology. Therefore, the extent to which employee involvement in the implementation of a new IT system moderates the effectiveness of the technology is a question whose answer has immediate consequences in both the research and policy realms.

In this paper, I begin to address this issue by testing for the performance effects of a specific type of health IT at varying levels of workplace-level EI while holding functional- and strategic-level variables in place. I do so by examining the implementation of one piece of an EHR system—a scheduling module—across a single region of Kaiser Permanente, the nation’s largest, not-for-profit health plan. I draw first on qualitative, observational data to develop an understanding of the processes by which the scheduling

module facilitates the work of frontline employees. This stage of data-gathering also allows me to identify a performance measure directly tied to the effective use of this particular technology, an outcome of interest to the organization itself and measured reliably across clinics over time. My investigation also illustrates the specific ways in which workers and union representatives are involved in the development, deployment, and use of the IT, particularly those forms of EI that the organization believes will improve the effectiveness of the scheduling module. The study also sheds light on the business strategy served by the technology and the nature of the employment contract linking the technology's users to the investing organization. This qualitative evidence is then used to develop context-specific measures of workplace-level EI practices and IT in use and to conduct a longitudinal analysis of the individual and joint effects of IT and EI on performance across multiple healthcare clinics.

The study offers a number of advantages over existing ones. First, it allows us to hold constant many of the unobservable contextual factors that remain unaccounted for in national, cross-industry studies of IT's performance effects (e.g., see Brynjolfsson, Hitt, and Yang 2002; Caroli and van Reenan 2001) as well as in large-*n* studies seeking to make sense of EI's moderating role in IT deployment (e.g., see Choe 1996; Kim and Lee 1986). Second, the study leverages the strength of a case study approach by investigating a very specific, well-defined technological change—something that cannot be done in national studies in which IT is frequently defined rather vaguely (Brown and Campbell 2002) and that has yet to be done even in more-grounded studies of EI and IT (Mirvis, Sales, and Hackett 1991). Third, rather than relying on measures of revenue or profit, it relies on a contextually appropriate, homogeneous performance measure such as that suggested by Ichniowski, Shaw, and Prenzushi (1997) and MacDuffie (1995). Finally, the study supplements more-grounded examinations of employment practices and IT developed largely in manufacturing rather than in the service sector.

Employee Involvement and Technological Change

Employee Involvement in Human Resources and Organizational Behavior

The fields of HR and OB offer a far-reaching literature on EI, theorizing the effects of “participation” largely through a psychological or motivational lens. In the United States, empirical analyses date at least as far back as the Hawthorne (Roethlisberger and Dickson 1939) and Harwood (Coch and French 1948) studies. These foundational pieces from the “human relations” school first came to symbolize the benefits attendant to participation, but were later (and famously) maligned for their methodological shortcomings, in particular, their lack of controls. Subsequent and more careful analyses of EI have yielded a much more cautious view of its instrumentality over organizational performance. Motivated by anecdotal and ideological accounts of the importance of EI, Locke and Schweiger's (1979) extensive review of what they label “participatory decision-making” concluded that though participation may drive job satisfaction, it does not reliably influence productivity.

In the absence of evidence of a universal relationship, HR and OB theorists have at least sought to answer two overarching questions. Contingency theories (e.g., Vroom and Yetton 1973) attempted to explain *when* or under what organizational conditions EI should be used to boost performance. Though contingency models examining employee-level traits and the appropriateness of different types of decisions have found little support in the data (Miller and Monge 1986), more organizationally grounded approaches have indeed indicated a link between EI and performance. Kanter's (1983) empirical work, for example, suggested that EI is appropriate for frontline staff if they have knowledge or expertise—tacit or explicit—not available at higher ranks within the organization, results that have since been replicated and generalized (Latham, Winters, and Locke 1994; McCaffrey, Faerman, and Hart 1995; Scully, Kirkpatrick,

and Locke 1995). Aside from asking when EI might boost performance, HR and OB research has examined *how* EI should be implemented to promote its performance benefits. That is, ascribing Locke and Schweiger's (1979) "non-results" to a unitary conceptualization of participation, researchers sought to determine what institutional forms of EI might strengthen the link between EI and performance. Their findings suggested that self-directed teams in which EI centers on everyday work are much more likely to drive performance than are weaker forms of participation, such as offline problem-solving groups or quality circles (Cotton et al. 1988; Cotton 1993). However, even this seemingly safe conclusion has been called into question on methodological grounds (Leana, Locke, and Schweiger 1990).

The HR and OB literature diverge with respect to their treatment of technology. The work of Edmondson, Bohmer, and Pisano (2001) exemplifies OB's most-nuanced examination of the role of technology in organizations. Channeling Kanter's conceptualization of frontline worker knowledge, they explain the effectiveness of new technologies as a consequence of the form of worker knowledge—tacit or codified—required to leverage more fully new technologies. In a related qualitative study, the authors examined the collective learning process of those responsible for implementing the same technology, arguing that the deep entrenchment of routines developed around old technologies can limit the success of new ones (Edmondson et al. 2003). This need to realign workflows around new technologies is a ubiquitous one and indicates the larger disruption to organizational routines occasioned by technological change (Barley 1986). It follows logically that this is a time in which clearer two-way communication regarding managers' rationale for the change and frontline workers' resulting training needs would benefit all parties involved.

Despite the fact that OB, in particular, considers the role of technology in organizations generally, neither HR nor OB reserves a place for technology in theory, linking HR practices to organizational performance (Becker and Huselid 1998, 2010).

One notable exception in the HR literature is Mirvis, Sales, and Hackett's (1991) comparison of two very different technologies—computerized machinery in a metal fabrication factory and word processing technology in a publishing company. They concluded that a top-down deployment strategy like that used in the factory proved less effective than the more participatory, training-focused strategy employed in the publishing house. Their findings are undermined, however, by an "apples to oranges" research design, and more widely cited contributions to the HR literature are much more likely to treat technology solely as a source of measurement error (Huselid and Becker 1996; Locke and Schweiger 1979) rather than as an appropriate object of study. As a result, despite a wealth of theoretical and empirical work linking EI to performance, HR and OB research has yet to fully examine EI and IT in tandem. That is, it has yet to consider explicitly and carefully the possibility that EI's empirically elusive performance effects may, at least in part, come through its moderation of the technology-performance link.

User Participation and Technological Change in Information Systems

Researchers in the field of Management Information Systems or more simply, IS, have, of course, long been concerned with the association between aspects of workplace technological change and business performance. Furthermore, there is a well-developed empirical stream within the IS domain that examines the moderating effects of what it labels "user participation" or "user involvement" on the link between information systems design (ISD) and myriad organizational outcomes (e.g., He and King 2008). Ives and Olson (1984: 387), for example, theorized that user involvement is simply "a special case of [participatory decision making] in which users and system designers substitute for superiors and subordinates." Therefore, these and other researchers have adopted Locke and Schweiger's (1979) convention of partitioning expected benefits into two broad categories: job satisfaction and improved performance. Their studies have

yielded the same set of tentative conclusions as those in OB, namely that user participation drives attitudinal and behavioral measures like job satisfaction but has little or no effect on performance.

The IS literature, however, goes one step further. A number of studies have proffered contingency models to account for different organizational factors potentially moderating the relationship between user participation in ISD and measures of performance. For example, Hunton and colleagues (Hunton 1996b; Hunton and Price 1997) employed experimental techniques, collecting data from individual workers or students after seeking to manipulate the degree of perceived instrumentality of worker voice. Some subjects were afforded no voice at all, and others were placed along a continuum of increasing levels of instrumentality. In the language of employment relations, rightward movements along this continuum would be labeled “information rights,” “consultation rights,” and finally, at the far right-hand side, “co-determination rights” (Freeman and Lazear 1995). In addition, net increases in the level of voice instrumentality result in improved attitudinal and performance measures. With respect to the findings regarding attitudinal measures, these results fall in line with findings from IS research predicated on broad, national surveys (e.g., Choe 1996; Kim and Lee 1986), multi-organization studies (e.g., McKeen, Guimaraes, and Wetherbe 1994; McKeen and Guimaraes 1997), and even some mixed-method, multi-site, single-organization studies (e.g., Hunton 1996a; Hunton and Beeler 1997). However, the performance effects detected under experimental or quasi-experimental conditions are not consistently replicated in multi-method, multi-site studies (Brodbeck 2001; Hunton 1996a; Hunton and Beeler 1997).

The source of this ambiguity and of the broader finding of weak performance effects of EI in ISD (He and King 2008) is the IS literature’s tendency to examine the success of IT projects outside the context of the employment relationship. That is, even those analyses that control for or hold constant features of the technology itself (e.g., Brodbeck 2001) or even of the organization more

broadly (e.g., Choe 1996; Hunton 1996a; Hunton and Beeler 1997; Hunton and Price 1997) abstract away from the set of larger institutional features guiding the various manifestations of employee involvement. These include forces that employment relations scholars know to be essential to understanding work-related phenomena, such as business strategy and the nature of the contract—implicit or explicit—governing the relationship between workers and firms (Dunlop and Weil 1996; Levine 1995).

Employee Involvement and Technological Change in Employment Relations

In this paper, I am leveraging employment relations theory to fill gaps left by the HR and OB literatures on the one hand, and the IS literature on the other. That is, I am more closely considering the role of technology in approaches to EI and bringing a broader conceptualization of the employment relationship than that found in received EI research in the IS field. This is possible because scholars of employment relations have an abiding interest in what Dunlop (1958 [1993]) labeled the “technological context.” In fact, the field’s nuanced conceptualization of technology is part of what set pluralist industrial relations, that is, employment relations, apart from earlier approaches to the study of work and employment. Marxists, for example, portrayed new technologies and the technological change process as a deliberate strategy on the part of managers to tighten control over workers and the labor process through deskilling (Braverman 1974; Marx 1849 [1978]). Employment relations criticizes this view as deterministic, adopting more of an institutional perspective, paying very close attention to the interplay of technology and EI in production.¹

¹ Science and technology studies (STS) combats technological determinism in a different manner, by shining a spotlight on human agency. Though more focused on “technologies of consumption” than the realm of production (cf. Noble 1984; Oudshoorn and Pinch 2007: 556), STS counters deterministic approaches by

Over the past three decades, in particular, employment relations research has delivered a growing body of evidence on the effects of technology and workplace practices, motivated in part by the highly visible and widely reported early experiences of General Motors (GM) and others in the auto industry with investments in automation. Case study research has documented that in the 1980s, GM invested billions of dollars in automation technology—\$650 million in one GM factory alone (Kochan 1988)—but did not achieve the expected performance improvements or achieve the levels of performance observed in Japanese plants in North America or in Japan (Krafcik 1988). Instead, follow-up case study and quantitative analyses demonstrated that the combination of new technologies and innovative employment practices that positioned shop floor workers to “give wisdom to the machine” (MacDuffie and Krafcik 1992; MacDuffie 1995) is what delivers these levels of performance. This evidence suggests that a “bundle” of innovative employment practices, inclusive of opportunities for worker involvement in problem solving, moderates the return on investments in new technologies.²

These results have subsequently been replicated in other manufacturing settings, including a few service industries. Kelley (1996), for example, showed that increased computerization in the machined products sector drives larger productivity gains in firms that involve workers through participatory structures. Likewise, Batt (1999) found that telecommunications sales representatives with access to new technology outperform those not using it, and that the size of the performance increment is

greater for those workers reporting high levels of involvement in problem-solving and participation.

Interestingly, employment relations research that focused on EI and performance to the exclusion of technology has been unable to establish a conclusive link between EI and economic performance (Cappelli and Neumark 2001; Freeman and Kleiner 2000; Kleiner, Leonard, and Pilarski 2001). Appelbaum and Batt (1994) suggested that measurement error may be the problem, since neither researchers nor practitioners have a single, shared understanding of the meaning of EI or how it actually occurs in workplaces. Instead, the dominant finding in the literature on high-performance work systems (HPWS) is that “bundles” or clusters of employment practices, not individual practices, are the true drivers of economic performance (e.g., Becker and Huselid 1998; Ichniowski, Shaw, and Prensushi 1997; MacDuffie 1995). Of course, the instrumentality of EI-inclusive bundles of employment practices also stands on firm theoretical ground. At the same time, consistent with aforementioned findings from HR and OB (Cotton et al. 1988; Cotton 1993), it appears that not all forms of EI “pack the same performance punch.” That is, purely consultative offline forms of EI, such as the “quality circles” popularized in the 1980s and 1990s, generally yield weak performance improvements, if any (Levine and Tyson 1990).

I advance theory along two lines. First, I proffer an alternative explanation for the empirical elusiveness of the EI-performance link. I theorize that the implementation of new technologies, IT in particular, offers one avenue by which EI positively influences firm performance, thereby filling a gap in the management literature left by scholars of employment relations, HR, and OB. Taking an employment relations approach—characterized by organizational and phenomenological groundedness—I suggest that the deployment of an IT system, with its unavoidable disruption to organizational routines (Barley 1986; Edmondson, Bohmer, and Pisano 2001), occasions an opportunity to leverage EI to the organization’s advantage. That is, those workplaces that successfully

examining the ways that actual users of technology as well as the social environment more broadly shape characteristics of new technologies, implying that emergent manifestations of IT and the impact of new hardware and software, for example, depend on early stage “negotiations” between the relevant actors.

² Interestingly, in his groundbreaking empirical study, MacDuffie (1995) measured technology very carefully in an effort to isolate the performance effects of employment practice bundles. However, he did not focus on the ways that certain employment practices managed to “unlock” new technologies.

include workers in the deployment will show larger gains from the use of the new system than workplaces taking a more traditional, top-down approach—a process suggested by Mirvis, Sales, and Hackett (1991). Because it draws on what we already know about the ways employment practices complement new technologies, the theory begins to clarify the ambiguity of the EI-performance link. Furthermore, the argument allows for a critique of the HR and OB literature's treatment of technology, suggesting an additional contingency heretofore largely ignored by these fields.

The second theoretical advance is founded on the received research from IS that, despite direct examination of the phenomenon, has been unable to pin down EI's moderation of the IT-performance link. This is a result of that field's narrow conceptualization of the employment relationship. The three-tiered approach to the study of employment relations, first proposed by Kochan, Katz, and McKersie (1986) as a generalization and extension of Dunlop (1958 [1993]) and since extended (Budd 2004), offers a useful lens for understanding this issue. The bottom tier of this model, the workplace level, refers to those activities through which workers and their supervisors relate to one another on a daily basis (Katz, Kochan, and Colvin 2008: 6). This includes various forms of worker representation that the IS literature puts under the umbrella of user participation. The IS literature has, in fact, been meticulous in its consideration and measurement of different structures for guiding these interactions (e.g., see Boland 1978), sometimes even employing a grounded, inductive approach that allows the data to speak to the different forms of EI that might emerge in a given sample of IT projects (see McKeen, Guimaraes, and Wetherbe 1994; McKeen and Guimaraes 1997). The common ways they measure workplace-level EI include the incidence of worker representatives in the implementation process (see Boland 1978; Brodbeck 2001; Yeh and Tsai 2001), the extent of worker input sought at different stages of the development process (see Kim and Lee 1986), and, as noted earlier, the instrumen-

tality level of workers' voice opportunities (ranging from no voice at all to near co-determination) (Hunton 1996a; Hunton 1996b; Hunton and Beeler 1997; Hunton and Price 1997; Lawrence, Goodwin, and Fildes 2002).

Where the IS literature falls short, however, is with respect to the two tiers of the employment relations framework that exist above the workplace level. The middle level of the employment relationship, immediately above the workplace level, is what has come to be labeled the "functional" level of the employment relationship. It encompasses the process and outcomes of negotiations, either explicitly in the unionized case or more implicitly in the non-unionized one. By omitting this level of the employment relationship from its analysis, the IS literature ignores a number of important determinants of EI's instrumentality over the effectiveness of new IT. The question arises, for example, have frontline users been assured that their earnest attempts to use the technology will not result in job loss or wage reductions? Located at the uppermost level of the employment relationship in the three-tier framework is what Kochan, Katz, and McKersie (1986) referred to as the "strategic" level, which includes the strategies and structures that exert long-run influences on the nature of the relationship between a firm and its workers. These include issues related to business strategies as well as decisions regarding the employment or HR strategies necessitated (or allowed for) by these strategic choices (Kochan, McKersie, and Cappelli 1984). In the absence of details about matters at the strategic level, readers of IS research know nothing, for example, about the larger goals served by the effective use of new IT, nor can they understand how decisions made at the strategic level drive behaviors at the workplace level.

Consider this illustration predicated on the business strategy typology promulgated by Porter (1980). The IT whose deployment workers are being asked to facilitate may be part of a business strategy focused solely on cost minimization, with the resulting HR strategy being to minimize labor costs and to maximize output. This "cost leadership"

business strategy often goes hand-in-hand with an autocratic approach to HR in which supervisors seek to “drive” rather than to “motivate” workers (Arthur 1992). Hence, participatory structures at the workplace level may prove ineffective, since workers should see little reward, and in fact, some real penalties associated with the success of the new technology. Alternatively, EI activities in the workplace may emerge from more of a “differentiation” business strategy in which the firm seeks to leverage its assets—including its human ones—as a source of competitive advantage. Under this scenario, workers are not a “necessary evil” or a cost to be minimized, but rather an object of investment that must be developed, rewarded, and empowered. As a result of the commitment that they receive from the firm, workers can comfortably believe that their work to make the new technology maximally effective will be rewarded. In this latter case—differentiation—even workplace-level EI structures that appear identical to those employed under a cost leadership strategy should be far more instrumental in boosting performance.

Lab-based experimental studies in IS necessarily neglect forces above the workplace level by design. That is, the experimental approach was called on specifically to forestall the influence of institutions that in real organizational settings would be situated on the functional or strategic levels. However, in the case of the field experiments and the multi-organizational or broad national studies, these features of the employment relationship are unmeasured contextual variables that impinge on the relationship between workplace-level EI and economic performance. My employment relations approach bridges the gap between HR and OB’s approach to EI (which under-theorizes the role of technology) with the IS literature’s approach to EI (which gives short shrift to the nuances of the employment relationship).

Technological and Organizational Context

This study not only integrates technology and technological change into research on

EI, but it also pays special attention to functional- and strategic-level aspects of the employment relationship, holding them in place to identify the moderating role of EI in IT deployment through variation in workplace-level measures of EI. In this way, one can see how EI complements IT in the production and delivery of healthcare services. Establishing this relationship reliably requires a deep understanding of the technology and of workplace-level aspects of the employment relationship, including relevant workflows and measures of EI. The IS literature has actually paid close attention to what employment relations scholars would label workplace-level variation in EI, though existing studies of the effects of EI and IT on performance in employment relations have actually been criticized for failing to do (Brown and Campbell 2002; Ichniowski et al. 1996). Even the IS studies, however, ignore functional- and strategic-level features of the employment relationship. Consequently, I focus first on issues at the two highest tiers of the employment relationship, describing the workplace-level EI variations in these structures. That is, I describe the functional and strategic aspects of EI and of the Kaiser Permanente labor management partnership (LMP), particularly with respect to the organization’s strategy for its EHR system. This detail provides the context needed to reliably interpret the quantitative results that follow.

Functional- and Strategic-Level Aspects of Employee Involvement at Kaiser Permanente

Kaiser Permanente, the integrated health insurer and healthcare provider, was chosen for this study in part because of its pioneering business strategy. It has been a forerunner in healthcare’s conversion from paper-based to electronic recordkeeping and, at the same time, has a history of promoting EI as part of an overall labor management partnership (Kochan et al. 2009). Once fully deployed, Kaiser’s EHR system, KP HealthConnect, will include a full complement of interoperable administrative and clinical health IT applications. One of these,

Table 1. Highlights of the KP HealthConnect Effects Bargaining Agreement between Kaiser Permanente and the Coalition of Kaiser Permanente Unions

Coalition agrees to:

- commit to the “successful implementation of KP HealthConnect and the full realization of its benefits.”
- engage in development, implementation, and continuous improvement efforts at each stage, regionally and nationally.



Joint commitment to create “an environment where all staff . . . freely engage in the transformation effort.”

Kaiser agrees to:

- extend existing language on flexibility and job and wage security to changes engendered by new technology.
- follow a process for incorporating into the bargaining unit new jobs created by the technology.
- fund KP HealthConnect labor coordinators in each region and for release, backfill, and training demands arising from the initiative.

Source: KP HealthConnect Effects Bargain, effective 5 April 2005.

which I refer to as the “scheduling module,” is used for scheduling office visits, procedures, and lab tests in each region’s outpatient or “ambulatory” clinics—essentially, large-scale doctors’ offices.³

The LMP is a cooperative arrangement between Kaiser Permanente and thirty union locals representing workers in seven of its eight regions (Kochan et al. 2009). As of 2008, the Coalition of Kaiser Permanente Unions (CKPU) and thus, the LMP, covers about 86,000 Kaiser employees. The configuration of the CKPU replicates that of its management-side counterparts, creating labor-management “partners” at every level in every region in which the CKPU represents workers. At the apex of the LMP in its Oakland-based office sits a representative from Kaiser—a senior vice president reporting directly to Kaiser’s COO—alongside the CKPU’s director.

The LMP funds a full-time KP HealthConnect union coordinator at the national level to represent the interests of the CKPU with respect to this system’s development, deployment, and ongoing use. It also negotiated

and now administers a national KP HealthConnect “Effects Bargain” agreement governing job and wage protections for workers as they relate to the EHR initiative (see Table 1). Together, these provisions and personnel assignments establish the importance of labor to the KP HealthConnect initiative and seek to assure that this system will advance the interests of the workforce as well as Kaiser’s goals. Further, the agreement underlines the need for flexibility at all levels in processes and workflows and for the active involvement of labor representatives and frontline workers in developing and implementing the initiative. In exchange, the document creates and funds regional KP HealthConnect union representatives to represent labor alongside IT and operations leads at the top of each region’s KP HealthConnect project team. Among other protections, the agreement makes guarantees with respect to training and preparation as well as commits to mitigating the effects of staffing challenges that would inevitably occur in the run-up to implementation, something that prior research makes clear is essential for the effectiveness of EI (Levine 1995).

The Effects Bargain established the creation of at least one full-time KP HealthConnect labor coordinator to serve on each regional leadership team. Since the labor coordinator was charged with monitoring KP HealthConnect-related service process and

³ The term “outpatient” is often used to describe those patients expected to check-in and out of the hospital on the same day. However, since this study does not address anything related to “inpatients” or hospital care, I use the adjectives “ambulatory” and “outpatient” interchangeably.

workflow change experiments and pilots, he or she also assumed responsibility for identifying and responding to demands for front-line worker involvement arising in the course of the initiative. In the aggregate, Kaiser expected labor's active participation in configuring, implementing, and eventually encouraging optimal use of KP HealthConnect. In exchange, workers were given a say in how the system would be deployed and used and were assured that the effort put forth to use the technology would not result in job loss or wage reductions.

One of Kaiser's regional operations, Kaiser Permanente of the Northwest, signaled its commitment to both the Partnership and KP HealthConnect by funding two employees to serve as KP HealthConnect labor coordinators, each pulled directly from the bargaining unit. With clinical functionality largely in place, the region turned to one of KP HealthConnect's non-clinical applications, the scheduling module. The labor coordinators assumed their positions on the local configuration team alongside IT and operations leaders, programmers, and application specialists. They also began assembling a cadre of bargaining unit members to serve as "super-users," who would ultimately serve as the primary link between the workplace level and employment relations features at the functional and strategic levels.

Workplace-Level Aspects of Employee Involvement at Kaiser Permanente

Super-users were support staff end-users drawn from throughout the Northwest region. At any one time, there were approximately 15–20 active super-users. They were the first to learn how to use the scheduling module and served as liaisons between front-line support staff and the regional configuration team. As the region grew closer to implementing the system in the spring and summer of 2005, super-users were temporarily transferred from their regular roles on the front lines to full-time liaisons. Not only did this allow them to travel the region answering questions and facilitating the training of other bargaining unit members, but it also demonstrated the firm's commitment to

the new technology with a clear up-front investment much like that which they were expecting from the workforce. Though much of what the super-users did was informal, their participation—and by extension, the participation of all those frontline workers whom they touched—made the scheduling module more effective through four main channels.

First, during their travels throughout the region, the super-users sought suggestions on how to improve the system or its rollout. Through weekly meetings, they relayed this information to the labor coordinators, who ensured it was integrated into the planning being done by the regional leadership team. It was through this process that frontline staff pointed out that the transition between scheduling systems could not be done in waves—by clinic, by department, or by any way other than what would eventually be labeled a "big bang." This is because Kaiser patients, even though assigned to a specific provider in a specific clinic, draw on services from many departments and often multiple facilities. Aside from communicating this up to management through their labor coordinators, the super-users also made a related case with respect to training, also voiced at the strategic level by the regional labor coordinators: as a consequence of the decision to go with a "big bang" rollout, all end-users would have to be trained before "go-live."

Training was, in fact, the second area in which super-users played a key role in the deployment of the scheduling module. They worked with regional trainers to develop and lead sessions for their frontline co-workers. This introductory training occurred mainly at the regional training facility, but it called upon the super-users to scope out opportunities within the clinics to ensure staff were up and running on the technology. Later on in the process, they played a similar dual role in follow-up or "optimization" training.

Super-users were also charged with communicating information downward from regional leadership to those on the frontlines, a responsibility that often included as much justification as communication. For example, management's recognition that staff from all clinics would have to be trained be-

fore the rollout reinforced the need for some extra flexibility from the rank-and-file. In particular, the short time frame meant that some training would have to occur in the evenings and on weekends, a decision that was not welcomed by the workforce.

Finally, super-users provided ongoing, “just-in-time” support for co-workers not only around the time of the deployment, but thereafter as well. These experts would eventually return to their jobs able to serve as their workplace’s *de facto* leaders and “go-to” people for all matters technological and work-related pertaining to the KP HealthConnect scheduling module. Indeed, super-users played just as vital a role in the initiative when they returned full-time to their regular positions. Managers and frontline staff reported their being in demand as KP HealthConnect resource people in clinics, providing co-workers with quick answers to the sorts of “just-in-time” questions that arose as those who were already formally trained became everyday users.

Despite the sturdy structure supporting the mandate for workforce participation in terms of the organization’s long-term goals for the technology and in the agreement governing employment relations issues relating to KP HealthConnect, interviews with frontline staff in many clinics across multiple Kaiser regions revealed a great deal of workplace-level variation in just how involved workers felt they were in the project. This deviation between stated policies and their impact on the ground is actually quite common in studies linking employment practices to performance (e.g., Bartel 2004; Jones, Kalmi, and Kauhanen 2009). Within well-defined regional boundaries, however, there was little or no variation in functional- and strategic-level structures bolstering EI in support of the new technology. Furthermore, within these confines, attributes of the IT module itself—including when it “went live”—as well as a host of contextual variables, can be reasonably assumed not to vary. I exploit these advantageous quasi-experimental conditions in order to undertake a more careful analysis of EI’s role in IT implementation than that permitted by the research designs employed in earlier

studies (e.g., Bresnahan, Brynjolfsson, and Hitt 2002; Kim and Lee 1986; Mirvis, Sales, and Hackett 1991). That is, I demonstrate that EI around new IT increases the technology’s effectiveness, relying on variation in workplace-level EI measures, holding constant employment relations features at the functional and strategic levels.

Technology and Workflow at Kaiser Permanente

Through interviews with managers and labor leaders in Kaiser’s national headquarters as well as those in multiple regions, the Northwest region’s scheduling module emerged as one with clear and measurable performance improvement expectations. Furthermore, it was implemented in organizational units doing the same work and that were similar enough on other dimensions to provide for suitable comparisons. Headquartered in the suburbs of Portland, Oregon, the region employs 880 physicians and 8,900 employees to serve just over 480,000 “members” (patients). The region spans the greater metropolitan Portland and Vancouver, Washington areas. It offers ambulatory care through 27 outpatient medical office buildings, 15 of which serve as hubs for primary care—family practice, pediatrics, and internal medicine. The study focuses on these primary care clinics in part because so many of the performance outcomes of interest to Kaiser are shaped by the member’s experience with his or her primary care physician (PCP). Bounding the sample in this way, moreover, allows the researcher to spend time in all of the clinics, accounting for or assuring the non-variation in contextual characteristics. For example, including appointment-making procedures beyond primary care would introduce variation across specialties and ancillary services.

The scheduling module addressed a very concrete set of organizational challenges—inefficiencies and patient dissatisfaction with the appointment-setting process. Among other challenges, those support staff charged with setting patient appointments using the legacy scheduling applications frequently found themselves asking even long-term

Kaiser members for data that should be permanently linked to a member's health record number (HRN), namely contact information. The legacy system also made it difficult to schedule regularly recurring appointments and often lacked up-to-date information on providers' availability vis-à-vis vacation scheduling, "panel support" time, or the use of planned or unplanned leave.

To understand how this would have a negative impact on economic performance, consider the process by which members make a primary care appointment by phone. They dial their clinic's appointments line. The call is received by a member intake specialist (MIS). The MIS opens the schedule corresponding to the member's PCP and searches for the first available appointment time or the first available time slot amenable to the member. This only disposes of about 40% of cases. More frequently, large sections of a provider's schedule would be blocked as "unavailable" for one of the reasons listed above. The MIS would then transfer the member to the medical assistant (MA) supporting the appropriate provider. If the MA picks up the phone, he or she could override or correct the schedule. If instead the MA is serving another patient or is otherwise unavailable, the patient calling could leave a message. If the patient ever called again, possibly returning a call from the MA, he or she would have to begin the process again at the clinic's call center, in which the MIS would attempt to make an appointment and would likely run into the same complication.

The end result was that 75–80% of members initially denied an appointment would ultimately be given one within an acceptable time frame. However, this chain of events came at the great expense of patient satisfaction with the appointment-making process. Furthermore, appointment-setting required 4–5 "touches" from more highly paid MAs in addition to MISs, rather than the single touch of one MIS. Effective use of the new scheduling module could address this issue and the patient dissatisfaction that arose from it. However, the new technology would certainly cause a disruption to existing routines for setting patient appointments. Get-

ting input from workers and ensuring they were properly trained could potentially mitigate these challenges.

Complementarity between Employee Involvement and Information Technology

At Kaiser, the new IT—the scheduling module—served as a tool for workers, providing them real-time, up-to-date information that facilitated their ability to better meet a strategic goal. Therefore, one might expect that just turning the technology on—which occurred at the same time across all clinics examined—would boost performance. Whereas there was no inter-clinic variation in when the IT "went-live," there was variation in the levels of EI achieved in each clinic. At some clinics, workers reported the frequent presence of and reliance upon so-called super-users. However, at other clinics, workers claimed not to have had their ideas or concerns solicited or considered or reported being trained not by a fellow front-line worker in the form of a super-user, but rather by a manager or regional IT staffer. This inter-clinic variation in EI is what enables the identification of the theorized complementarity between EI and IT. While the IT might boost performance across-the-board, these improvements should be measurably larger under higher levels of EI. Finally, as alluded to above, these quasi-experimental conditions allow for an unprecedented, "apples to apples" comparison of before-and-after effects in very similar organizational sub-units doing identical work and using the same new technology (cf. Mirvis, Sales, and Hackett 1991).

Methods

For it to be true that EI facilitated the deployment of the scheduling module, it must be shown that variation in EI drives variation in performance. This analysis does so by measuring the performance impact of the same technology—the scheduling module—in 16 clinics in the same regional operations of the same organization over a 35-month period beginning in October 2004 and ending

Table 2. Definitions of Variables

<i>Variable</i>	<i>Description</i>	<i>Source</i>
Employee Involvement index	sum of responses to 8 survey items (listed below)	employees
suggestions have been valued	answered on a 7-point Likert-type scale in which 1 = “strongly disagree” and 7 = “strongly agree”, and then standardized	employees
issues have been ignored	answered on a 7-point Likert-type scale in which 1 = “strongly disagree” and 7 = “strongly agree”, and then standardized, with coding subsequently reversed	employees
unionized super-user improves my use	answered on a 7-point Likert-type scale in which 1 = “strongly disagree” and 7 = “strongly agree”, and then standardized	employees
affected staff were asked for guidance	answered on a 7-point Likert-type scale in which 1 = “strongly disagree” and 7 = “strongly agree”, and then standardized	employees
introduced to technology by a union member	binary variable created from a question allowing respondents to choose between a fellow union member, a member of the IT staff, or a manager	employees
received follow-up training from a union member	binary variable created from a question allowing respondents to choose between a fellow union member, a member of the IT staff, or a manager	employees
relies on a “super-user” in their clinic	binary created from a yes-or-no question	employees
made specific recommendations for effective use	binary created from a yes-or-no question	employees
satisfaction with length of phone call required to make appointment	answered on a 9-point Likert-type scale in which 1 = “extremely dissatisfied” and 9 = “extremely satisfied”, and then standardized	patients
Time Trend	linear time trend beginning with the first month of data, i.e., October 2004 = 1, November 2004 = 2, . . . , August 2007 = 35	interviews, archival records, and clinic observation
Transition Period	dummy variable to capture performance fluctuations around the time of “Go-Live”; set to 0 for all months except June, July, and August 2005	interviews, archival records, and clinic observation
Module-in-Use	dummy variable to capture the effects of “Go-Live”; set to 0 until September 2005, and then set to 1 for all months until the end of the observation period	interviews, archival records, and clinic observation
Time Since “Go-Live”	linear time trend beginning with the first month in which September 2005 = 1, October 2005 = 2, . . . , August 2007 = 24	interviews, archival records, and clinic observation

August 2007. Measures of IT “go-live” are constructed from interviews, archival data, and clinic observations. Performance is measured using Kaiser’s Patient Satisfaction Survey, and EI is assessed using a new survey of employees designed specifically for this

study. Table 2 details all of the variables used in the quantitative analyses.

The analysis leverages the multi-method nature of the research in numerous ways. It uses the rich qualitative information to understand the processes that generated the

data and, more directly, to construct temporal variables, such as when the technology was “switched on.” This allows for a number of methodological benefits. For example, qualitative research revealed why the scheduling module was such an attractive choice for in-depth study—its direct connection to a well-measured outcome of great interest to Kaiser managers. Whether the new system was effective could be measured by patients’ perceptions of the appointment-making process. Indeed, Kaiser had for many years collected patient-level data on the appointment-setting process as part of a mailed paper-and-pencil Patient Satisfaction Survey sent shortly after an appointment. Though the use of these types of “localized” performance measures poses a challenge for generalizability, a number of researchers have argued for their use on reliability grounds (e.g., Hunter and Pil 1995), claiming that they provide a more direct causal link than do financial performance measures. Some researchers have chosen to use such measures even when more generalizable dollar figures could have been easily imputed (see Bartel, Ichniowski, and Shaw 2007; Ichniowski, Shaw, and Prenzushi 1997; MacDuffie 1995).

Due largely to the newness of the technology, Kaiser’s human resource records do not contain reliable measures of the flavor of EI examined here. Though Kaiser conducts an annual poll of its employees, the instrument has only recently been augmented with a single and very broad question about the health IT system. Therefore, the best option was to develop a new employee survey specifically for this study, ensuring that the EI measures were not about some broad EI construct, but about EI in the context of the deployment of this specific IT module. There are a number of advantages to surveying employees directly, and then aggregating these data to the clinic (i.e., establishment) level. First, EI measures cannot be biased by individual clinic-level managers wanting to offer an idealized account of EI (Jones, Kalmi, and Kauhanen 2009). Second, Huber and Power (1985) suggest that single-response bias be tackled by asking survey questions of the “most-informed respondent” in the es-

tablishment. In this case, only those employees expected to use the scheduling module in the course of their everyday work are included in the analysis. This technique also avoids “frame-of-reference” problems (Hunter and Pil 1995) by asking frontline workers the very EI-related questions that they should know the answers to—not questions about a broad EI construct. Third, Gerhart et al. (2000) suggested that drawing on multiple respondents from each establishment disposes of inter-rater reliability issues, though they also noted that research designs bounded to a small number of organizational sub-units and a homogenous group of workers rarely suffer from this problem anyway. Finally, perhaps the most significant methodological challenge to studies linking employment practice “inputs” to performance “outputs” occurs when the same instrument is used to collect both. In this way, so-called “common method bias” generates artificially inflated correlations between EI, IT use, and performance (Podsakoff et al. 2003). However, the research design here circumvents the causes of common method bias with its collection of the independent and dependent variables from completely separate and unrelated sources—one long in existence for organizational use and another conceived of and administered years later purely for the purposes of this research.

Having described and justified key methodological choices, I will next briefly explain the variables constructed from qualitative research—those picking up when the technology was turned on and those intended to control for random performance movements around the time the technology was turned on. Likewise, there are variables to capture the trending of the performance variables, allowing for the separation of trend from the changes engendered by the use of the scheduling module. Then, I describe in detail the Patient Satisfaction Survey and the employee survey and explain how relevant variables were constructed from questionnaire items. Finally, I explain the estimation strategy that relies on these data, focusing on how it identifies the moderating effects of EI on the effectiveness of the new technology.

Performance Trends, Transition to the New Technology, and Module-in-Use

The observation represented in the archival data occurs over a 35-month period. It is important that the influence of trend over this period be controlled for in order to meaningfully identify the effects of the new technology. The first linear time trend (“Time Trend”) begins with October 2004 and ends with August 2007. The next step toward identifying the theorized effects is to detect the discontinuity in performance associated with turning the new technology on. The scheduling module went live across all clinics observed at the end of July 2005. Therefore, if a single dummy variable were used to capture the discontinuity, then all months from August 2005 onward would be set to equal one. However, in order to control for performance gyrations around “go-live,” the analysis presented here allows for June, July, and August 2005 to be labeled “transition months.” That decision gets operationalized with the binary variable “Transition Period,” which equals zero for all months except the three just noted. Therefore, “Module-in-Use” does not begin to take on the value of one until September 2005, just after the period of transition. This was a conservative choice, since it potentially “dummies out” the benefits that would accrue from the IT being in use in July and August. Changes in the number of transition months allowed for almost no difference at all in any of the subsequent estimates. A second linear time trend—“Time Since ‘Go-Live’”—captures the month-to-month changes (as opposed to the structural break) associated with “go-live.” Therefore, it carries a value of zero until September 2005, at which point the second linear time trend begins at one and increases by one up to 24 for August 2007. Thus, as operationalized in the paper, there are 8 pre-“go-live” months, 3 transition months, and 24 post “go-live” months.⁴

⁴ Since the panel is unbalanced, however, the total number of observations is not simply equal to 16 clinics \times 35 months.

Patient Satisfaction and Ease of Scheduling

I constructed a dependent variable from an item on the Patient Satisfaction Survey asking respondents to rate on a nine-point Likert-type scale their satisfaction “with the length of time spent on the phone to schedule the appointment.” At the same time, the survey also included the question, “Were you able to get the appointment scheduled by talking to just one person?” This allowed for confirmation that this specific form of patient satisfaction was, in fact, driven by the efficiency with which one’s appointment request was disposed of. The continuous variable and the dependent variable were strongly related. Those who answered “yes” for the binary performance item were, on average, more satisfied with the length of time required to make their the appointment ($t = 74.4, p < .001$), providing some face validity for reliance on the single, continuous dependent variable (Furr and Bacharach 2008; Schwab 2005).

With approximately 43,000 patient responses, the response rate for the survey was 35%, which stacks up favorably to comparable customer surveys administered by mail (Kaplowitz, Hadlock, and Levine 2004). Though management could not provide the necessary data dismissing the possibility of response bias, this bias should be consistent over the time period studied. Furthermore, the marketing literature suggests that disgruntled or dissatisfied patients may be more likely than others to respond to such surveys (Richins 1983). To the extent that this is true and that the use of the technology dissatisfies patients, it only serves to make the statistical estimates more conservative, that is, biased away from theorized results.

Employee Involvement in IT Deployment

Measures of EI were developed from an author-administered employee survey of MAs and MISs. Responses to eight survey items were summed to construct the EI index. The first four items are:

- 1) My suggestions relating to the design and improvement of [the scheduling module] have been valued;
- 2) My issues or complaints about it have been ignored;
- 3) There is at least one bargaining unit member in my office who helps me be a better user of [the scheduling module]; and
- 4) Before it was rolled out, the people whose work would be affected were asked for guidance.

Each was answered using a seven-point Likert-type scale in which seven represented strong agreement. The second item was reverse-coded. The remaining four items were binary in nature. Respondents answered questions on whether a fellow member of the bargaining unit introduced them to the scheduling module, provided them with their follow-up training on the module, or otherwise served as an on-site expert or “super-user” for the scheduling module. Respondents also answered yes or no as to whether they provided any specific recommendations on additional ways that the system could be used to meet its strategic goals. As a further reliability check, the survey included an open-ended question asking workers to document a specific suggestion that they had made. This step provided additional confidence that respondents understood exactly the kinds of EI they were being asked about (Hunter and Pil 1995).

The employee survey included questions derived from the author’s observations and interviews to measure EI relevant to employees in this particular organizational setting, similar to the methodological approach adopted by Bidwell (2009). According to Jarvis, Mackenzie, and Podsakoff (2003), the construction of formative indicators such as these rather than more traditional “reflective” measures makes sense when indicators “define” different aspects or dimensions of the construct and when indicators need not be interchangeable. In Kaiser’s case, there were multiple ways in which workers might have participated in the IT initiative, and any one of them could effectively substitute for any other. For example, a worker may

have been directly canvassed for their thoughts on effective system use. Alternatively, they may have relied frequently on guidance from a super-user. Summing answers into a composite measure therefore captures the overall level of EI in this context, even though there is no *a priori* reason to expect a high correlation between items (Bidwell 2009).⁵

The survey was piloted on both frontline workers and union and management leaders, and then administered electronically through the organization’s intranet in Fall 2007—shortly after the end of the constructed data series. Although organizational constraints prevented the survey from being run earlier or multiple times, conducting it well after the implementation of the scheduling module provided assurance that the chief concern—recall bias—would actually make the findings more conservative. The survey achieved a response rate of 58%, amounting to 268 MAs and 128 MISs that use the technology in the course of their everyday work. Analyses confirmed that those MISs who responded had about the same average age and job tenure as those who did not. The MA respondents had the same average tenures as their non-responding colleagues, but were marginally older, on average, than those that did not respond—41.8 years versus 39.3 years ($t = 2.44, p < .01$).⁶ Not surprisingly, the number of responses from each clinic—ranging from eight to 43—was mainly driven by clinic size.⁷

Estimation Strategy

In this section I demonstrate that the use of the IT is associated with performance

⁵ This scale proves only marginally reliable by conventional standards ($\alpha = .58$). Nonetheless, a low alpha does not indicate low reliability in the case of formative measures like that employed for EI (Bidwell 2009; Bollen and Lennox 1991; Jarvis, Mackenzie, and Podsakoff 2003).

⁶ I could not test for randomness with respect to sex. However, nearly all of the MAs and MISs sampled were women.

⁷ The work of Gerhart and colleagues (2000) suggests that even a very small number of respondents should be enough to ensure reliability in studies like this one.

increases at the clinic level and that these effects are greater in those clinics with higher mean levels of EI. The most straightforward way to illustrate the moderating role of EI is to collapse the data into a dataset of clinic-months, and then to regress the performance measure on a vector of independent variables. These variables would include controls, namely for trend, but also main effects for IT “go-live” and for EI. The focal explanatory variable would be the two-way, multiplicative interaction term crossing IT “go-live” (“Module-in-Use”) with EI, and a statistically significant, positive coefficient estimate on this term would support the theory. Indeed, with some modifications to account for the dependency structure of the data and performance gyrations right around the “go-live” month, this is essentially how the paper tests the impact of EI and IT on the continuous performance measure described above—patient satisfaction with the length of time required to make an appointment.

On a practical level, this requires melding patients’ responses to the Patient Satisfaction Survey—the dependent variable—with employee responses to the employee survey—the independent variable. Calculating the mean EI index for each clinic is straightforward. Given that workers were only surveyed once, this measure is time-constant. Aggregating the patient satisfaction data is only slightly more complicated. About 43,000 patient observations were linked to the specific PCP with whom the patient-respondent made the appointment, and then these data were crossed with archival managerial data placing physicians into specific clinics over time. Following Jones, Kalmi, and Kauhanen (2009) and Bartel (2004), I do this by taking the average of patient satisfaction responses by clinic by month, standardized—a method that further strengthens the reliability of these specific performance measures (Harter, Schmidt, and Hayes 2002). The models include on the right-hand side the variables to capture trend (“Time Trend” and “Time Since Go-Live”) and transition (“Transition Period”) as well as the main effect of the new technology being in-use (“Module-in-Use”) and of EI (“Employee Involvement”). Finally, the focal independent

variable is the two-way, multiplicative interaction of “Module-in-Use” with EI. Whereas the point estimate on “Module-in-Use” will establish the influence of the scheduling module on performance, the estimate for the two-way interaction establishes the moderating impact of EI.

Given the dependence structure of the data, the usual assumptions required of OLS do not hold. In particular, one would expect that the error terms would be systematically correlated at the clinic level. Accommodating this data structure requires a longitudinal model, multilevel in the sense that individual observations are of clinic-months “clustered” in clinics. Therefore, the models estimated here instead partition the variance term into a random effect at the clinic level in addition to the usual zero-expectation error term. That is, the observations can be assumed independent conditional on the random effect, and the estimates can be interpreted with the same ease as typical OLS coefficients (Skrondal and Rabe-Hesketh 2004).⁸

Results

Table 3 presents summary statistics from the survey of the Northwest’s support staff. Recall that means are calculated using only responses from those MAs and MISs expected to use the scheduling module in the course of their work. The first set of variables represents the four continuous items contributing to the EI scale. Notice how in all four cases, means hover near the neutral response (4 = “neither agree nor disagree”), albeit with significant variation about the mean. Overall, only 11% of respondents claimed that they were first introduced to the technology by a fellow member of the bargaining unit (as opposed to a manager or an IT staffer), though 18% asserted that they had, in fact, received follow-up training from a co-worker. About 40% noted the importance of “super-users”—fellow members of

⁸ The time-constant nature of the EI measure unfortunately precludes the estimation of clinic-level fixed effects with these data.

Table 3. Descriptive Statistics for Worker-Level Variables Included in the Employee Involvement Index

Variable	Mean	Std. Dev.
suggestions have been valued	3.99	1.53
issues have been ignored	3.57	1.65
unionized super-user improves my use	4.01	1.77
affected staff were asked for guidance	3.77	1.52
introduced to technology by a union member	0.11	0.31
received follow-up training from a union member	0.18	0.39
relies on a "super-user" in their clinic	0.39	0.49
made specific recommendations for effective use	0.15	0.36

Notes: Values based on responses from those medical assistants (MAs) and member intake specialists (MISs) reporting expected use of the system ($n = 396$). The first four components of the EI index were answered on a seven-point, Likert-type scale in which 1 = "strongly disagree" and 7 = "strongly agree", though the values for the second item have been reversed for ease of comparison. The remaining four items are binary.

the bargaining unit pulled from their regular, frontline positions to assist in the development and deployment of the system—to their successful use of the scheduling module. Interestingly, about 15% of respondents specifically recommended ways in which the system could be used more effectively, the details of which were validated with the responses to a free-form text field included in the survey. For example, some workers suggested the need for "write" privileges in addition to "read-only" privileges at certain screens. Others pointed out the need to make sure that a patient's contact details remain on-screen throughout the appointment-setting process or the need to allow the home phone number field to be left empty for those patients having only a cell phone. Others had suggested the creation of shortcuts for frequently used "bundles" of mouse clicks, like those required to make certain, regularly occurring types of office visit appointments. A simple ANOVA was estimated on the EI index to ensure that there are truly differences-in-means across clinics as opposed to noisy data within each creating the false appearance of different means ($F = 1.78, p < .05$).

Table 4 breaks out the dependent variable—a patient's satisfaction with the length of the phone call required to make the appointment—for each (de-identified and re-labeled) clinic, derived from patient-level data. The variable was standardized such

Table 4. Descriptive Statistics for Dependent Variables, by Clinic

Clinic Name	Satisfaction with length of phone call required to make appointment		
	Mean	Std. Dev.	n
Bruford	-0.07	1.01	4,051
Collins	0.01	1.00	2,078
Copeland	0.004	0.99	2,864
Dolenz	0.04	0.96	4,056
Escovedo	0.09	0.97	3,016
Fleetwood	0.20	0.93	3,046
Henley	0.09	0.97	3,371
Mullen	-0.10	1.05	1,028
Pearl	-0.02	0.97	3,084
Peterson	-0.04	1.04	976
Schock	-0.05	1.02	2,898
Slichter	-0.08	1.02	2,921
Starkey	-0.07	1.04	3,018
Torres	-0.03	1.01	2,992
Ulrich	0.08	0.90	255
Watts	-0.07	1.04	3,194

Notes: Values based on responses to Patient Satisfaction Survey, in which the item—"satisfaction with length of phone call required to make appointment"—is standardized at mean zero and a standard deviation of one. Survey responses were collected over a 35-month period from October 2004 to August 2007.

that the overall sample mean was equal to zero and the standard deviation equal to one. Therefore, each clinic's mean for the variable as reported in Table 4 is relative to the overall sample average. Over the obser-

Table 5. IT and Employee Involvement as Determinants of Patient Satisfaction with Length of Phone Call Required to Make an Appointment for an Office Visit

Variables	1	2	3	4	5
Time Trend	0.01*** (6.98)	-0.01** (-2.73)	-0.05*** (-5.21)	-0.05*** (-4.87)	-0.05*** (-5.03)
Time Since "Go-Live"		0.03*** (4.97)	0.06*** (5.65)	0.06*** (5.30)	0.06*** (5.46)
Transition Period			0.15* (2.26)	0.15* (2.25)	0.15* (2.36)
Module-in-Use			0.44*** (6.31)	0.43*** (5.87)	0.42*** (6.02)
Employee Involvement				0.03 (0.43)	-0.14 (-1.89)
Module-in-Use × Employee Involvement					0.27*** (4.06)
<i>n</i>	496	496	496	468	468
clusters	16	16	16	15	15
<i>R</i> ²	.11	.16	.26	.25	.28

Notes: Multilevel random effects regression with significance tests performed using robust standard errors. Dependent variable is mean patient satisfaction with the length of time it took to make an appointment by telephone for each clinic in a given month. Since *n* represents clinic-months and "clusters" is the number of distinct clinics included in each estimate, their quotient represents the mean number of months of data supplied by each clinic. In the first model, for example, each clinic contributes, on average, 31 months of data.

*Statistically significant at the .05 level; **at the .01 level; ***at the .001 level.

vation period of October 2004 to August 2007, the Fleetwood clinic averaged .2 standard deviations above the sample mean, the highest of all the clinics. The clinic labeled Mullen achieved the lowest performance and the widest variation on this metric over the sample period.

Table 5 displays the multilevel models estimated on the dataset of clinic-months, beginning with a simple model considering only the effects of a linear time trend. The first model shows a small but statistically significant month-to-month increase in the dependent variable between October 2004 and August 2007. Once a separate, post-implementation trend is added on the right-hand side (in the second model), the estimated partial slope on the original time trend turns negative and remains so for the remaining models to be estimated. By contrast, the post-implementation time trend ("Time Since 'Go-Live'") that first appears

in the second model reveals a positive association between the use of the scheduling module and the performance measure it was intended to influence. Despite the negative, month-to-month effect of the overall time trend ("Time Trend"), the post-implementation time trend is actually positive and remains so for all subsequent estimates. Consistent with anecdotal accounts, customer service suffered prior to the implementation of the scheduling module, a trend that reversed itself with the transition to the new system. Moreover, without the new technology, it appears that month-to-month performance would have continued to decline. The next model adds two dummy variables capturing transition to ("Transition Period") and deployment of the scheduling module ("Module-in-Use"). Both estimates are positive and statistically significant in this and the remaining models. Also note the point estimate on the post-implementation time

trend doubles. That means that once one accounts for a structural break in the time series, one can see evidence of a large (.44 standard deviations), one-time jump in performance as well as a steady, sizable (.06 standard deviations) month-to-month performance increase associated with the scheduling module, despite what would otherwise be a declining performance function (-.05 standard deviations each month) over time. These effects are not sensitive to changes in the way the transition period is operationalized, such as one month or two months on either side of the transition from legacy systems to the new IT.

The last two models in Table 5 incorporate the effects of EI on the efficacy of the technology. Model 4 incorporates only a main effect for EI. Interestingly, this predictor has an estimated performance effect that is insignificantly different from zero. This provides face validity, since the EI variable should only be measuring EI related to the IT deployment, meaning that its effect should only show up when crossed with the technology measure. It is also worth noting that the inclusion of the EI variable in the fourth model does virtually nothing to the point estimates of all those variables carried over from the three versions of the equation previously estimated. The fifth and final model in Table 4 adds the two-way interaction to directly capture the incremental, moderating effect of EI on the IT-performance link. Controlling for all of the other effects, an increase of one standard deviation in the EI index increases the effectiveness of the technology by .27 standard deviations. Interestingly, the estimate for the main EI measure remains insignificant, further demonstrating that EI's performance impact appears to come through its moderation of the scheduling module's effect on performance, just as one would expect given the specific flavor of EI that it measures. The results are also robust to many different ways of operationalizing the EI measure.

Discussion and Conclusions

Though employment relations has long acknowledged the role of technology in its

theory building (see Dunlop 1958 [1993]; Slichter 1941; Slichter, Healy, and Livernash 1960), that focus has been largely limited to trade union responses to new technologies that were intended to serve as substitutes for labor. As IT and other new technologies become even more ubiquitous, employment relations scholars would do well to look within both the IT and EI processes at work to better understand how and why they interact to affect performance outcomes. In this case, reliance on the mixed-method approach indicative of employment relations as well as employment relations theory enabled an explanation of EI's moderation of the IT-performance link, one that the OB, HR, and IS literatures have been unable to establish conclusively. In particular, by more richly considering the role of EI around new workplace technologies, these findings build on the OB and HR literature's effort to establish a link between EI and performance. This analysis also benefits from the work of IS researchers, who have developed a rich literature on the moderating effects of user participation, but with similarly ambiguous results to those delivered by OB and HR. The distinction between the approach of IS as a field and this study is that rather than focusing solely on workplace-level features of the employment relationship such as the incidence of training and whether or not employees were asked for feedback, this study is also informed by important aspects of the employment relationship that exist on the functional and strategic levels. Since EI is not a purely workplace-level phenomenon, these aspects must be fully considered—either controlled for or held constant by virtue of the research design, in order to make valid inferences from workplace-level data.

The design of the study allows for a clean separation of the technology inputs from the EI inputs that management theory suggests complement one another in production. The great benefit of IT is that it makes more information available to frontline workers (Bresnahan, Brynjolfsson, and Hitt 2002; Brynjolfsson and Mendelson 1993). However, pushing information downward and outward—in this case, up-to-date information on patients and on physician

availability—will do much less to influence performance if those workers who will need to use the technology cannot shape how it is used, are not “brought on board” with clear communication from managers and union representatives, and are not offered proper training. For example, with respect to the scheduling module at Kaiser, aspects of the technology and of the organization necessitated that some training had to occur outside of regular working hours, and the labor coordinators and the super-users played a key role in justifying this unpopular decision to the region’s workforce.

More specifically, Kaiser Permanente’s deployment of its scheduling module—one component of its much larger EHR system—was associated with clinic-level performance improvements. However, these improvements were more than 50% greater in those clinics in which workers scored one standard deviation greater than average on a contextual measure of EI. It appears that although the scheduling module provided workers across all the clinics additional, real-time information on provider availability and patient information, employees made better use of that information when they understood management’s strategic rationale for the system, when they were able to communicate their own ideas and concerns back up to the strategic level, and, most critically, when they were availed of fellow frontline workers who could ease them through the deployment process and provide introductory and follow-up training.

This study offers convincing evidence that EI in implementation moderates the performance effects of IT. Whereas earlier empirical work suggested the importance of EI in this way (Mirvis, Sales, and Hackett 1991), the relationship had yet to be demonstrated by looking at the effectiveness of identical technology, with people doing the same work, in nearly identical workplaces, over time, under varying levels of employee involvement. Scholars of OB should welcome these findings, for they offer a much-needed explanation for the persistence of EI structures and processes despite a lack of empirical evidence in their favor (Locke and Schweiger 1979). Rather than proposing a

contingency along the lines of those already considered such as characteristics of the workers themselves (see Miller and Monge 1986) or aspects of the type of knowledge required to do the work (Latham, Winters, and Locke 1994; McCaffrey, Faerman, and Hart 1995; Scully, Kirkpatrick, and Locke 1995), I am suggesting that the new technology is itself a channel through which EI influences performance. Therefore, the findings I present here fold into an emerging stream of the OB literature considering the ways that social structure, organizational attributes, or attributes of the work itself moderate the link between new technologies and organizational performance (Edmondson, Bohmer, and Pisano 2001; Edmondson et al. 2003). In this case, however, the grounded nature of the research suggests that it is variation in EI around implementation that moderated the IT-performance link.

Despite a deep interest in EI, HR as a field practically ignores technology as an object of study (see Batt 1999). In this study, I demonstrate that technology must be examined in depth as an avenue through which EI can drive organizational performance. Furthermore, the rich, qualitative description of EI structures and processes at the functional and strategic levels facilitates a deeper understanding of workplace-level EI data than that afforded by the IS literature. It would be wrong, though, to view this gap in the IS literature as a purely methodological one. In fact, it appears to be theory-driven in the sense that IS concerns itself with either “user participation” or “user involvement,” but *not* with “employee involvement” *per se*. That is, the field has been very careful in defining its constructs. Barki and Hartwick’s (1989: 53) distinction, casting user participation as “a set of behaviors or activities performed by users in the system development process” and user involvement as “a subjective psychological state reflecting the importance and personal relevance of a system to the user,” has been widely adopted, extended, and called upon to operationalize these variables in empirical studies. The field has never called on an actual EI construct, however, most likely because the field centers on

the technology rather than on the nuances of the employment relationship in which it is being designed and deployed. Put another way, IS has not considered the nature and details of the employment relationship beyond that which is immediately concerned with the design and use of the technology itself—those features of the employment relationship that exist above the level of the workplace.

With respect to Kaiser, we know that observed EI scores at each clinic were achieved within a very tightly defined set of employment relationship features. All of the workers under study had a credible promise of employment and wage security, one example of a functional-level employment relationship feature that goes unmeasured even in those IS studies that are careful to control for organizational characteristics such as size and structure (see Choe 1996). Furthermore, the technology under study was intended to address a very specific business issue, patient dissatisfaction and inefficiencies associated with the appointment-making process. This goal itself was just one element of a much larger business strategy centered on the use of IT to better serve patients. EI features above the workplace level, such as the establishment of labor coordinators and their ability to communicate information up and down from the frontlines actually paved the way for the effectiveness and usefulness of workplace-level EI structures, like the presence of super-users.

Note that this study incorporates the functional and strategic levels of the employment relationship but does not measure their performance effects. Rather, it takes advantage of quasi-experimental conditions to hold these variables constant, eliminating them as a source of unobserved heterogeneity in workplace-level measures. This suggests two related next steps for researchers interested in these under-studied employment relationship levels in the EI literature. On the empirical side, one could take very clean measures of characteristics related to the contract linking workers to their employers as well as to the longer-term goals that employers have for their organization and for the technology under study. A multilevel de-

sign in which strategic-, functional-, and workplace-level attributes of the employment relationship can all vary would allow for a rich, quantitative assessment of EI's moderation of the IT-performance link. An equally promising next step would be additional qualitative theory-building that fleshes out in greater detail how variation in functional- and strategic-level structures and processes—in addition to EI at the workplace level—coalesce to drive organizational performance.

One might challenge these results on a number of grounds. The issues of reliability and construct validity are the most critical, in part because both the EI and performance measures were developed or chosen specifically for this study rather than taken from previously validated instruments. The resulting EI measures were those that emerged as important to the effective use of this technology in this setting. Likewise, the performance measure was chosen for its tight coupling with the effective use of the scheduling module. With respect to endogeneity, one might argue that those clinics that were “ready” for the technology based on observed measures of EI or some other unobserved factors were, not surprisingly, able to use the technology more effectively. With respect to these issues, reliance on qualitative investigation in addition to the statistical estimates offers some assurance of the findings' overall validity. For example, it was the deliberative, pre-statistical investigative process that determined that the “go-live” date was set at the regional level and was not chosen clinic by clinic based on each clinic's readiness. Finally, given the unique features of the Kaiser labor management partnership, further work is needed to determine if similar effects are observed in more traditional, unionized settings or in non-union settings that provide other employee voice arrangements. However, it is reasonable to believe that even non-union workplaces can identify and select frontline workers to support an implementation effort like the one described here. In fact, such workplaces have clearly become the drivers of employment practice innovations, including the growth of various forms of EI (see Bryson et al. 2007;

Osterman 1994; Osterman 2000). Broadening or redirecting these programs to encompass IT implementations could ostensibly be executed at relatively low cost, a result with obvious implications for managers. This is certainly a fruitful avenue for future research.

This study sheds some much needed light on IT and EI in the service sector, and outside of manufacturing, the one that has been the focus of most of the empirical work to date on the employment practice correlates of organizational performance. Therefore, the results not only offer a lens into the service sector and “service processes” (as opposed to manufacturing’s “production processes”) more broadly, but they also inform the fastest growing sector of the U.S. economy—healthcare.

The immediate implication for both policymakers and healthcare administrators is that health IT can improve organizational outcomes. Therefore, it makes sense that the government should promote the diffusion of EHRs and related technologies, and for practices and physicians to respond accordingly to those incentives. Significantly, policies that seek only to encourage the adoption of health IT as opposed to the adoption of both the technology and the employment practices that more fully “unlock” it are, at best, incomplete. Such costly mandates—like those that appear in the 2009 stimulus package—should also include language to encourage the adoption of employment involvement structures and processes along the lines of those taken up in the case presented here.

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