Job Characteristics and Job Satisfaction: Understanding the Role of Enterprise Resource Planning System Implementation
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MIS Quarterly

RESEARCH ARTICLE

JOB CHARACTERISTICS AND JOB SATISFACTION: UNDERSTANDING THE ROLE OF ENTERPRISE RESOURCE PLANNING SYSTEM IMPLEMENTATION[1]

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Abstract

Little research has examined the impacts of enterprise resource planning (ERP) systems implementation on job satisfaction. Based on a 12-month study of 2,794 employees in a telecommunications firm, we found that ERP system implementation moderated the relationships between three job characteristics (skill variety, autonomy, and feedback) and job satisfaction. Our findings highlight the key role that ERP system implementation can have in altering well-established relationships in the context of technology-enabled organizational change situations. This work also extends research on technology diffusion by moving beyond a focus on technology-centric outcomes, such as system use, to understanding broader job outcomes.

[1]Carol Saunders was the accepting senior editor for this paper.

Keywords: ERP systems, job characteristics, job satisfaction, technology adoption, system implementation

Introduction

One of the most pervasive organizational change activities in the last decade or so has been the implementation of enterprise-wide information technologies, such as enterprise resource planning (ERP) systems, that account for 30 percent of all major change activities in organizations today (Davenport 2000; Jarvenpaa and Stoddard 1998; see also Herold et al. 2007). Some estimates suggest that ERP adoption is as high as 75 percent among medium to large manufacturing companies, 60 percent among service companies, and up to 80 percent among Fortune 500 firms (META Group 2004). ERP system implementations typically involve an extensive redesign of business processes and the deployment of new software to support those new business processes (Robey et al. 2002; Ross and Vitale 2000). Compared to the implementation of simpler technologies often studied in prior individual-level research (for a review, see Venkatesh et al. 2003), the implementation of ERP systems cause greater change with broader impacts on employees, fundamentally changing the nature of tasks, workflows, and, by extension, the jobs themselves (Davenport et al. 1996; Liang et al. 2007; Mullarkey et al. 1997). The importance of understanding ERP-initiated organizational change is evidenced by data indicating that the percentage of ERP failures is over 60 percent (Devadoss and Pan 2007; Langenwalter 2000) as well as trade press reports showing that half of the top-10 IT failures of all time are ERP systems from market-leading vendors, with losses ranging from $6 million to well over

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$100 million (e.g., Nash 2000). The importance of the ERP industry to the professional information systems community is further underscored by projections indicating that it will be a $47.6 billion industry by 2011 (Jacobsen et al. 2007). Thus, framed against calls in the academic literature to theorize richly about specific contexts of change (Herold et al. 2007; see also Johns 2006), there is little doubt that ERP system implementation represents an important context worthy of study in IS research (e.g., Estevez and Bohorquez 2005; Gattiker and Goodhue 2005; Liang et al. 2007).

Although underutilized systems continue to be a problem, there has been remarkable progress in illuminating the psychological mechanisms leading to initial acceptance and continued use decisions by employees (for a review, see Venkatesh et al. 2003). However, given the maturity of research on technology adoption, some have suggested that we may be reaching the theoretical limits of our ability to predict individual-level technology use and have called for research that moves beyond treating technology use as the ultimate dependent variable (Venkatesh 2006). Consistent with the need to move beyond technology-centric constructs as the primary dependent variables of interest (Markus and Robey 1988), recent perspectives on organizational consequences resulting from new systems have highlighted the emergent nature of technology implementation and use (Boudreau and Robey 2005; Devadoss and Pan 2007). As a number of ERP researchers have suggested, the success or failure of an ERP system implementation is rarely tied to the features of the technology itself, but rather, is often linked to the job and/or process reengineering that typically accompany such systems (e.g., Davenport 2000; Peppard and Ward 2005; Scheer and Habermann 2000). Thus, although the focus on outcomes, such as technology use, is important, use is not an end unto itself, but rather is best positioned as a means to attain other organizational and individual benefits (DeLone and McLean 1992, 2003; Martin and Huq 2007; Seddon 1997).

More than other systems, ERP systems have the potential to dramatically alter jobs and business processes. Moreover, the degree of shock to the organization resulting from such systems is likely to vary across implementation stages. Extant prior research on IT diffusion has characterized the technology implementation process as unfolding in phases, from the initial planning and acquisition phases through a final infusion stage, where the technology is fully integrated and utilized in novel or innovative ways within the organization (e.g., Cooper and Zmud 1980). More recent work on ERP system implementation has conceptualized the phases associated with ERP deployment and assimilation within the organization as "chartering," "project," "shakedown," and "onward and upward" (Markus and Tanis 2000). Within this framework, there is agreement that most of the changes and shock that result from the implementation process can be expected during the shakedown phase (Alvarez 2008; Gattiker and Goodhue 2005; Hakkinen and Hilmola 2007, 2008; Peppard and Ward 2005). The shakedown phase is conceptualized as lasting from the point the system is functional and accessible by users until normal use is achieved (Markus and Tanis 2000; Nah and Delgado 2006). There is evidence that the effects of ERP system implementation are often negative during the shakedown phase and that these early negative effects frequently result in major losses and/or abandonment of the system until the longer-term benefits associated with ERP system implementation and use can be realized (Alvarez 2008; Gattiker and Goodhue 2005; Hakkinen and Hilmola 2008; Staehr et al. 2002). Although the changes embedded in the technology often bring beneficial long-term effects for the organization (and for the employees themselves), they can also include detrimental short-term effects. Therefore, it is important to understand this new context—the shakedown phase of ERP system implementation—and its role in shaping employee perceptions and other job outcomes (e.g., Boudreau and Robey 2005; Brynjolfsson and Hitt 1998; Davenport 2000; Davis and Hufnagel 2007; Galliers and Baetz 1998; Josefek and Kaufmann 2003; Orlikowski 1991, 1993; Parker et al. 2001; Sauer and Yetton 1997; Zuboff 1988).

Focusing on the shakedown phase, we use the job characteristics model (JCM; Hackman and Oldham 1980) as the theoretical lens to understand the impacts of an ERP system implementation on employees' jobs. The basic thesis of the JCM is that various job characteristics together influence job satisfaction. Clearly, job satisfaction is an important outcome in its own right and has been linked to other key job outcomes, such as organizational commitment, turnover intentions, and job performance (e.g., Couger et al. 1979; Goldstein 1989; Griffeth et al. 2000; Singh et al. 1996; Tett and Meyer 1993; Thatcher et al. 2002). There is empirical support for the notion that changes in one's job are likely to have an influence on job attitudes (Ang and Slaughter 2000). Given that ERP system implementations have the potential to drastically alter jobs, thereby changing people's reactions to their work situation, a fundamental argument that we make is that job perceptions and the implementation of an ERP system will interact to influence employees' job satisfaction. Although prior research on job characteristics and job outcomes has extensively related these two sets of constructs, the role of technology implementation or the context in which the technology implementation occurs has not been explicitly modeled to understand how and why various job characteristics influence job satisfaction. While IS research has examined job characteristics and/or job satisfaction (e.g., Goldstein 1989; Thatcher et al. 2002), the focus has more

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often been on understanding technology implementation from the perspective of how often the technology is used (see Venkatesh et al. 2003), and has given little consideration to how the relationship between job characteristics and job satisfaction may be altered as a consequence of large-scale technology implementations in organizations.

Against this backdrop, our broad objective is to fill this gap in the literature by taking an integrative and holistic view of an ERP system implementation and its impacts. Building on the JCM, we develop a model that proposes a moderating effect of ERP system implementation on the relationship between job characteristics and job satisfaction (e.g., Staw and Cohen-Charash 2005). This model of job satisfaction advances prior research in a few important ways. First, we challenge two central, traditional assumptions of most prior job satisfaction research. One point of contention is that, in ERP system implementations, the relationships between various job characteristics and job satisfaction are *not* as stable as traditional, cross-sectional models, such as the JCM, tend to imply. Instead, our model suggests that some of the job characteristics will influence job satisfaction differently following an ERP system implementation. Another point of contention is that a purely cross-sectional view of job satisfaction is insufficient to gain a complete understanding of job satisfaction in times of ERP-initiated change. Although cross-sectional models of job satisfaction are certainly useful as a starting point, some IS researchers have noted that they do not provide a complete or accurate understanding of job satisfaction in times of organizational change (e.g., Igbaria and Greenhaus 1992). Second, this research will contribute to the literature on technology implementation in general and ERP system implementation in particular. This work will also contribute to the vast body of research on JCM by contextualizing it to the shakedown phase of an ERP system implementation. Although the change literature is rich at the macro (e.g., organizational) level, research on technology-based organizational change initiatives at the individual level is limited and this work will further our understanding of the specific context of ERP system implementation on employees. Finally, by bringing together IS research on ERP systems and organizational behavior research on job characteristics, this work provides a multidisciplinary and holistic understanding of both ERP system implementations and organizational change.

Theory

In this section, we begin with the definitions of constructs and then present our research model and the justification for our hypotheses.

Construct Definitions

The three core sets of constructs in our model are ERP system implementation, job characteristics, and job satisfaction. *ERP system implementation* captures the organizational adoption of a firm-wide enterprise system and represents the pre- versus post-implementation phases. *Job characteristics* are drawn from JCM (Hackman and Oldham 1980) and comprise the following five constructs: *task significance*, defined as the extent to which a job has impact on the lives of people in an organization or society in general; *task identity*, defined as the extent to which a job involves completing a whole identifiable outcome; *skill variety*, defined as the extent to which a job requires the use of different talents; *autonomy*, defined as the extent to which a job provides the employee with discretion to choose how the work is done and to set the schedule for completing the work activities; and *feedback*, defined as the extent to which carrying out the work activities provides the employee with clear information about his or her performance. *Job satisfaction* is defined as the extent of positive emotional response to the job resulting from an employee's appraisal of the job as fulfilling or congruent with the individual's values (see Janssen 2001).

Model Development

Background and Description of the Model

Figure 1 presents the research model. Consistent with the approach of Ang and Slaughter (2001), we draw from Hackman and Oldham's (1980) JCM. Our model extends JCM by suggesting that the ERP system implementation moderates the relationships between job characteristics and job satisfaction.

The notion that job characteristics have an important influence on job satisfaction or other job outcomes is well established in management and IS research (e.g., Ang and Slaughter 2001; Igbaria and Guimaraes 1993; Igbaria et al. 1994; Goldstein 1989; Thatcher et al. 2002; Wong et al. 1998). However, given that the deployment of new technology represents one of the most significant organizational change events in today's firms (Herold et al. 2007; Jarvenpaa and Stoddard 1998) and, likewise, because ERP systems can have such a profound impact on the nature of an individual employee's work (e.g., Devadoss and Pan 2007), we contend that the implementation of an ERP system will interact with job characteristics to influence job satisfaction.

While studies examining only simple relationships (e.g., the direct influence of job characteristics on job satisfaction) are appealing for their parsimony, they are potentially problem-

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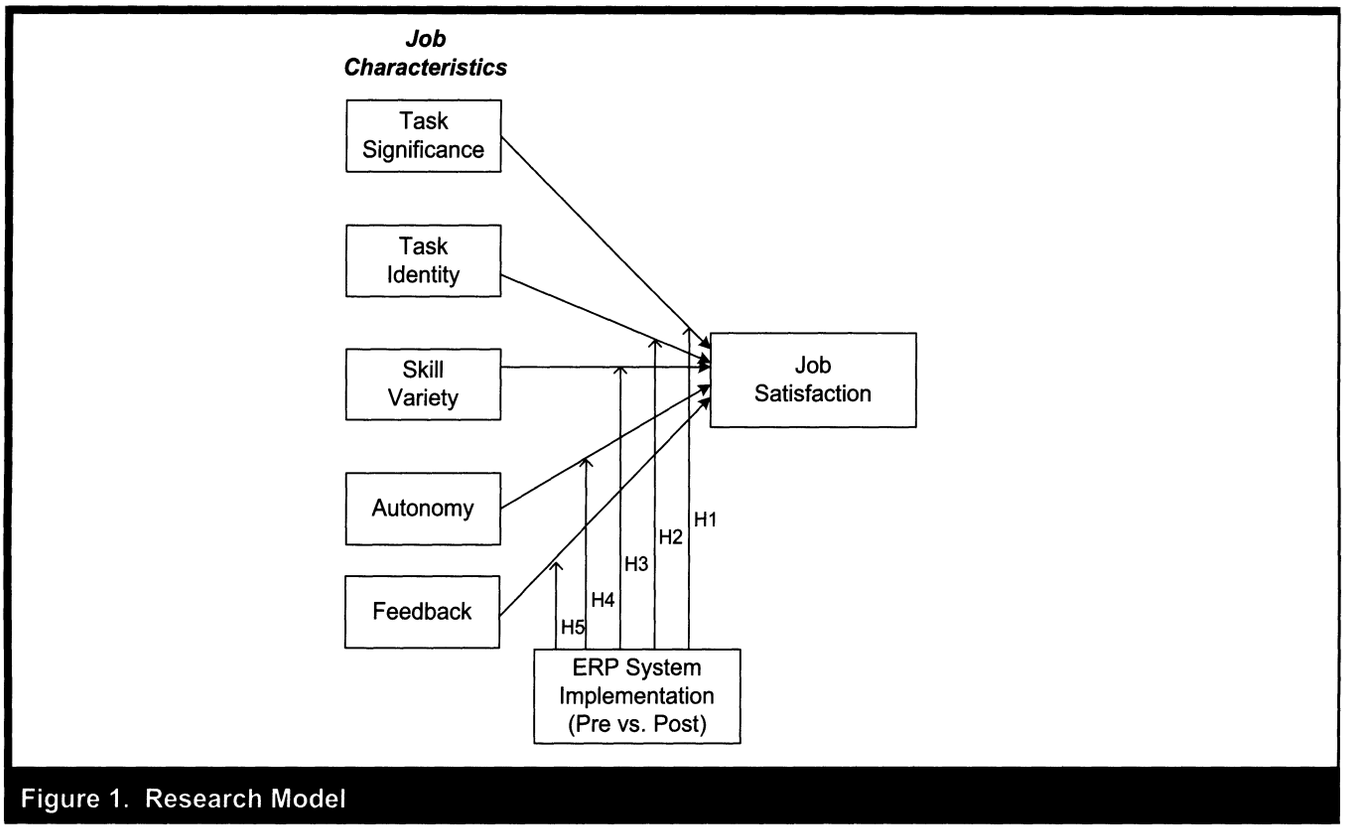

Figure 1. Research Model

atic as they can mask deeper, more complex forces that are at work (Johns 2006; Singh 1998). Given that an ERP system implementation has a dramatic impact on work flow and employees' jobs (e.g., Kraemmerand et al. 2003; Peppard and Ward 2005), it is possible that the changes brought about by an ERP system implementation may have a dynamic relationship with what was previously believed to be a static influence on job satisfaction.

Consistent with the JCM, we believe the job characteristics-job satisfaction relationship will be positive before an ERP system implementation. However, in contrast to JCM's basic tenets, we make the case that the different job characteristics will not have a direct positive influence following ERP implementation—in other words, we believe that the job satisfaction relationships will all be moderated. Such a view is not entirely unprecedented because prior IS research has suggested, or empirically demonstrated, that the relationship between job characteristics and job satisfaction may not be as stable as once thought (Goldstein 1989; Igbaria et al. 1994; Thatcher et al. 2002). However, we are not aware of any studies that have looked at this systematically in the context of an ERP system implementation.

From a theoretical perspective, prior to an ERP system implementation, we expect each of the job characteristics to have a positive influence on job satisfaction, as predicted by the JCM. The JCM has served as an important theoretical basis for research on job design, redesign, and enrichment and the accumulated knowledge suggests that job (re)design strategies should focus on influencing key job characteristics because of their positive influence on job outcomes. For example, Ilgen and Hollenbeck (1991) argued that favorable perceptions of job characteristics can lead to positive motivations that, in turn, can lead to increased job satisfaction (see also Champoux 1978; Fried and Ferris 1987; Singh 1998; Singh et al. 1994; Tyagi and Wotruba 1993).

Other theoretical perspectives, such as sociotechnical systems theory, have also suggested that job (re)design initiatives can favorably influence job outcomes (Campion and McClelland 1993; Parker and Wall 1998). Summarizing this view, most empirical and meta-analytic evidence on the JCM suggests that there is a strong linear relationship between an employee's perceptions of various job characteristics and job outcomes such that more favorable perceptions of any particular job characteristic will lead to favorable outcomes, such

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as increased job satisfaction (Farias and Varma 2000; Fried and Ferris 1987; Griffeth 1985; Hackman and Lawler 1971; Ilgen and Hollenbeck 1991; Judge et al. 1997; Mathieu et al. 1993). Thus, prior to an ERP system implementation, we believe that the prevailing wisdom embodied in the JCM will hold such that higher levels of each job characteristic will lead to higher levels of job satisfaction.

As indicated in our research model (see Figure 1), in situations of job change, the IS literature suggests that significant changes in job contexts, such as those imposed by ERP systems or other significant organizational change mechanisms, have the potential to alter the relative influence of job characteristics on job satisfaction (Ang and Slaughter 2001; Boudreau and Robey 2005; Igbaria et al. 1994; Orlikowski 1993). Such a view is echoed in the job challenge literature, which suggests that job redesign resulting from significant organizational changes may create overwhelming challenges for some employees leading to lower job satisfaction (Cavanaugh et al. 2000; Champoux 1992; Singh 1998; van der Velde and Feij 1995; Xie and Johns 1995).

Building on expectation disconfirmation theory, recent models in the IS literature have demonstrated that initial beliefs change with experience and involvement (Bhattacherjee and Premkumar 2004; Igbaria et al. 1994). Furthermore, consistent with adaptation level theory (Helson 1964), employees are likely to process new job demands and the technology experiences associated with them different from how they may have originally perceived the job (i.e., pre-ERP system in this context). Specifically, where our model departs from the predictions of the JCM following an ERP system implementation context is with the JCM hypotheses that each of the job characteristics will positively influence job satisfaction. We believe the *opposite* will be true *following* an ERP system implementation as employees adapt to the new system and embedded processes that characterize the shakedown phase (Peppard and Ward 2005).

Hypotheses Development

In theorizing about how an ERP system implementation will alter the relationship between how work (tasks) are perceived and job satisfaction, we reiterate that the system often drastically alters employees' jobs. It is, therefore, only logical to assume that the incorporation of technology and its embedded work flows will change the status quo for how employees perceive their jobs and, thus, how satisfied they are with the work itself. The section that follows builds each of the individual hypotheses for how ERP system implementation moderates each of the relationships between each of the job characteristics and job satisfaction.

Two of the job characteristics, task significance and task identity, speak specifically to the nature of the work and the day-to-day tasks that employees do as part of their overall job. As previously independent tasks become more interdependent (Gattiker and Goodhue 2005) and more elements of the job are off-loaded to the system, the ERP system implementation is likely to be perceived as stripping out the significance and variety of an employee's work that was inherent in the (old) job. Likewise, given that the knowledge of the workflow and business processes tends to be held by employees,[2] each is likely to have at least a basic understanding of the identity of their tasks prior to ERP system implementation (Martin and Huq 2007). However, as business processes within the organization become more tightly coupled and interconnected, the end-to-end nature of the task is likely to become less apparent to any single employee and, therefore, the relationship between task identity and satisfaction is likely to be attenuated following an ERP system implementation (Gattiker and Goodhue 2005; Martin and Huq 2007). More specifically, as some tasks or even entire jobs are subsumed by the ERP system, employees may feel that their jobs are somehow less important and may feel less empowered to "make a difference" compared to their pre-ERP system jobs. Such feelings of personal significance may be reduced, particularly given the level of investment that organizations are typically required to make in the ERP system itself and for its follow-on support needs. Some have even suggested that as the ERP system imposes its own logic on how work is performed during the shakedown phase, the system itself will be perceived as an important "actor" within the organizational environment (Kraemmerand et al. 2003). In these cases, employees may feel that the organization values the ERP system as the key enabler of business processes more than the individual ingenuity and creativity of employees themselves in completing their jobs.

While we believe that task significance and task identity will have a positive influence on job satisfaction (i.e., job satisfaction will move in the same direction as both job characteristics) prior to the implementation of an ERP implementation, for the reasons outlined above, we believe that ERP system implementation will interact with employee's perceptions of the job to negatively moderate the relationship with job satisfaction. Therefore, we hypothesize

[2]Even the term *knowledge worker* implies that the business process know-how is held by the employee him/herself.

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H1: The effect of task significance on job satisfaction will be moderated such that the relationship is more negative following ERP system implementation.

H2: The effect of task identity on job satisfaction will be moderated such that the relationship is more negative following ERP system implementation.

Given the complexity of modern ERP systems, simply having to learn to use the new technology itself can be frustrating (Boudreau and Robey 2005). Moreover, consistent with results for other broad-reaching types of systems employed in organizations, the new ERP system is likely to require new skills and competencies and, as a result, employees may resent having to learn the new software, acquire new technical skills, and adapt to the new business processes enforced by the system (see Alvarez 2008; Hakkinen and Hilmola 2007; Nah and Delgado 2006; Orlikowski 1991). Such employees may also feel overwhelmed by the adjustments required due to the increase in information available in a new ERP system and the complexity associated with accessing and manipulating that data. These challenges will be particularly pronounced in the shakedown phase when employees are still adapting to the new technical skills and work processes associated with their technologically redesigned job (Devadoss and Pan 2007; Kraemmerand et al. 2003). As a result, those knowledge workers may experience job stress associated with the new task demands (variety) causing their job satisfaction to be low (e.g., Burke 2001; Konradt et al. 2003; LaRocco et al. 1980; Singh et al. 1996; Xie and Johns 1995). Such reactions to technology-enforced job changes are common in the IS literature (e.g., Orlikowski 1991, 1993), although they have not been systematically studied longitudinally over the course of a large-scale ERP system implementation. Although learning the new system typically requires additional technical skills, the fact that most, if not all, of the management of embedded processes and workflow is monitored and/or controlled by an ERP system suggests that many of the ad hoc, creative, or higher-order managerial techniques required to manage tasks and processes in the old system will be suppressed (Alvarez 2008). This development implies that the relationship between skill variety and job satisfaction will be moderated by the implementation of an ERP system.

Similarly, as organizations implement technology in order to try to push decision-making responsibility and monitoring to lower levels in the organization (Sauer and Yetton 1997), many employees—particularly those who are uncomfortable with technology or who are accustomed to more "traditional" or personalized oversight methods from senior managers—may not be comfortable with changes in autonomy resulting from the redesigned job. Such feelings are echoed by users in the study conducted by Boudreau and Robey (2005): "right now I'm so frustrated with [the system]. Like yesterday, I was feeling stupid, inept, inadequate—all of those things! And you know how that makes you feel about your job, you just want to go home and quit" (p. 10). Employees accustomed to a given level of autonomy (and who may have been attracted to the job due to its level of autonomy) may find changes in autonomy brought about by the system threatening (Alvarez 2008), leading to attendant changes in job satisfaction. Thus, similar to the logic for changes in task identity, we believe ERP system implementation will moderate the relationship between autonomy and job satisfaction.

Feedback is also a common concern with new automated systems, particularly given that most leading ERP systems routinely collect automated data about employee performance and report it to managers using standard metrics (time on task, cycle time, number of orders processed, etc.). Given that most employees express frustration with electronic monitoring and its associated feedback (Chalykoff and Kochan 1989; George 1996), employees are likely to have concerns about the pervasive feedback embedded in modern ERP systems following implementation, especially when the monitoring is new to them as would be the case in the shakedown phase. As monitoring and measurements collected by the ERP system increase, employees may find that the *nature* of the feedback they receive changes (e.g., moving away from personal oversight by managers to system-based feedback). Similar to the logic for skill variety and autonomy, we believe that the changing nature of the feedback during the shakedown phase will contribute to feedback having a negative effect on job satisfaction. In sum, the nature of the relationship between feedback and job satisfaction is likely to be changed following an ERP system implementation. Given that ERP systems have a profound impact not only on the skills required by employees to understand and work with the system, but also on the nature of the work and its associated business processes, we hypothesize

H3: The effect of skill variety on job satisfaction will be moderated such that the relationship is more negative following ERP system implementation.

H4: The effect of autonomy on job satisfaction will be moderated such that the relationship is more negative following ERP system implementation.

H5: The effect of feedback on job satisfaction will be moderated such that the relationship is more negative following ERP system implementation.

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Method

The study was conducted over a one-year period in a telecommunications firm. Data were gathered four months before the implementation of an organization-wide ERP system to provide the pre-implementation baseline and eight months after the implementation to capture employee reactions in the shakedown phase. The researchers had no direct role in the ERP system implementation, but rather were passive observers throughout the process. The organization set the time frames for the implementation and training, and limited the data collection opportunities to specified points in time during the implementation. However, this did not compromise the scientific goals of the study and was consistent with how we wanted to collect the data. In this section, we provide details about the participants, technology, measurement, and procedure.

Participants

The participants were employees of a medium-sized firm in the telecommunications industry. The sampling frame was the list of 3,402 potential users of the new ERP system. We received 2,794 usable responses across all points of measurement, resulting in an effective response rate of just over 82 percent. Our sample comprised 898 women (32 percent). The average age of the participants was 34.7, with a standard deviation of 6.9. All levels of the organizational hierarchy were adequately represented in the sample and were in proportion to the sampling frame.

While ideally we would have wanted all potential participants to provide responses in all waves of the data collection, this was particularly difficult given that the study duration was 12 months and had multiple points of measurement. Thus, the final sample of 2,794 was determined after excluding those who did not respond despite follow-ups, those who had left the organization, those who provided incomplete responses, or who did not choose to participate for other reasons. Yet, we note that the response rate was quite high for a longitudinal field study; this was, in large part, due to the strong organizational support for the survey and the employees' desire to provide reactions and feedback to the new system. Although we did not have any data from the nonrespondents, we found that the percentage of women, average age, and percentages of employees in various organizational levels in the sample were consistent with those in the sampling frame. Employees were told that they would be surveyed periodically for a year in order to help manage the new ERP system implementation. Employees were told that the data would also be used as part of a research study and were promised confidentiality, which was strictly maintained.

ERP System Description, Implementation, and Deployment

The ERP system introduced was from a market-leading vendor and was deployed in all departments (functional areas) in the organization. Due to rapid growth, the organization had determined that its aging, fragmented systems had become increasingly inefficient. They, therefore, made the decision to replace them with an integrative ERP system, including new hardware and software platforms, to provide short-term benefits and long-term opportunities, such as providing scalability for future growth. Such ERP systems typically cost millions of dollars (depending on the configuration) and are designed to centrally integrate all functions of the business to increase effectiveness and efficiency. Here, the organization used a deployment strategy such that the old systems remained available even after the ERP system implementation. Such access to the old systems was designed to facilitate a smooth transition to the ERP system and obtain employee buy-in over the course of several months. The ERP system was new to the organization and none of the employees possessed any prior knowledge of the system. The development and implementation process was led by a consulting firm and lasted a year, with the last six months of the effort being almost entirely at the participating firm's site, and the process included interviews of members of the management and employees in various organizational units. Further, members of various stakeholder units were involved in providing feedback on the system as the design evolved.

Measurement

ERP system implementation was a dummy variable coded "0" for pre-implementation and "1" for post-implementation. The dummy variable allowed us to examine the moderating effect of ERP system implementation on relationships between each of the job characteristics and job satisfaction (see Woolridge 2006). *Job characteristics* were measured using a version of the 15-item Job Diagnostic Survey (JDS; Hackman and Oldham 1974). We used a version of the JDS that was modified to remove the reverse-coded items, as there is some empirical evidence to suggest that replacing the reverse-coded items with positive items is better from the perspective of reliability and validity (e.g., Idaszak and Drasgow 1987). Job satisfaction was measured using a three-item scale adapted from Janssen 2001). The measures for all job characteristics and job satisfaction are provided in the Appendix. *Gender*, *age*, *organizational tenure, organizational position*, and *job type* are important control variables given their impact on several key constructs related to technology adoption and job outcomes (Lefkowitz 1994; Morris and Venkatesh 2000;

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Venkatesh and Morris 2000; Venkatesh, Morris, and Ackerman 2000). Gender, age, and organizational tenure were measured using single-item scales. Organizational position was coded as an ordinal variable based on employee grade/level[3] used by the organization. Job type was coded as clerical, administrative, knowledge worker, and management in keeping with the classification scheme used in the organization. While some employees spanned job types, we asked them to choose the job type based on the dominant set of job activities during a typical work week. We used three dummy variables to code the data, with clerical workers being the reference group (0, 0, 0).

We also measured *perceived job transformation*, defined as the degree to which an individual believes all aspects of their job, including tasks, roles, and orientation, have been altered by the introduction of new technology—here, the ERP system. The purpose of measuring perceived job transformation was as a manipulation check to determine whether the ERP system implementation created a change in jobs. We created four items to measure this construct by following the procedures for scale development recommended in DeVellis (2003).

Procedure

The study was conducted in a telecommunications firm in naturally occurring conditions before, during, and after the organization's ERP system implementation. The training programs were conducted separately for each organizational unit by organization position. A training company worked with the consulting firm that implemented the ERP system to develop the training materials. Several training teams, with three members each, were employed and each training team had a consultant from the technology development firm. The researchers did not have control over the training or its structure. In order to test for potential biases related to training, the data were coded by training team and time of training. No significant mean differences or interactions in the model were found when comparing training groups.

Given the size of the organization and to minimize work disruption, the training was conducted over a two-month period and occurred three to five weeks prior to the implementation of the ERP system module(s) in each business unit. The dates of each employee's training were tracked to ensure timely follow-up. The training occurred at approximately the same time for each group (relative to the implementation date). Bar codes were printed on each survey that allowed specific responses to be tracked over time. Following the training, change management consultants supported the employees for three months. Technical assistance was also available via the central IT support department and the IT support department in each business unit. The pre-implementation measures were collected four months prior to the ERP system implementation and the post-implementation measures were collected eight months after the implementation. The eight month point was chosen because we believe it is likely to represent the reactions near the end of the shakedown phase when employees have had a chance to crystallize their views about the job changes brought about by the ERP system and its embedded business processes, consistent with the theoretical framing for our study.

Results

The first step was to examine the reliability and validity of the different scales. All scales were reliable, with Cronbach alphas greater than or equal to .70. A factor analysis, with direct oblimin rotation to allow for correlated factors, supported a five-factor solution for job characteristics data pooled across the pre- and post-implementation time periods. These results, presented in Table 1, show that all loadings were.71 or higher and all cross-loadings were .28 or lower, thus supporting internal consistency and discriminant validity of the scales. A potential threat to the validity of most surveys is common method bias (Podsakoff et al. 2003). We ran a Harmon's one factor test where the principal component analysis showed the first factor extracted just over 10 percent of the variance, thus reducing concerns about possible common method bias.

The descriptive statistics, reliabilities, and correlations are presented in Table 2. The average scores of the pooled job characteristics were between approximately 3.5 and 4.5, with standard deviations around 1. The average job satisfaction score was a little over 4.6. The various control variables were somewhat correlated with the job characteristics and job satisfaction. Likewise, the job characteristics were somewhat correlated among each other and with job satisfaction. Of course, we should not read too much into the correlations and their implications for our model testing because the correlations are based on the pooled data. We examined the mean and standard deviation associated with the manipulation check variable, perceived job transformation, and found that 8 months after ERP system implementation, the mean was 5.11 and the standard deviation was .94, thus suggesting that employees perceived a substantial change in their job following the implementation.

[3]Employee grade/level data captures finer level detail than traditional organizational position measures. For example, a software engineer could be a grade 6, 7, 8, or 9.

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Table 1. Factor Analysis with Direct Oblimin Rotation

	1	2	3	4	5
Task significance 1	**.71**	.24	.13	.14	.10
Task significance 2	**.74**	.28	.12	.12	.14
Task significance 3	**.80**	.17	.10	.12	.11
Task identity 1	.13	**.73**	.07	.07	.03
Task identity 2	.20	**.79**	.08	.07	.10
Task identity 3	.21	**.71**	.04	.03	.02
Skill variety 1	.08	.07	**.80**	.02	.19
Skill variety 2	.03	.04	**.84**	.05	.12
Skill variety 3	.05	.09	**.85**	.02	.11
Autonomy 1	.22	.24	.04	**.79**	.23
Autonomy 2	.23	.28	.13	**.71**	.21
Autonomy 3	.20	.21	.20	**.73**	.24
Feedback 1	.02	.02	.07	.21	**.75**
Feedback 2	.04	.03	.04	.24	**.71**
Feedback 3	.01	.02	.05	.28	.73

Table 2. Descriptive Statistics, Reliabilities, and Correlations

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender (1 = men)	0.68	0.47	NA												
2. Age	34.71	6.93	.14*	NA											
3. Org position	NA	NA	–.23**	.40***	NA										
4. Org tenure	9.94	5.66	.23***	.22***	.24***	NA									
5. Admin (1) v. other	0.25	0.44	–.17**	.16**	–.27***	.25***	NA								
6. Kdge wrkr (1) v. others	0.53	0.50	.23***	–.18**	.08	.09	.09	NA							
7. Mgmt (1) v. others	0.22	0.42	.30***	.33	.29***	.29***	.10	.03	NA						
8. Task significance	3.95	1.24	.17*	.22**	.21**	.17*	.05	.08	.14*	.79					
9. Task identity	3.86	1.08	.16*	.16*	.20**	.16*	–.01	.11*	.10	.14*	.76				
10. Skill variety	4.12	1.10	.17*	.15*	.18**	.17*	.02	.11*	.14*	.10	–.04	.75			
11. Autonomy	3.54	1.13	.19**	.19**	.23**	.19**	–.15*	.15*	.13*	.13*	.12*	.13*	.71		
12. Feedback	4.49	1.31	.20**	.20**	.04	.07	–.07	.12*	–.11*	.08	–.07	–.10	–.16*	.71	
13. Job satisfaction	4.67	0.95	.22**	.21**	.20**	.17*	.06	.07	.10	.24***	.28***	–.07	–.08	–.05	.75

Notes: 1. Diagonal elements are Cronbach alphas.
2. NA: Not applicable; *p < .05; **p < .01; ***p < .001.

Given our repeated measures design, we used a generalized estimating equations (GEE) method (Liang and Zeger 1986; Zeger and Liang 1986; Zeger et al. 1988) to test our model. GEE is appropriate because it accounts for the correlation of responses within measures from the same subjects over time, thus reducing the potential for inefficient and biased regression estimates (Ballinger 2004). GEEs can be used to test main effects, interactions, and categorical and continuous independent variables (Ballinger 2004). Although GEE models are somewhat robust to misspecification of the correlation structure of the dependent variable, such misspecifications can result in inefficient estimates. Therefore, we specified an unstructured correlation model (Fitzmaurice et al. 1993) where observations across time are allowed to freely

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correlate within subjects. Such an approach is consistent with Ballinger (2004) who suggests that this is the optimal correlation modeling structure because it is the least restrictive in terms of modeling the true within-subject correlation structure and there is no reason to expect within-subject correlations to decrease over time when individuals are performing the same behavior over time. The other important assumption of the GEE estimation approach is the distribution of the dependent variable, which we noted was normally distributed (per Ballinger). We mean-centered the variables in the model before computing the interaction terms to reduce multicollinearity (Aiken and West 1991).

With job satisfaction as a dependent variable, we pooled the pre- and post-implementation data that resulted in two records per individual. The ERP system implementation dummy variable was used to test for moderation—here, the change in the pattern of relationships between job characteristics and job satisfaction before and after implementation. The variance inflation factors (VIFs) in our various model tests were less than 5—well below the threshold of 10 (Aiken and West 1991), suggesting that multicollinearity is not a concern.

Table 3 shows the results related to the prediction of job satisfaction using the pooled data set (i.e., pre- and post-implementation data). Most of the hypotheses were supported; however, contrary to our expectations that all of the job characteristics would be moderated by ERP system implementation, two job characteristics—namely, task significance and task identity (H1, H2)—did not have a significant interaction effect. The effects of the other three characteristics—namely, skill variety, autonomy, and feedback—were moderated as evidenced by significant interaction terms, thus supporting H3 through H5. In order to understand the pattern of interactions, we plotted the effects at the two different levels of ERP system implementation (pre and post) and found that the effects of skill variety, autonomy, and feedback on job satisfaction were positive before implementation and negative after implementation. The moderated model explained 47 percent of the variance in job satisfaction, an increase of 16 percent over the main effects-only model and an increase of 30 percent over the control variables model.

Discussion

Many have cited the need for greater interaction between technology and organization research (e.g., Orlikowski and Barley 2001). To that end, we developed and tested a model of how and why an ERP system implementation affects the relationship between employees' job characteristics and their job satisfaction. We theorized that the relationships between the five job characteristics in JCM and job satisfaction would be moderated by ERP system implementation. Our year-long study of employees in an organization indicates that, in addition to being a challenging technological endeavor, ERP system implementation moderated the effects of skill variety, autonomy and feedback on job satisfaction. In contrast, task identity and task significance had direct, positive effects on job satisfaction and these effects were not moderated. Perhaps the most significant contribution of the current work is the integration of key job-related constructs into a comprehensive nomological network around ERP system implementation.

In highlighting the dynamic and complex influences of a new ERP system implementation on perceptions of job characteristics and job satisfaction, this research helps extend current theoretical perspectives associated with technology adoption and use. It responds to calls in the research literature for theoretical frameworks and research examining ERP system implementations (e.g., Devadoss and Pan 2007) and assimilation in organizations, particularly during the challenging shakedown phase (Gattiker and Goodhue 2005; Hakkinen and Hilmola 2008; Liang et al. 2007). The current work is responsive to suggestions that researchers begin to move beyond focusing on *technology-centric variables* as the end in itself and puts a spotlight on the downstream *consequences* of technology implementations (Venkatesh 2006; Venkatesh, Davis, and Morris 2007).

Theoretical Implications

This research builds on a long tradition of management theory that has examined the relationship between job characteristics and job satisfaction, and extends work in the management and IS literatures that recommends analyzing job characteristics at a more granular level (e.g., Griffin et al. 1980; Igbaria et al. 1994; Thatcher et al. 2002) and that calls for a more central role for the context of change in theory development (Johns 2006; Orlikowski and Iacono 2001). Perhaps the biggest "takeaway" from the study is that any firm conclusions about all job characteristics (and thus, by extension, the JCM itself) in this context apply only in a steady state prior to an ERP system implementation. Once such a system is implemented, the relationship between three job characteristics—namely, skill variety, autonomy, and feedback—and job satisfaction is moderated (as indicated in Table 3), as expected (see H3 through H5). Identifying the breakdown of existing theories and changes to the fundamental nature of relationships in established theories in important contexts is viewed as the frontier for new theory development (see Alvesson and Karreman 2007; Johns 2006).

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Table 3. Predicting Job Satisfaction

	Control Variables	Main Effects	Moderated Model
R^2	.17	.31	.47
ΔR^2		.14	.16
Gender	.16**	.02	.14**
Age	.14**	.05	.11*
Organization position	.12**	.03	.12*
Organization tenure	.12**	.03	.02
Administration (1) vs. others	–.13**	–.02	.01
Knowledge worker (1) vs. others	.02	.02	.02
Management (1) vs. others	.11*	.04	.03
Task significance		.14**	.14*
Task identity		.21***	.17**
Skill variety		.09	.04
Autonomy		.04	.04
Feedback		.06	.02
ERP (0: Pre-implementation; 1: Post-implementation)		–.23***	–.13*
Task significance × ERP			.02
Task identity × ERP			.01
Skill variety × ERP			–.22***
Autonomy × ERP			–.25***
Feedback × ERP			–.25***

Notes: 1. *p < .05; **p < .01; ***p < .001.
2. All ΔR^2 were signfiicant.

Interestingly, not all of the relationships between job characteristics and job satisfaction changed. In contrast to the results for skill variety, autonomy, and feedback, the relationships between task significance and task identity and job satisfaction were not moderated by ERP system implementation. Thus, based on our results, it appears that task significance and task identity are always likely to have a positive influence on job satisfaction, consistent with the primary tenets of JCM (Ilgen and Hollenbeck 1991; Judge et al. 1997). Although we hypothesized that the relationships would be moderated (becoming more negative following ERP implementation), in hindsight, given that task significance is defined as the impact the job has on the lives of people, it is perhaps not surprising that task significance would ever have a detrimental influence on job satisfaction following ERP system implementation. This notion is consistent with studies in the IS literature demonstrating task significance as one of the strongest positive predictors of job satisfaction (Thatcher et al. 2002). Similarly, because task identity is conceptualized as the degree to which a job involves completing a whole outcome, it is also perhaps difficult to conceptualize a job where an increase in the ability to see the task/job in its entirety from beginning to end (as may be enabled by increased views and reporting of the workflow associated with a given task in ERP systems) would not retain a strong positive relationship with job satisfaction. In sum, our results and post hoc analysis suggest that two of the job characteristics, namely, task significance and task identity, have a stable positive relationship with job satisfaction both before and after ERP system implementation, consistent with predictions of the job characteristics model; however, the relationship of three characteristics (skill variety, autonomy, and feedback) and job satisfaction are not stable and, instead, are moderated by ERP system implementation. Based on our findings, Figure 2 presents our revised model of ERP system implementation, job characteristics, and job satisfaction.

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To add additional richness to our analysis, follow-up interviews provided illustrative examples of ways in which specific employees were affected by the change. One purchasing manager, who under the old system had substantial leeway in finding and negotiating vendor agreements, had his freedom significantly altered as the system automated the selection process. For example, overrides of system decisions were very cumbersome and were only approved on an exception basis in the new business process. While the manager understood the benefits of the new system, he found the change to his autonomy jarring and, at times, difficult to accept. In addition, employees in the research and development unit found that, in the new system, they had access to vast arrays of data, technical reports, ongoing projects, contracts, etc. This gave them much greater visibility into projects in other parts of the organization but, at the same time, created an element of "information overload" for some employees. As one employee put it, "In the old system, ignorance was bliss…but, now I don't have that anymore. With the shared workspace, I am responsible for knowing what others are doing."

Illustrating the important role that ERP system implementation plays in the general applicability of the JCM in a post-ERP implementation environment, we take one job characteristic, skill variety, as an interesting case in point. The classic JCM literature would have a difficult time accepting or interpreting the negative interaction term for skill variety × ERP system implementation on job satisfaction. Yet, in this context, the results suggest that the demands associated with learning the new skills required following ERP system implementation had a detrimental influence on job satisfaction, a finding that is likely to resonate with IS professionals who have actually had to implement such systems.

From a theoretical perspective, these results are important because they suggest that job characteristics and their influence on job satisfaction are not as static as suggested in previous research, particularly following an ERP system implementation. Our results suggest that new technology implementations, particularly ERP systems, represent an important boundary condition for the traditional predictions of the JCM. Although the approach employed in this study has not been previously used to examine the effects of technology implementation on jobs, our results are consistent with some suggestions in the social science literature and prior IS research indicating that satisfaction ratings are both dynamic and multidimensional (Hsee and Abelson 1991; Igbaria et al. 1994). Extrapolating from those results to a broader theoretical perspective, our results suggest that stress and/or routinization may be important mechanisms at work as jobs are redesigned based on processes embedded in the ERP system and can potentially become more compartmentalized or fragmented. Such a view appears consistent with observations for similar implementations documented by both Alvarez (2008) and Boudreau and Robey (2005), indicating many users of an ERP system experienced a loss of control and changes in role identity in the months following implementation of large enterprise systems. Because our research provides additional insights into this phenomenon by examining the five job characteristics at a more granular level, we hope that it spurs further research to investigate the underlying psychological mechanisms that may be at work about which we can only speculate.

Limitations and Suggestions for Future Research

We believe that this work represents just a first step in research on large-scale system implementation and job design. Clearly, there are many unanswered questions and we hope our research spurs further debate and theorizing that builds on the model and results reported here. For instance, there are many models that explain job satisfaction and it is important to determine which model is best suited in various situations. Of particular interest to IS researchers is the fact that none of the existing models include any technology-related constructs. It is possible that certain models, such as the dynamic model presented in the current work, may be more appropriate for ERP system implementations and/or other major organizational change activities, while more static models that are common in much of the prior IS and management literature may be more appropriate in a stable organizational environment.

While this work focuses on job characteristics and job redesign, future research should explore established determinants of technology use and other outcomes associated with job characteristics. Further, research shows that the some of the predictor variables in this work (i.e., job characteristics) may have a complex, nonlinear effect on different outcomes of interest. For example, Xie and Johns (1995) found a nonlinear (U-shaped) relationship between an additive index of the different job characteristics and stress. Such a perspective builds on Selye's (1956) seminal work positing stress as the driver of an inverted-U performance curve such that low and high levels of stress are often dysfunctional but between the two (high and low stress) is an "optimal" level of stress that serves as an energizing force that can yield positive outcomes. Future research could explore the influence of stress on job satisfaction or other outcomes, particularly as it is induced by technological change in the workplace. Performance outcomes should also be studied because they may help researchers relate technology use and job-related constructs to performance at the individual level.

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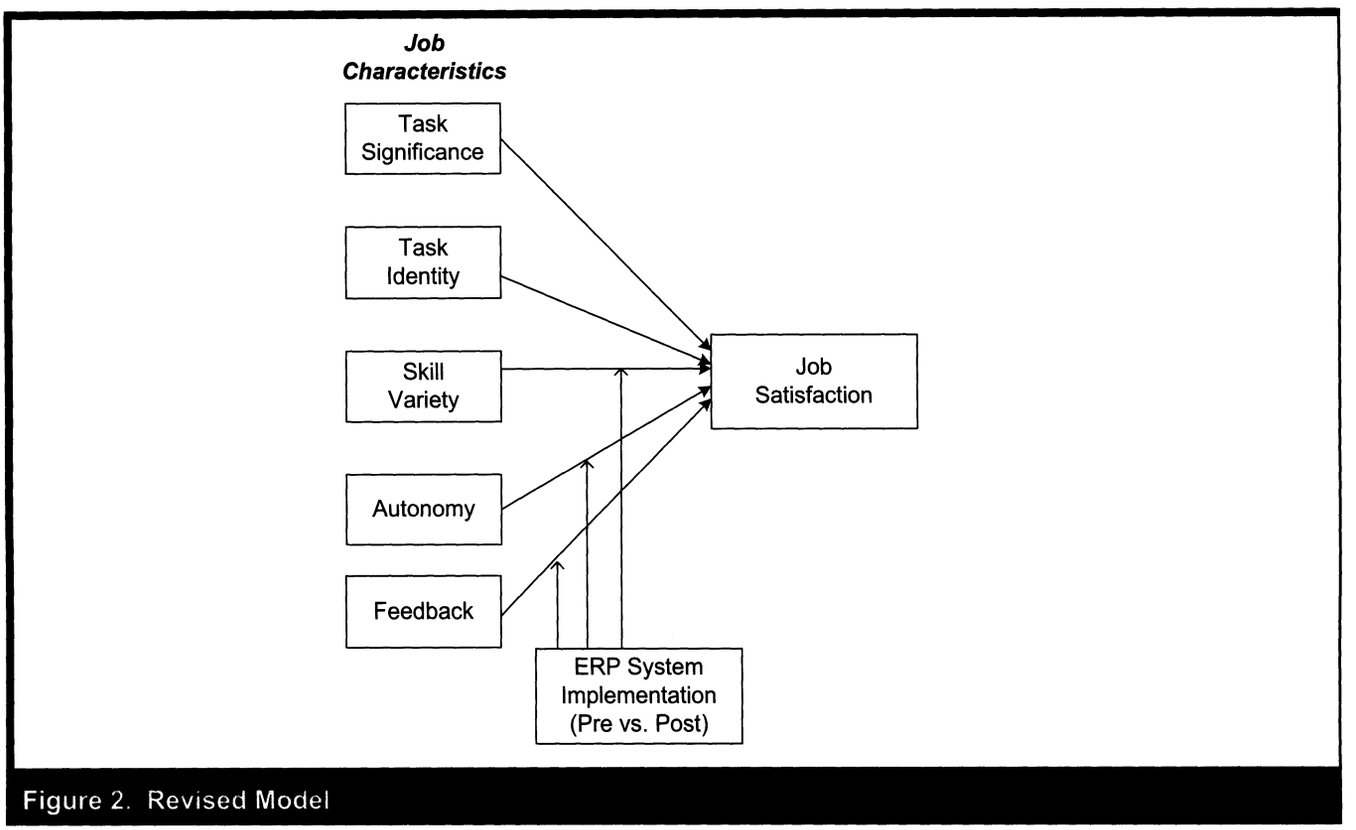

Figure 2. Revised Model

It is important to acknowledge some of the limitations of the current work so one can appropriately interpret the findings and delineate additional future research directions. Obviously, despite the large sample size, this research represents the experience of a single organization going through a large-scale ERP system implementation. The study was conducted in an organization in the telecommunications industry during the implementation of an ERP system and, thus, the extent to which this particular ERP system implementation will generalize to other organizations, other ERP systems/technologies, or other organizational change initiatives is uncertain and should be studied. Furthermore, the findings from our study provide insights to the shakedown phase of ERP system implementation, when individual and organizational adaptations to the new system are most in flux. Care should be taken in generalizing the findings beyond this context and future research is needed to further identify the degree to which these effects on job characteristics and job satisfaction persist beyond the shakedown phase.

In addition, a modest limitation to this work is that the training content varied across business units as a function of the ERP modules being implemented. However, this is also typical of virtually any ERP system implementation of any size and, thus, is not an artificial constraint in this work. Finally, while it is possible that having access to the old system for a limited time may have had some influence on employees' perceptions of the new system, we believe our results are likely a more conservative representation of the more extreme perceptions that might emerge if access to the old system was completely cut off when the new ERP system was implemented. Moreover, the parallel implementation method is a common strategy for deploying new systems of this magnitude.

The current work uses a fairly simple conceptualization of an individual in terms of gender, age and organizational position. Given that our focus was not on individual characteristics *per se*, we included some simple variables as controls. Future research should include additional variables including personality differences (e.g., receptivity to change) or technology perceptions to help researchers gain a deeper understanding and achieve more actionable guidance for organizations implementing new ERP systems. For instance, we attributed the observed changes to the new software and business processes introduced but did not directly model or measure any such characteristics. Understanding various technology characteristics and business process characteristics and their impacts on job characteristics and/or job outcomes will be important to further extend the model presented here.

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Practical Implications

It is clear that the moderating effects of the ERP system implementation on job satisfaction carry important implications for managers. For example, it is interesting to note that the challenges felt at the individual level (as evidenced by the negative interaction between many job characteristics and ERP system implementation) are indicative of the challenges IT managers and CIOs have observed in realizing a short-term return on investment from ERP systems in the first year following implementation (Davenport 2000). Recent research suggests that organizational benefits become more prominent in the second and third years following implementation (Gattiker and Goodhue 2005). Our findings at the individual employee level may partially explain the lag in productivity, efficiency, and other financial benefits that many organizations experience when implementing ERP systems. Our results also suggest that the time needed for employees to adapt to the software and embedded business processes that comprise the ERP solution may be substantial. Clearly, the sooner managers can put organizational mechanisms, such as training and reward systems, in place to help the organization and employees navigate the shakedown phase quickly, the sooner employees, teams, and the organization as a whole are likely to realize the potential benefits that ERP systems offer.

It is also important *not* to jump to the conclusion that a company should avoid implementing an ERP system because employees may be dissatisfied. Our data do not imply this and therefore should not be misinterpreted. Rather, our research highlights the fact that there are many different stakeholders with different agendas and criteria for judging whether an ERP system implementation is appropriate or successful in the organization. There are well-documented benefits, including organizational efficiencies, data integration, increased interdependence among work units, and consistent reporting (Gattiker and Goodhue 2005) for why organizations might adopt an ERP system. Our research focuses only on one element of success—how employees' perceptions of their job and ERP system implementation interact to influence job satisfaction—and calls on organizations to manage this issue proactively in order to reap the broader benefits associated with the implementation of ERP systems.

There are a number of important job design and change management implications as well. For example, with older technologies, common wisdom suggested that one should redesign business processes and then choose the technology accordingly so it aligns with business processes. In marked contrast, today's large, integrated ERP systems offer the potential to reverse this prescribed logic. In other words, ERP systems *require* implementing new business processes that are a *de facto part of* the technology-based ERP solution. For instance, from an organizational perspective, Cisco's well-known ERP system implementation involved, in effect, the employment of a new set of applications and "best practice" *business processes* provided by the technology vendor (Cisco 2005; Koch 2000). This implies that existing business processes must often be redesigned to fit those embedded within the chosen ERP solution itself. As a result, technology professionals and business managers must work hand-in-hand when assessing job redesign strategies that might be driven by technology. Certainly, in some cases, this is likely to have a beneficial effect; however, common arguments about ERP systems "empowering" workers must be considered carefully. Our findings suggest that managers should work first to help understand the impacts that such systems and their embedded work processes have on employees' jobs.

Practitioners should pay particular attention to the impact that the ERP system implementation itself can have on job satisfaction beyond the standard predictors used in human resources research and practice, especially because technological factors play such a crucial role in today's jobs and will continue to do so for the foreseeable future. By examining the effects of an ERP system implementation on job satisfaction, our results should signal to managers that the anticipated efficiency and effectiveness gains through major ERP system-driven transformations that are relevant and perhaps of primary importance to many organizational stakeholders (e.g., managers and stockholders) may come with a price of lower job satisfaction for some organizational employees if implementation is not managed carefully.

Conclusions

The process of implementing new ERP systems in organizations is complex. While often hailed as a way to make employees more effective and efficient in their jobs, this research illustrated a contingent relationship between the implementation of an ERP system and well-established theoretical linkages between job characteristics and job satisfaction. Although researchers and practitioners have studied optimal system design aimed at increasing the overall acceptability of systems, this research underscored the importance of going beyond only a technical analysis of system requirements and functionality to a deeper analysis of the impact that a new ERP system is likely to have on the day-to-day jobs of affected employees. Our results suggested that the influence of ERP system implementation may be more complex than previously thought, at least in the immediate

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aftermath following implementation. In looking at some of the downstream consequences arising from ERP system implementation, our results suggest that managers should not only consider the ERP system as an important technological artifact in the organization, but also view it as a key driver of job design and organizational change strategies as well.

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Appendix

Items

1. Job Characteristics
   a. *Task Significance*
      In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?*
      This job is one where a lot of other people can be affected by how well the work gets done.
      The job itself is very significant and important in the broader scheme of things.
   b. *Task Identity*
      To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?*
      The job provides me the chance to completely finish the pieces of work I begin.
      The job is arranged so that I can do an entire piece of work from beginning to end.
   c. *Skill Variety*
      How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?*
      The job requires me to use a number of complex or high-level skills.
      The job is complex and nonrepetitive.
   d. *Autonomy*
      How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?*
      The job gives me considerable opportunity for independence and freedom in how I do the work.
      The job gives me a chance to use my personal initiative and judgment in carrying out the work.
   e. *Feedback*
      To what extend does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing—aside from any "feedback" coworkers or supervisors may provide?*
      Just doing the work required by the job provides many chances for me to figure out how well I am doing.
      After I finish a job, I know whether I performed well.

2. Job satisfaction
   Overall, I am satisfied with my job.
   I would prefer another, more ideal job. (reverse score)
   I am satisfied with the important aspects of my job.

3. Perceived job transformation
   The system changed my job significantly.
   The system altered my job substantially.
   The system made my job very different.
   The system transformed my job greatly.

*Seven-point anchors (strongly disagree, moderately disagree, slightly disagree, undecided, slightly agree, moderately agree, strongly agree) were used.

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