A Longitudinal Field Investigation of IT Impact on Technology, Job, and Performance Outcomes in the Workplace

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Abstract

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ABSTRACT

Little is known about the impact of information technology on downstream individual outcomes in the workplace. This research presents the results of a 12-month field study of 2,810 employees in a telecommunications firm. The research model captures the dynamic process of new technology implementation, focusing on the interrelationships between job characteristics, technology outcomes, job outcomes and individual performance. Results indicated that the implementation of new information technology influenced both job and performance outcomes when moderated by job enrichment and perceived job transformation, and had a direct effect on system satisfaction. These results have far-reaching implications for information technology and management researchers interested in how new technology affects key outcomes within organizations.

INTRODUCTION

In organization and society, information technology (IT) has resulted in changing the way people work and live. IT use in the workplace is generally not an end in itself but a means toward achieving greater productivity and quality of life (e.g., Zuboff, 1988). Some observers have stated that IT is unlikely to have its desired effect unless work processes are redesigned or reengineered (Davenport, Jarvenpaa, & Beers, 1996). Others have advocated jointly considering the technological environment and the human processes when designing new workplace computing systems (e.g., Guha, Grover, Kettinger, & Teng, 1997). Analyses of the productivity impacts of IT at the level of the organization, the industry, and the economy have suggested that IT investments are likely to produce disappointing results unless work processes are altered to take greatest advantage of the new technology (Caron, Jarvenpaa, & Stoddard, 1994). With this backdrop, the current work aims to further our understanding of the influences of information technology introductions on key individual outcomes in the workplace.

Technology acceptance and implementation are often described as one of the most, if not the most, widely-researched topics in the information systems (IS) literature (e.g., Hu, Chau, Sheng, & Tam, 1999). This important stream has provided rich insights into the key determinants of IT usage...
and has led to the development of robust theory used to predict individual acceptance of new technologies. However, like all research, these perspectives have been necessarily limited in scope and have not focused on other key individual outcomes in organizational settings. The current research focuses on the broader implications of technology implementation by examining usage as an independent variable and examining downstream consequences associated with usage of new technologies. Specifically, the present research moves beyond modeling information technology use per se and examines the impact of use on three classes of variables: technology outcomes (i.e., system satisfaction), job outcomes (i.e., job satisfaction, organizational commitment), and performance outcomes (i.e., self-rated and supervisor-rated performance assessment). We also incorporate two key job characteristics as moderating influences: job enrichment—which has a rich history of use in the management literature (e.g., Dwyer & Fox, 2000; Hackman & Oldham, 1980), and perceived job transformation—a construct introduced in this research. These constructs capture both the nature and magnitude of job redesign, thus explicitly modeling the complex dynamics and consequences of employee use of technology.

THEORY

Conceptual Framework

In focusing on individual outcomes as consequences of use, the current work integrates theory from the fields of organizational behavior, human resources, and IT/IS. Organizational behavior researchers have long focused on key job outcomes such as job satisfaction and organizational commitment as primary foci of their work (e.g., Cable & Judge, 1996; Griffin & Bateman, 1986; Locke, 1976; Mannheim, Baruch, & Tal, 1997; Saks & Ashforth, 1997; Kirkman & Shapiro, 2001). Similarly, researchers from human resources continue to study and refine robust theories of human performance assessment in organizations (e.g., Baird, 1977; Cleveland & Shore, 1992; Tansky & Cohen, 2001). The current research seeks to expand the nomological net.
associated with new technology introduction by moving beyond examining use as the ultimate dependent variable of interest, and focusing on individual outcomes that are commonly studied in the organizational behavior and human resource management literatures. Figure 1 presents the proposed research model that outlines three broad classes of outcomes associated with the use of technology: technology outcomes, job outcomes, and performance outcomes. In addition, the model incorporates the expected moderating effects of job characteristics—job enrichment and perceived job transformation. We will first the various constructs and then develop the theoretical justification for the various proposed relationships.

**Construct Definition**

Many of the constructs have a long history of development and use in prior research; we provide a high-level overview and definition of those constructs here. Since perceived job transformation is a construct new to this research, we offer a more extended treatment of the construct. Technology outcomes are defined as those behaviors and attitudes about the technology itself that relate to and/or are derived from actual use of that system. Specifically, they include behavioral intention to use the system, usage behavior, and system satisfaction. Behavioral intention to use the system is defined as the user’s assessment of the likelihood that they will use the system in the future (Davis, Bagozzi, & Warshaw, 1989; Morris & Dillon, 1997; Taylor & Todd, 1995). Usage goes beyond the initial exposure to the system (i.e., through training) and reflects the dynamic socio-cognitive processes associated with the lasting influences of the technology (Venkatesh & Davis, 2000). The concept of “satisfaction” has been of interest to researchers in a wide variety of disciplines. For example, researchers in consumer behavior have conceptualized satisfaction as an attitude-driven judgment based on post-purchase interaction with a given product or service (Yi, 1990). In IS research, the construct of “system satisfaction” (sometimes termed
"user satisfaction") is often conceptualized as a subjective measure of "IS success" (see Delone & McLean, 1992). System satisfaction is seen as a surrogate measure of IT impact (e.g., Bailey & Pearson, 1983; Doll & Torkzadeh, 1988) and it retains a central role in contemporary research on IS implementation (e.g., Palvia, 1996; Torkzadeh & Doll, 1999). For the purpose of this work, consistent with attitudinal theorists (e.g., Fishbein & Ajzen, 1975) and IS research (e.g., DeLone & McLean, 1992; Szajna & Scamell, 1993), system satisfaction is defined as an individual's subjective evaluation of the degree to which a system meets his or her expectations.

The second class of constructs is job outcomes—they do not focus on the technology but on an individual's world view about her/his job and the organization itself. For the purpose of this research, these are job satisfaction, defined as the extent of positive emotional response to the job resulting from an appraisal of the job as fulfilling or congruent with the individual's values (e.g., Smith, Kendall, & Hulin, 1969; Janssen, 2001), and organizational commitment that captures the individual's attachment to the overall goals and values of the employing organization (McNeese-Smith, 1996). The third category of outcomes examined is performance outcomes that are defined as the subjective evaluation of an employee's productivity on the job by the individual or her/his supervisor (Baird, 1977; Cleveland & Shore, 1992; Shore, Shore, 7 Thornton, 1992).

A final class of constructs, called job characteristics,\(^1\) represents key moderators of the relationships between system usage and job outcomes/performance outcomes. The two job characteristics examined in this research are job enrichment and perceived job transformation. Job enrichment relates to the extent to which a job change strategy, such as new technology introduction, gives an employee greater task variety, task identity, task significance, autonomy, and feedback (Hackman & Oldham, 1980). Job enrichment is typically known to stimulate employee motivation and performance (Dwyer & Fox, 2000; Hackman & Oldham, 1980). Implicit both in the term "enrichment" and the definition itself is a positive valuation of job design such that these
“enriching” changes will have a beneficial influence on employee attitudes and behavior. Thus, job enrichment is designed to capture the nature of changes in the job due to job design changes—specifically, in this research, we examine job enrichment as it relates to the new technology introduction.

Perceived job transformation is defined as the degree to which an employee believes all aspects (e.g., tasks, roles, and orientation) of her/his job have been altered by some organizational change—i.e., here, the introduction of new technology. This view is consistent with Nelson’s (1990) discussion of changes in a job based on new technology introduction. As she points out, simply measuring changes in job content may not capture the dynamics of how individuals perceive and react to those changes, particularly when experienced as a longitudinal change process—i.e., through initiation, implementation, and institutionalization. Consistent with Klein and Sorra’s (1996) discussion of innovation climate, perceived job transformation as defined in this research is not related to employees’ satisfaction with the technology, the organization, or their jobs. It is particularly important to note that no valuation is placed on the nature of this change—for example, employee A might view the event of interest—i.e., new technology introduction—as having a beneficial effect on his or her job while employee B may perceive a detrimental impact. Even though the direction or nature of influence is different—i.e., direction is different from a job enrichment perspective—both individuals are likely to perceive the transformational aspect of the change as quite significant. Thus, unlike job enrichment that is the nature of change, perceived job transformation is the magnitude of change. Taken together, the two constructs—job enrichment and perceived job transformation—represent complementary influences within an organizational context. Figure 2 presents the potential range of job enrichment and perceived job transformation scenarios.
Finally, a number of demographic/individual difference variables have been shown to influence technology, job, and/or performance outcomes and thus, need to be controlled for. Recent research on new technology adoption has demonstrated that both gender and age can influence the process by which users adopt and use new technologies (e.g., Gefen & Straub, 1997; Morris & Venkatesh, 2000; Venkatesh & Morris, 2000). In addition, given the wide range of positions contained in this sample, and the potential for technology to influence and transform those positions differently, we controlled for occupational position, consistent with the suggestions offered by Lefkowitz (1994).

**Hypothesis Development**

Intention models are well established and widely employed to explain a wide variety of human behavior. Much psychology research (Ajzen, 1991; Fishbein & Ajzen, 1975) detail how behavioral intention to perform a given behavior fully mediates the relationship between individual perceptions and the behavior of interest. Prior research has developed and extensively validated intention-based models across a wide range of tasks and technologies (Davis et al., 1989; Venkatesh & Davis, 2000). The results from this stream of research support the notion that behavioral intention to use technology fully mediates the relationship between individual perceptions of the technology and actual usage (e.g., Taylor & Todd, 1995; Venkatesh & Morris, 2000). We include this relationship in the proposed model to provide an anchor for the current work in the extant literature on technology acceptance and usage behavior while seeking to extend the nomological network of technology implementation to other technology, job, and performance outcomes. Thus, we hypothesize:

**H1a:** Behavioral intention to use a system will positively influence system use.
As noted earlier, perceived job transformation reflects the extent to which a job may be changed as a result of the introduction of a new system. However, the relationship between perceived job transformation and use is likely to be a complex one. On one hand, if the extent of transformation is high, it is possible that technology will play an increasingly important role in managing the transformed job, resulting in high usage. The above scenario might suggest a direct and positive relationship between perceived job transformation and use. However, it is also possible to argue the opposite—if the extent of transformation is high, the efficiency and effectiveness gains may offset the necessity to use technology because the technology subsumes much of the required hands-on work, thus freeing the individual to perform other non-technology related activities. Likewise, situations with low transformation might result in increased use as the new technology might automate otherwise routine tasks. In this case, while the tasks themselves remain relatively unchanged (i.e., low transformation), technology usage may increase considerably. In fact, it is quite likely that these two scenarios co-exist for any given technology within an organization depending on the specific employee and the role of the technology in the employee’s job. This suggests that the amount of transformation, in and of itself is not likely to be predictive of use; rather, it is the nature of that transformation—as captured by the job enrichment construct—that is critical to unlocking the relationship between job transformation and use.

Therefore:

**H1b**: Job enrichment will moderate the relationship between perceived job transformation and system use.

There is some disagreement about the direction of causality between system satisfaction and other usage-related constructs. Some suggest that system satisfaction is an antecedent of system usage (e.g., Delone & McLean, 1992; Igbaria & Tan, 1997). This is consistent with an attitudes-to-behavior direction of influence such as that posited by social psychological models of human
behavior such as the theory of reasoned action (Fishbein & Ajzen, 1975) and the theory of planned behavior (Ajzen, 1991) as well as well-known models of IS usage (e.g., Davis et al., 1989; Thompson, Higgins, & Howell, 1991). An alternative perspective takes a behavior-to-attitudes perspective on causality suggesting that attitudinal variables such as system satisfaction are driven by individual experiences with the target system in context (see Melone, 1990 for an extended discussion of this viewpoint). For example, Abdul-Gader and Kozar (1995) suggest that computer experience (i.e., usage behavior) can alleviate computer alienation—conceptually, the inverse of satisfaction.

Recent research in marketing has also suggested a similar pattern. Consumer satisfaction is an emergent property that is formed on the basis of extended experience with the item of interest and that studies of satisfaction are best when grounded in individual evaluations of the product after extended usage (Iacobucci, Grayson, & Ostrom, 1994; Tse, Nicosia, & Wilton, 1990). Echoing this view, Fournier and Mick (1999) detail case examples where satisfaction with a given product ebbed and flowed on the basis of usage experiences with that technology. Furthermore, particularly with technically-sophisticated products, individuals will not only gain first-hand knowledge of benefits they had expected to accrue from system usage, they may also discover novel or unexpected benefits that emerge from extended use of a new product (Fournier & Mick, 1999; Oliver, 1989). A dominant theoretical frame for research on satisfaction in the marketing literature incorporates such expectations as an anchor from which satisfaction judgments are adjusted based on experience. For example, using qualitative research techniques, Fournier and Mick (1999) discuss how as a result of their continued use of technology, initial individual expectations about a range of technically-sophisticated products were either confirmed or positively disconfirmed (leading to satisfaction) or were negatively disconfirmed (leading to dissatisfaction). Given the demonstrated importance of
individual experiences with technology in influencing individual perceptions and attitudes about that technology, we hypothesize:

H2: System use will influence individuals' system satisfaction.

The management and organizational behavior literatures have focused on job satisfaction. Two perspectives on job satisfaction commonly appear in the literature. The first suggests that satisfaction is a relatively stable individual characteristic (Pulakos & Schmitt, 1983; Staw, Bell, & Clausen, 1986). The other suggests that satisfaction is an emergent quality that is derived from the situational context based on factors such as organizational climate (e.g., Schneider, 1975) and job characteristics (e.g., Hackman & Oldham, 1980). We adopt the latter view consistent with recent research on the relationship between work environment and satisfaction (Shalley, Glison, & Blum, 2000).

There is very little research on how technology usage may influence job satisfaction. Most of the existing literature relating to technology contexts and job satisfaction examines it from a human resource (HR) perspective—for example, attempting to understand the career orientations and turnover intentions of IT workers (e.g., Igharia & Greenhaus, 1992; Lee, 2000). However, these studies have very little to say about how the introduction of new technology into the workplace may affect employees’ job satisfaction. There is little prior empirical support for the contention that technology usage should have a direct effect on job satisfaction. In fact, studies that examined such a relationship found no support for a direct relationship between the two constructs (e.g., Ang & Koh, 1997). We make the case that the relationship between usage and job satisfaction will be moderated by job characteristics (i.e., job enrichment and perceived job transformation). Specifically, the degree to which an employee feels that the technology allows them to perform activities that were not possible before the introduction of technology (see Kolodny, Liu, Stymne, & Denis, 1996; Kraemer & Danziger, 1990; Yaverbaum & Culpan, 1990) will be a critical
determinant in whether or not technology use plays a role in influencing job satisfaction. In other words, when technology usage per se is critical to an individual’s job, it can have an important influence on job satisfaction.

Furthermore, because of the role of social aspects on user acceptance and use of technology (Venkatesh & Davis, 2000), it is possible that employees may actually fear or resent new technology being introduced into the workplace if it is seen as routinizing or deskilling existing job processes (Orlikowski, 1993). Thus, the degree to which usage of the technology is seen by individuals as having an overall significant and positive effect on their jobs (i.e., high job enrichment and high job transformation) will have a powerful “multiplier effect” on the relationship between technology usage and job satisfaction. Fournier and Mick (1999) provide support for this view and suggest that the formation and emergence of satisfaction ratings are only meaningful when placed in the context of the relevant environment (in this case, the employee’s job and workplace). Given that Venkatesh and Davis (2000) demonstrated that employees can accurately assess the fit of a technology to various aspects of their job, we expect that based on early assessments of the system, an employee can tell a particular system’s potential to enrich and/or transform her/his job. Thus, based on this contingent view of technology usage and job satisfaction, we hypothesize:

H3a: The influence of system use on post-implementation job satisfaction will be moderated by the interaction of job enrichment and perceived job transformation.

In addition to the benefits gained when employees have high ratings of job satisfaction, organizations have long recognized the long-term implications of building employee commitment to the organization. The importance of this construct is demonstrated by the fact that some studies have indicated that organizational commitment is a strong predictor of turnover intentions (e.g., Igharia & Greenhaus, 1992; Porter, Steers, Mowday, & Boulian, 1974; Fogarty, 2000). The relationship between technology usage and organizational commitment has received very little
attention despite calls in the literature for further research on the topic (e.g., Nelson, 1990). There is, however, a strong theoretical basis for the relationship in the personnel and organizational psychology literature (e.g., Yan & Louis, 1999). For example, research on boundary-spanning work experiences—defined as the extent to which a job involves communication and interaction with individual’s outside the person’s own department (Yan & Louis, 1999) provides substantial support for a positive association between boundary-spanning activities and both job satisfaction and other positive organizational outcomes (e.g. Hallenback, Hautaluoma, & Bates, 1999). This is important from a technology implementation perspective since boundary-spanning activities may be enhanced through use of advanced information and communication technologies (Yan & Lewis, 1999).

Among IS employees, empirical evidence has confirmed a strong relationship between boundary-spanning activities and organizational commitment (Igbaria, Parasuraman, & Badawy, 1994). From the perspective of the present research, the body of empirical evidence to date suggests that to the degree that advanced technologies facilitate increased communication and interaction with those outside their department, employees may feel empowered to take on a broader and more proactive approach to defining work roles that may manifest themselves in traditional affective-reaction outcome measures such as job satisfaction and organizational commitment (Parker, Wall, & Jackson, 1997).

Research within the human resources domain has also provided valuable insight into underlying cognitive and affective processes that lie at the foundation of employee’s commitment to the organization. For example, there is ample evidence that person-job (P-J) and person-organization (P-O) fit are related to positive work outcomes (Kristof, 1996; O’Reilly, Chatman, & Caldwell, 1991). Other studies have demonstrated that individuals with high P-J and/or P-O fit perceptions have more positive job attitudes (Cable & Judge, 1996; Kristof, 1996). In a longitudinal analysis, Saks and Ashforth (1997) found that P-J fit was strongly positively related to
organizational commitment; however, P-O fit was not related. These results imply that, like the satisfaction constructs, organizational commitment is strongly tied to individual’s perceptions of the job itself. Returning to technology usage behavior, the aforementioned results further imply that, in and of itself, technology usage may not strongly influence work-related outcomes including organizational commitment; rather, only when use of technology significantly (perceived job transformation) and positively (job enrichment) alters the individual’s job will it have a positive effect on that individual’s commitment to the organization. For example, to the degree that the new technology increases boundary-spanning roles and enhances task variety, employees may experience greater attachment to the organization. However, when the job is transformed in a way that is perceived as negative (e.g., deskilling or routinizing the existing job), the employee’s commitment to the organization may be diminished (Karasek, 1990; DeCotiis & Summers, 1987). This is consistent with Nelson’s (1990) view that the relationship between individual attitudes and behavior (e.g., technology usage) will be moderated by organizational, work group, individual, and job-related factors. Based on tight coupling between technology usage and its influence on the job, we hypothesize:

H3b: The influence of system use on post-implementation organizational commitment will be moderated by the interaction of job enrichment and perceived job transformation.

Another critical issue relevant to the understanding of outcomes associated with technology use is performance outcomes. Performance outcomes are usually conceptualized along several different dimensions related to performance or task proficiency on the job (Meyer, Paunonen, Gellatly, Goffin, & Jackson, 1989). Two commonly used conceptualizations of performance are: (a) supervisor’s assessment of performance—i.e., the subjective assessment used in promotion and merit reviews (e.g., Klein, Hall, & Laliberte, 1990) and (b) the employee’s own perceptions of her/his performance (Schneider, 1990). While ideally, these two conceptualizations are perfectly
aligned, prior research suggests that they are related, yet distinct indices of individual performance outcomes (Baird, 1977). Thus, performance-related factors are considered to be both multi-faceted and complex.

Consistent with recent performance research (e.g., Siders, George, & Dharwadkar, 2001), performance assessment in the current study refers to those activities that are rewarded by the organization in the context of compensation and incentive-based reviews. In organizational settings, it therefore follows that employees will likely pursue those behaviors that they perceive to be rewarded by the organization. In the context of new technology introductions, some have suggested that some employees may feel compelled to use the technology for symbolic purposes and to convey that they are “technologically innovative” thereby positively influencing supervisor’s performance assessments (Webster, 1998). Similarly, others have stated that in the context of new technology implementations, one of the factors that may influence use is praise from supervisors for use of the new system (Klein et al., 1990).

Given the extensive use of technology in today’s complex organizations, it seems unlikely that employees would use technology purely for symbolic effect—i.e., a direct effect of use on performance assessment (Klein & Sorra, 1996). Rather, organizational support for “reengineering” or “business process improvement” aimed at changing existing organizational processes and thereby transforming employees’ jobs will likely moderate the usage-performance relationship. In other words, this suggests that technology usage for routine organizational tasks may be expected but will not result in higher performance assessment. Rather, technology usage is more likely to be viewed positively when it is associated with positive transformative changes to the underlying tasks themselves that allows employees to become more effective and/or efficient. Such a view implies that perceived job transformation and job enrichment go hand-in-hand in influencing both self- and supervisor-rated performance. Therefore:
H4a: The influence of system use on self-rated performance assessment will be moderated by the interaction of job enrichment and perceived job transformation.

H4b: The influence of system use on supervisor assessment of performance will be moderated by the interaction of job enrichment and perceived job transformation.

Summary

This section has presented a theoretical model that expands the nomological net related to understanding the impact of technology implementation on individual outcomes. Specifically, we presented a model integrating job characteristics with technology, job, and performance outcomes (Figure 1). The model takes a longitudinal perspective on technology implementation in organizations. Key to understanding the impact on individual outcomes is the moderating roles of job enrichment and perceived job transformation. Depending on the nature and magnitude of the job change caused by technology, the technology is expected to create positive outcomes through re-engineering or negative outcomes due to routinization and deskilling of an employee’s job.

METHOD

Participants

Participants were employees of a medium-sized firm in the telecommunications industry. Of the nearly 4,000 total employees, 3,402 agreed to participated in the study with 2,810 providing usable responses at all points of measurement for an effective response rate of about 83%. Of the 598 employees who did not agree to participate in the study, some were not invited due to the nature of their jobs (e.g., janitorial staff), others were excluded from the study by the firm’s management due to the temporary or probationary nature of their position, and others still did not want to participate in the study. While ideally we would have wanted all participants (3,402) to provide responses for all waves of the data collection, this was particularly difficult given that the study duration was 12 months and had multiple points of measurement—the final sample of 2,810 was
arrived at after excluding those who did not respond despite follow-ups, those who had left the organization, those who provided incomplete responses, etc. Of the 2,810 participants, 901 were women (32%). 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—i.e., largely in proportion to the entire organization.

System

The system being introduced was an organization-wide information system that was aimed at replacing many existing smaller systems. The objective of the new system was to provide the highest level of enterprise application integration with a web front-end (e.g., Schmidt, 2000). The system was new to the organization and none of the employees possessed any prior knowledge of the system being introduced. The design and development process was spearheaded by a consulting firm and lasted a year with the last six months of the effort being almost entirely at the telecommunication firm’s site. The system design and development followed included interviews of various stakeholders, employees in various organizational units, and employees at various levels of the organizational hierarchy including top management. The long-term goal was to replace the old, fragmented systems with the new, integrative enterprise-wide system. In the short-term, the new system was setup such that the old systems in place were also supported via plug-ins that connected old systems to the new system—such access was expected to be available for up to 24 months to facilitate a smooth transition and obtain employee buy-in through the implementation and post-implementation phases.

Measurement

One of the critical issues in this research, given the longitudinal nature of the study and the fact that the data were being collected from employees, was the length of the survey instrument. In order to maximize the sample size, we chose short scales wherever possible. Also, we tried to use
multiple methods such as archives to collect data, thus maximizing the response rate and enhancing the validity and reliability of the data. In measuring the various constructs, we reviewed the literature to find established scales. Behavioral intention and usage behavior have been measured previously in IS literature. In keeping with that tradition, we measured behavioral intention via a three-item scale adapted from Davis et al. (1989) and employed extensively in other research (Taylor & Todd, 1995; Venkatesh & Morris, 2000). Usage behavior was measured via system logs as duration of use—this measurement approach is consistent with previous research (see Venkatesh & Morris, 2000). Further, in measuring system use, the system logs were closely studied to eliminate idle times (user inactivity) of greater than 5 minutes—this is consistent with the previous research (see Collopy, 1996; Venkatesh, Morris, & Ackerman, 2000) to ensure a more accurate estimate of system use as there is a tendency in today’s work environment to be simply logged in even if one were not actively using the system.

Job satisfaction and organizational commitment have been studied extensively in prior research. While there are many scales, we sought both a valid, reliable scale as well a short scale—we adapted and extended the scale of O’Reilly and Caldwell (1981). Similarly, organizational commitment has been measured extensively in the organizational behavior literature and we adapted the scale of O’Reilly and Chatman (1986). Both these adapted short scales have been used recently (e.g., Speier & Venkatesh, forthcoming) and demonstrated good reliability and validity.

Employee performance was measured via self-assessment and merit/supervisor assessment—the information was obtained from the organization’s archives. Self-assessment of performance was via a survey instrument that was administered internally by the organization at the time of merit review. Performance was also measured via supervisor ratings of various employee attributes. The researchers were given two aggregate performance metrics, one for self-assessment and one for supervisor assessment, for each employee that was a cumulative score from various
attributes. The researchers did not have direct control over the specific performance metrics or its
calculation—however, we believe that these index measures used by the organization for merit and
pay evaluations was a critical, valid variable representing performance. Further, the performance
attributes and the procedure to calculate the performance metric employed by the organization was
one they had used for 8 years, comprised three pages of questions, and used what the organization
described to be “standard measures” of performance. Such an index measure is the result of
formative indicators that sample the content domain and is generally deemed an acceptable
alternative to standard scale development (see Bollen, 1989; Diamantopoulos & Winklhofer, 2001)

Job enrichment was measured consistent with our conceptualization and with previous
research that viewed the construct as an index rather than a construct with reflective indicator
variables (see Diamantopoulos & Winklhofer, 2001; Dwyer & Fox, 2000). In keeping with this, we
employed a five-item scale similar to the one reported Dwyer and Fox (2000) to measure the job
enrichment index as it related to the new system.3 The five items represent the domain of job
enrichment as identified in the job characteristics model (see Dwyer & Fox, 2000; Hackman &
Oldham, 1980). Perceived job transformation was a new construct introduced in this research. The
measures were developed via a careful application of a variety of methods—there are many
examples of measure development in the IS literature including Davis (1989), Moore and Benbasat
(1991), and Compeau and Higgins (1995), among others. Specifically, we generated twenty
candidate questions. From these twenty questions, we arrived at a final scale that had 4 items—the
procedures used in arriving at these measures were very consistent with previous research and
included peer reviews, card sorting, and pre-tests.

Procedure

The research was conducted in a telecommunications firm in naturally-occurring conditions
before, during, and after one of the organization’s major technology implementations. The
organization conducted several training programs that were conducted separately in each organizational unit and organization positions within organizational units—the researchers did not have control over the training or its structure. However, the training structure was deemed appropriate to communicate the most appropriate information for each unit and organizational position. A training company worked with the consulting firm that built the system to develop the appropriate training materials. Several training teams, with 3 members on each team, were employed and each training team had a consultant from the system development firm. The training team information was tracked for use as a dummy variable in the analysis.

The training was conducted over a 2-month period given the size of the organization and desire to minimize work disruption. The dates of each employee’s training program were tracked to ensure timely follow-up. Following the training program, change management consultants were deployed in the entire organization for a period of 3 months to facilitate the transition. Technical assistance was also available in the “IT support department” of the organization and various organizational units.

Since employees were responding to multiple surveys and it was important to track specific respondents over time, unique bar codes were printed on each survey that allowed specific responses to be tracked over time. Despite the detailed information gathered from all participants and about all participants, in keeping with our promise of confidentiality of participant information, the data were always reported to the organization in an aggregate form only. The data collection schedule is shown in Figure 3.

**RESULTS**

We conducted preliminary analysis to examine reliability and validity using Cronbach alpha estimates, principal components analysis (PCA), and interitem correlational analysis. The
Cronbach alpha estimates of all constructs, with one exception (discussed later), were 0.70 or higher, suggesting that the measures were reliable. A PCA with varimax rotation supported the factor structure expected from the theory and measures. Similarly, the interitem correlations indicated that the correlations among pairs of items measuring a particular construct were significantly greater than correlations across pairs of items measuring different constructs—Fisher’s z-transformation and a t-test were used to statistically examine the differences. The details of these preliminary analyses are not reported here due to space constraints and further, since a structural equation modeling technique (EQS) was used to analyze the data, a report on the measurement model will provide necessary information about validity.

**Measurement Model**

EQS 3.0 (Byrne 1994) was used to perform a confirmatory factor analysis (CFA) and the test of the structural model. The overall fit of the measurement model, based on a CFA, was good. The various measures of overall fit were: comparative fit index (CFI) = .91; normed fit index (NFI) = .90; nonnormed fit index (NNFI) = .86. As evidence of convergent validity, all items loaded as expected on the pre-specified construct and were significant as determined by the t-values. Table 1 presents the factor structure matrix for the constructs in the model, and Cronbach alpha reliability statistics for all scales. In addition, Lagrange Multiplier (LM) tests indicated no significant cross-loadings for measurement items, further establishing discriminant validity. As can be seen from Table 1, some scales are not included in the validity analysis due to the nature of the measurement process—performance and use; these two constructs were measured via a single number report per employee from archival data, which in turn is modeled as the single indicator. Although job enrichment is included in the analysis, notice that the Cronbach alpha estimate was quite low (.52). However, this is not a cause for concern as this measure is an index with formative indicators. In situations with formative indicators, it is more important to sample the entire domain rather than
convergence. Specifically, Diamantopoulos and Winklhofer (2001), drawing from Bollen (1989) and Bollen and Lennox (1991), note that high indicator variable collinearity could suggest that the indicators are too overlapping and perhaps not providing the necessary content coverage (see also Bollen 1984). The descriptive statistics and correlations are shown in Table 2.

INSERT TABLES 1 AND 2 ABOUT HERE

Structural Model

After confirming the appropriateness of the measurement model, EQS was used to test the proposed research model. Figure 4 presents the structural model results. Examination of overall fit measures indicated that the data fit well with the proposed model: CFI=.90; RMSEA=.05; GFI=.91; AGFI=.88; AIC=132.1; CAIC=198.61. The structural model incorporated three control variables—gender, age, organizational position—in examining the various relationships. Also, pre-implementation measures of job satisfaction, organizational commitment, and performance measures were used as controls in predicting post-implementation outcomes.

INSERT FIGURE 4 ABOUT HERE

Both intent to use the system and perceived job transformation moderated by job enrichment were significant predictors of short-term use, supporting H1 (a and b). System satisfaction was determined by short-term use, supporting H2. Short-term use moderated by perceived job transformation and job enrichment influenced job satisfaction and organizational commitment, supporting H3 (a and b). Similarly, perceived job transformation and job enrichment moderated the effect of short-term use on performance outcomes, supporting H4 (a and b).

While EQS is a robust structural equation modeling approach that produces much useful information such as fit statistics that previous generation techniques do not provide, EQS does not provide variance explained ($R^2$). In order to determine the variance explained using a structural
equation modeling technique, we employed Partial Least Squares using PLS-Graph, version 2.91.03.04. The resulting variance explained in the various constructs is also shown in Figure 4.

Post-hoc Analysis

In order to further understand the three-way interactions and their practical significance, we conducted a post-hoc analysis using split samples. We split the sample into four subsamples: low-low, low-high, high-low, and high-high in terms of job enrichment and perceived job transformation using the means as the midpoint. The data in each subsample were analyzed separately. The pattern of results were similar for all four dependent variables—job satisfaction, organizational commitment, and both performance constructs. As expected, the low-low scenario resulted in no impact while the low enrichment and high transformation scenario, that we labeled deskilling, showed that use had a strong negative influence on job and performance outcomes. When the enrichment was perceived to be high, the effect of use on the dependent variables was positive with the influence being higher (stronger path coefficient) when the transformation was high. Figure 5 summarizes the key findings.

INSERT FIGURE 5 ABOUT HERE

To examine the robustness of this pattern, the following additional analyses were conducted:

1. Median split;

2. The data were divided into subsamples using low, medium, and high as the grouping variables using the mean as the guide. The middle was discarded and the remaining subsamples were analyzed; and

3. Median split of (2) above.

The pattern of results were largely similar with the only differences being in terms of the strength of the relationships varying somewhat, which is to be expected given the varying cutoff points. However, more importantly, the directionality in all subsamples remained the same.
In order to shed further light on the phenomenon, we examined the subsamples broken down by organizational position (Table 3). The breakdown shown in Table 3 in conjunction with the pattern from Figure 4 reveals some important insights. In the four categories where there are the most number of employees (i.e., middle management, supervisors, knowledge workers, and administrative/clerical workers), the system was perceived to transform the job significantly but the enrichment was found to be low. In fact, in those four organizational positions, the number of employees whose job was significantly transformed with minimal enrichment was greater than the number of employees in both enrichment situations.

DISCUSSION

In this paper, we developed a longitudinal, causal model of various critical individual outcomes in organizational settings. We explain the relationship across job characteristics, job outcomes, technology outcomes, and performance outcomes, while controlling for individual characteristics. The proposed model was supported in a study conducted in an organizational setting with 2,810 employees over a 12-month period during which a major enterprise-wide information system was introduced in the organization. The technology outcome of usage that has been studied in much previous IS research is demonstrated to have a significant impact on job satisfaction, organizational commitment, and performance even when controlling for pre-implementation measures of these constructs. Job characteristics—job enrichment and perceived job transformation—moderated most relationships.

It is worth noting the particular strengths of this research study. A strength of this study is the field setting for a major organizational technology introduction. Additional strengths include sample size, duration of the study, and number of points of measurement. Further, the design uses multiple methods at different points in time to measure various model constructs—specifically, computer system logs were used to collect usage data; organizational archival data were used to
gather performance data using both a self-assessment and key informant assessment; using a validated survey instrument, job satisfaction and organizational commitment were measured 4 months pre-implementation and 8 months post-implementation; other perceptual outcomes such as perceived job transformation, job enrichment, and intention were measured using validated scales immediately after training; system satisfaction was measured 8 months post-implementation. Overall, the richness of the study underscores the robustness and validity of the model.

Before we discuss key implications and contributions of the current work, it is also important to acknowledge some of the limitations of the current work so as to appropriately interpret the findings and scope while simultaneously delineating future research directions. The study was conducted in an organization in the telecommunications industry during the implementation of one major organization-wide system. It is possible that the results observed are idiosyncratic to this setting. However, given that the technology studied was representative of major IT systems being introduced, some concerns are alleviated. Also, since all organizational positions were studied, concerns about generalizability are somewhat mitigated. It is possible that the unique organizational hierarchy contributes to the results. In any case, future work is necessary to examine the generalizability of the model and results to other settings and technologies. Related to the study, it should be noted that although there were about 4,000 employees in the organization, only 2,810 participated in the study—while this is a good response rate, the non-response indicates the possibility of some selection bias. Since it is a field study employing much sensitive data, this could not be avoided. Only future research and replications can help examine the generalizability of the model presented here and/or identify possible additional contingencies or situational variables that should be incorporated in the model. Given the duration of the study, we measured job enrichment and perceived job transformation as they related to the introduction of the new technology system. Future research should measure pre-implementation job enrichment and post-
implementation job enrichment and employ more sophisticated measures to examine the change that is associated with the technology introduction. One approach might be the use of polynomial regression techniques such as those suggested by Edwards and Parry (1993) to more directly test the relationships that can only be inferred when opting to use a difference score approach.

Further research should also include additional control variables. Although the current work did include some individual characteristics and previous job and performance outcomes, additional general individual characteristics (e.g., personality), computer-related traits (e.g., playfulness, computer self-efficacy), and technology perceptions (e.g., relative advantage) should also be controlled. For the current work, the length of the survey instrument was a key constraint—this constraint is likely to play a significant role in future research efforts as well. Thus, it is only through piece-meal investigations, replications, and extensions can a more comprehensive understanding of the entire phenomenon emerge.

This research makes several important contributions. We integrate key organizational behavior and human resource research with IT/IS research. The model proposed creates a strong nomological network of relevant organizational outcomes at the individual level. The holistic model validated in this research thus advances our understanding of today’s organizations that have IT as an integral part of their functioning. Further, the model makes important contributions to the literature in each of the three major streams it draws from, especially given the longitudinal nature of the study that is uncommon in studying such organizational phenomena. By incorporating these organizational phenomena into an extended model of new technology introduction and implementation, this research moves well beyond the existing knowledge base focusing on usage determinants and puts a spotlight on the downstream consequences of use that have historically been of interest to organizational researchers and practicing managers alike.
The introduction of a new construct—perceived job transformation—is an important scientific contribution. This new construct is different from the widely-employed job enrichment construct (e.g., Hackman & Oldham, 1980). While the focus of job enrichment is on nature of job change, perceived job transformation is related to the magnitude of change both good and bad. Our theory suggested that job enrichment and perceived job transformation would jointly moderate the impact of use on several outcomes. The emergence of perceived job transformation as an important situational construct, particularly in organizational studies of technology, is underscored. Researchers should also consider this new construct in other scenarios that do not involve technology introductions since the construct can certainly be adapted to situations that are independent of technology introductions and focused on other organizational and/or job change situations.

Perceived job transformation was observed to have several negative correlations with many other model constructs—job enrichment, intention, system use, system satisfaction, job satisfaction, and organizational commitment. For example, perceived job transformation measured immediately after training had a negative correlation with short-term use, suggesting that—in aggregate—the greater the job change caused by the technology, the less likely an employee was to use the new system. However, results indicated that this relationship was moderated by job enrichment such that these effects were attenuated when job enrichment was high. Thus, the type of transformation (i.e., whether it enriches the job or not) plays a critical role in influencing user’s short-term usage decisions.

A similar result appeared with respect to the negative moderating influences associated with short-term usage and the downstream job and performance outcomes. For example, the influence of short-term usage on both job outcomes (job satisfaction and organizational commitment) was moderated by the simultaneous influences of both job enrichment and perceived job transformation.
The pattern of results for each of the individual constructs was remarkably similar, suggesting that the underlying causal mechanisms behind job satisfaction and organizational commitment are quite similar. The results here suggest that technology usage, per se, is of little importance in employee’s assessment of subsequent job outcomes. For example, in a “status quo” scenario (i.e., low perceived job transformation and low job enrichment), the influence of technology usage on job outcomes was non-significant. Conversely, in the “technology-enabled reengineering” scenario (high/high), the influence of usage on job outcomes was strongly positive. In the other two scenarios (“deskilling” and “reskilling”), the nature of the relationship between usage and job outcomes changed dramatically based on the combination of perceived job transformation and job enrichment. In the low job transformation/high job enrichment situation (i.e., “reskilling”), usage had a positive influence on user’s job outcomes, perhaps suggesting that the technological changes implemented by the organization allowed the employee to devote more time and resources to the demanding and/or creative aspects of the job, thereby increasing job satisfaction and commitment. When perceived job transformation was high and job enrichment was low (i.e., “deskilling”), technology usage had a strongly negative relationship on job outcomes, suggesting that the technology itself may have caused the job to become more routinized and therefore, less satisfying than it was prior to the implementation of the new technology, thus leading to lower job satisfaction and organizational commitment.

Likewise, a similar pattern of results was observed for the performance outcomes (self assessment and supervisor assessment of performance). In the high/high scenario, performance assessment was strongly and positively associated with technology usage. In the low/low situation, technology usage had no significant influence on performance assessment. In the other two “mixed” scenarios, results differed. When perceived job transformation was low, but job enrichment was high, performance was positively influenced by technology usage, suggesting that,
in those situations, technology was viewed as an important productivity factor within the organization. Conversely, in the “deskilling” scenario (high transformation, low enrichment), usage of the technology was viewed negatively from a productivity point of view. Thus, in looking at the pattern of results across all four scenarios, it becomes clear that the combined influence of both the amount (transformation) and nature (enrichment) of the job changes exhibit key influences on key employee outcomes in the period following implementation.

The model has considered outcomes from the key streams of research that we drew from and also controlled for pre-implementation outcomes and individual characteristics. Future research should expand the nomological network to include established determinants of technology outcomes, job outcomes, and performance outcomes. Further, other important outcomes in each category merit further study. Technology outcomes may be expanded to include other system success measures beyond use and satisfaction (see Davis et al., 1989; Delone & McLean, 1992; Torkzadeh & Doll, 1999). Job outcomes such as person-organization fit (Cable & Judge, 1996; Kristof, 1996), person-job fit (Saks & Ashforth, 1997), and turnover intention (Lee et al., 2000), among others, should be studied. Performance outcomes could also be studied using measures of productivity that may help relate usage to more objective measures of performance at the individual level. Additional work focused on how the job and performance outcomes influence continued usage of the system is certainly warranted. Much prior research on IT IS contexts has predicted continued system use via very focused predictors that relate to the system itself (see Venkatesh & Davis, 2000 for a recent example). The current work suggests that the reach of technology use is very broad in terms of individual outcomes in organizations, thus begging the question about the converse relationship (i.e., individual outcomes to technology use).

More broadly speaking, we hope the current research effort will spawn further work that unifies and integrates research in diverse streams—for example, research in the psychological and
economic viewpoints of organizational phenomena such as technology introductions could be integrated to further our understanding of organizational behavior. Practitioners and organizational psychologists alike should pay attention to the impact of technology outcomes on job and performance outcomes beyond the standard predictors of these outcomes. The role of technology outcomes in these other critical individual outcomes in organizations is only likely to increase as the integral nature of technology to employee’s jobs and organizational functioning in general is only going to continue to rise. Some estimates put IT investment at 50% of all new capital investment. Further, constant upgrades of technology environments and software systems stand to impact job enrichment and perceived job transformation that in turn plays a crucial role in technology, job, and performance outcomes. In fact, the negative interaction terms and correlations serve as a caution to managers as efficiency and effectiveness through major technology-driven transformations may come with the price of declining job satisfaction and organizational commitment. Such situations can in turn lead to increased employee turnover that may result in hiring and training costs that may offset gains reaped through the technology success. This is particularly underscored by the worrisome pattern that was revealed by Table 3 with regard to the number of employees who perceived the technology as highly transformational but minimally enriching. It behooves the organizations to carefully examine work processes and flow and design the technical solutions with more just very simple views on efficiency and effectiveness. It would be hasty and erroneous to conclude that the technology has caused a problem; a more accurate assessment is that the technology has to be implemented with much more regard to the employees, their workspace, and work flow. Thus, research into the appropriate interventions and process and workflow design strategies is essential.

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CONCLUSION

The current work proposed a model integrating job characteristics, technology outcomes, job outcomes, and performance outcomes. The proposed model was validated in a telecommunications firm with 2,810 employees participating in an 12-month study. The findings have far-reaching implications for information technology and organizational behavior researchers and practitioners. It is important to recognize that technology can indeed play a critical role in job and performance outcomes. The good news is that a positively-accepted and used technology can create a favorable impact on employees and the organization. However, caution is necessary when making technology-related decisions as the psychological fabric of employees can be adversely affected by major technology implementations, particularly in situations that are not accompanied by the appropriate organizational interventions.

REFERENCES


Griffin, R.W. and Bateman, T.S. "Job Satisfaction and Organizational Commitment." In C.C. Cooper and J. Robertson (Eds.), International Review of Industrial and Organizational Psychology. New York: John Wiley & Sons.


<table>
<thead>
<tr>
<th>Measure</th>
<th>Parameter</th>
<th>Cronbach alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job satisfaction (T2)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall, I am satisfied with my job.</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td>I would prefer another, more ideal job. (reverse score)</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>I am satisfied with the important aspects of my job.</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td><strong>Organizational commitment (T2)</strong></td>
<td></td>
<td>.76</td>
</tr>
<tr>
<td>I am proud to tell others that I am part of this organization.</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>I talk up this organization to my friends as a great organization to work for.</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>I feel a sense of &quot;ownership&quot; for this organization rather than just being an employee.</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td><strong>Intent to use (T1)</strong></td>
<td></td>
<td>.90</td>
</tr>
<tr>
<td>I intend to use the system in the next &lt;no&gt; months.</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>I predict I would use the system in the next &lt;no&gt; months.</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td>I plan to use the system in the next &lt;no&gt; months.</td>
<td>.94</td>
<td></td>
</tr>
<tr>
<td><strong>Job enrichment (T1)</strong></td>
<td></td>
<td>.52</td>
</tr>
<tr>
<td>I believe the system will add a variety of new tasks to my job.</td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>I believe the system will help me complete whole and identifiable pieces of work.</td>
<td>.58</td>
<td></td>
</tr>
<tr>
<td>I believe the system will give me an opportunity to do things that significantly impact the jobs of other people in the workplace.</td>
<td>.51</td>
<td></td>
</tr>
<tr>
<td>I believe the system will make me more autonomous.</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>I believe the system will give me sufficient feedback about my successful completion of various activities for which I use the system.</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived job transformation (T1)</strong></td>
<td></td>
<td>.87</td>
</tr>
<tr>
<td>I believe the system will change my job significantly.</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>The system will alter my job substantially.</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>The system will make my job very different.</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>I believe the system will transform my job greatly.</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td><strong>System satisfaction (T2)</strong></td>
<td></td>
<td>.80</td>
</tr>
<tr>
<td>I am satisfied with the system.</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td>Overall, I am satisfied with the way the system works.</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>I am content with the system environment.</td>
<td>.85</td>
<td></td>
</tr>
<tr>
<td>I am totally dissatisfied with the system environment. (reverse scored)</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td><strong>Self-assessment of performance—Organization provided a metric</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Supervisor assessment of performance—Organization provided a metric</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>System use—System log</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Gender—Female, Male</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Age—Age in years</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Organizational position</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Executive/Top management, Middle management, Supervisory, Professional (knowledge worker), Administrative/Clerical, Technical, Other (please specify)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>s.d.</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>JSat0</td>
<td>5.1</td>
<td>0.87</td>
</tr>
<tr>
<td>OComm0</td>
<td>5.3</td>
<td>0.88</td>
</tr>
<tr>
<td>PerfSelf0</td>
<td>5.2</td>
<td>0.67</td>
</tr>
<tr>
<td>PerfSup0</td>
<td>5.3</td>
<td>0.71</td>
</tr>
<tr>
<td>B1t</td>
<td>4.0</td>
<td>1.21</td>
</tr>
<tr>
<td>JE1</td>
<td>4.2</td>
<td>1.07</td>
</tr>
<tr>
<td>PJT1</td>
<td>5.0</td>
<td>0.89</td>
</tr>
<tr>
<td>Use12</td>
<td>12.4</td>
<td>3.88</td>
</tr>
<tr>
<td>SysSat2</td>
<td>4.1</td>
<td>1.00</td>
</tr>
<tr>
<td>JSat1</td>
<td>4.2</td>
<td>1.02</td>
</tr>
<tr>
<td>OComm1</td>
<td>4.3</td>
<td>1.07</td>
</tr>
<tr>
<td>PerfSelf1</td>
<td>5.5</td>
<td>0.81</td>
</tr>
<tr>
<td>PerfSup1</td>
<td>5.7</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Notes:
1. Performance was scaled to a 7-point scale.
2. Usage is measured as average duration of use in hours per week.
3. JSat: Job satisfaction; OComm: Organizational commitment; PerfSelf: Self-assessment of performance; PerfSup: Supervisor assessment of performance; BI: Behavioral intention to use the system; JE: Job enrichment; PJT: Perceived job transformation; Use: Actual system use.
4. Subscript explanation: 0 represents T0 measures; 1 represents T1 measures; 2 represents T2 measures; 12 represents measures taken between T1 and T2.
<table>
<thead>
<tr>
<th>Organizational position</th>
<th>Low JE, Low PJT</th>
<th>Low JE, High PJT</th>
<th>High JE, Low PJT</th>
<th>High JE, High PJT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive/top management</td>
<td>9</td>
<td>11</td>
<td>41</td>
<td>40</td>
<td>101</td>
</tr>
<tr>
<td>Middle management</td>
<td>31</td>
<td>117</td>
<td>31</td>
<td>61</td>
<td>240</td>
</tr>
<tr>
<td>Supervisory</td>
<td>49</td>
<td>250</td>
<td>67</td>
<td>32</td>
<td>398</td>
</tr>
<tr>
<td>Professional (knowledge worker)</td>
<td>161</td>
<td>760</td>
<td>220</td>
<td>258</td>
<td>1399</td>
</tr>
<tr>
<td>Administrative/clerical</td>
<td>47</td>
<td>297</td>
<td>30</td>
<td>40</td>
<td>414</td>
</tr>
<tr>
<td>Technical</td>
<td>100</td>
<td>5</td>
<td>11</td>
<td>0</td>
<td>116</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>60</td>
<td>36</td>
<td>30</td>
<td>142</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>413</strong></td>
<td><strong>1500</strong></td>
<td><strong>436</strong></td>
<td><strong>461</strong></td>
<td><strong>2,810</strong></td>
</tr>
</tbody>
</table>
1 The term "job characteristics" is used more broadly here than it is by Hackman and Oldham’s (1980) job characteristics model.

2 This paper incorporates the role of perceived job transformation in IT implementation but developing the construct itself is not the focus of this paper. However, since perceived job transformation is a new construct, we present here some key differences between this new construct and other job attitudes discussed in the literature that relate to alterations to employees existing jobs. Job enlargement, for example, refers to the process of adding new tasks to an employee’s job in an attempt to add variety and reduce boredom (e.g., Parker, 1998). While potentially transformational in nature, job enlargement explicitly addresses this through the addition of tasks and has no particular psychological component per se. Task revision, or role innovation (Katz & Kahn, 1966), is defined as actions taken to correct a faulty procedure, inaccurate job description, or dysfunctional role expectation (Staw & Boettger, 1990). Inherent in this definition (as well as its operationalization in the literature) is the notion that something is objectively or subjectively wrong with the status quo and that task revisions are undertaken in an attempt to “correct” the problem. Finally, more recent research has coined the term “job crafting” which refers to the physical and cognitive changes individuals make in the task or relational boundaries of the work (Wrzesniewski & Dutton, 2001). While this perhaps comes closest to the conceptual definition of perceived job transformation, Wrzesniewski and Dutton (2001) note that job crafting is an action and is actively undertaken by the employee themselves. Perceived job transformation, on the other hand, represents an employee’s reaction to changes in the job that may result from their own actions or the actions of others.

3 Three-item scales were used to measure each of the dimensions of job enrichment so as to more systematically differentiate perceived job transformation from job enrichment but those details are not reported here due to space constraints because of this paper’s focus on the research model. However, we examine the reliability and validity of perceived job transformation, as it relates to other model constructs, in the results section later in this paper.

4 It is important to note that while we conducted an extensive empirical validation of the perceived job transformation construct, especially as it relates to similar constructs such as the dimensions of job enrichment and the job enrichment index, those details are not reported here due to the focus of this paper and due to space constraints.

5 Additional procedures as discussed in Bollen and Lennox (1991), Nunnally and Bernstein (1994), and Diamantopoulos and Winklhofer (2001) were conducted at the level of each indicator. It was found that all indicators were significant and were candidates for continued inclusion in the index measure. As noted earlier, we did use 3-item measures for each of the five components of enrichment. The three-item measures were reflective indicators for each of the five components respectively and those scales exhibited high reliability and validity per the conventional testing procedures. Those details are not reported here due to space constraints.
<table>
<thead>
<tr>
<th>Job Enrichment</th>
<th>Perceived Job Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low impact/status quo</td>
</tr>
<tr>
<td></td>
<td>Few and/or less important tasks are subsumed by the technology</td>
</tr>
<tr>
<td>High</td>
<td>Reskilling</td>
</tr>
<tr>
<td></td>
<td>Computerization of routine tasks such that technology creates opportunities for employees to focus on demanding/creative tasks</td>
</tr>
<tr>
<td>Low</td>
<td>Deskilling</td>
</tr>
<tr>
<td></td>
<td>Routinization of previously skill-demanding and/or creative tasks</td>
</tr>
<tr>
<td>High</td>
<td>Technology-enabled reengineering</td>
</tr>
<tr>
<td></td>
<td>Synergistic application of job redesign and new technology to enhance effectiveness and efficiency</td>
</tr>
</tbody>
</table>
**Figure 3. Data Collection Schedule**

<table>
<thead>
<tr>
<th>T₀</th>
<th>T₁</th>
<th>T₁₂</th>
<th>T₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 months pre-implementation</td>
<td>Start of implementation (immediately post-training)</td>
<td>Post-implementation (from T₁ to 8 months post-T₁)</td>
<td>8 months post-T₁ (i.e., 1 year post-T₀)</td>
</tr>
</tbody>
</table>

**Job outcomes:**
- Job satisfaction
- Organizational commitment

**Technology outcomes:**
- Intention to use system

**Job characteristics:**
- Job enrichment
- Perceived job transformation

**System use:**
- Usage log for first 8 mos.

**Technology outcomes:**
- System satisfaction

**Job outcomes:**
- Job satisfaction
- Organizational commitment

**Performance outcomes:**
- Self assessment
- Supervisor assessment

**Job characteristics:**
- Job enrichment
- Perceived job transformation

**Note:** Data were gathered for 12 months after T₂ but are not included in the research model and are reported here due to space constraints.
Figure 4. Structural Model Results

Pre-implementation
Control variables

Post-training

Technology Outcomes
Intent to use system

Post-implementation
system use
System use

Post-implementation
outcomes

System satisfaction

Individual characteristics
Gender
Age
Organizational position

Job characteristics
Job enrichment
Perceived job transformation

Notes:
1. Where two path coefficients are shown, the first one relates to the first DV in the box where the arrow points to, and second relates to the second DV in the box where the arrow points to.
2. $R^2$:

Use: .48
Sys Sat: .11
Job Sat: .42
Org Comm: .43
Perf Self: .45
Perf Super: .46
Figure 5. Post-hoc Analysis Results

<table>
<thead>
<tr>
<th>Job Enrichment</th>
<th>Perceived Job Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Low impact/status quo</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>.03</td>
<td>- .29***</td>
</tr>
<tr>
<td>.07</td>
<td>- .28***</td>
</tr>
<tr>
<td>-.06</td>
<td>- .19**</td>
</tr>
<tr>
<td>-.05</td>
<td>- .18**</td>
</tr>
<tr>
<td>High</td>
<td>Reskilling</td>
</tr>
<tr>
<td>.19*</td>
<td>.32***</td>
</tr>
<tr>
<td>.18*</td>
<td>.31***</td>
</tr>
<tr>
<td>.15*</td>
<td>.25***</td>
</tr>
<tr>
<td>.15*</td>
<td>.24***</td>
</tr>
</tbody>
</table>

Note: The four coefficients noted are between use and each of the four outcomes of interest: job satisfaction, organizational commitment, self-assessment of performance, and supervisor assessment of performance.