Please cite this article as:

Venkatesh, V. and Goyal, S. " Challenging the Linearity Assumption:Impact of an Enterprise System Implementation on Job Outcomes," *Journal of Management Information Systems,* forthcoming.

CHALLENGING THE LINEARITY ASSUMPTION: IMPACT OF AN ENTERPRISE SYSTEM IMPLEMENTATION ON JOB OUTCOMES:

VISWANATH VENKATESH
Eminent Scholar and Verizon Chair of Business Information Technology
Pamplin College of Business, Virginia Tech
Blacksburg, VA 24061
vvenkatesh@vvenkatesh.us

SANDEEP GOYAL
Associate Professor
Information Systems Analytics and Operations
College of Business, University of Louisville
Louisville KY 40292

CHALLENGING THE LINEARITY ASSUMPTION: IMPACT OF AN ENTERPRISE SYSTEM IMPLEMENTATION ON JOB OUTCOMES:

ABSTRACT

Organizations usually have difficulty adjusting to technology-enabled changes. Recent research has examined the interaction between technology and the key job outcomes of employees. But this research stream has done so using a linear lens even though this interplay has been recognized to be dynamic and complex. We challenge here this linearity assumption. We theorized that enterprise system (ES) use influences post-implementation job scope, and the change from pre- to post-implementation job scope perceptions will have a complex effect on job outcomes that are best captured by a polynomial model. Drawing on the anchoring-and-adjustment perspective in decision-making research, our polynomial model highlights the dynamic nature of employee reactions to changes in job scope brought about by an ES implementation that cannot be captured by traditional linear models. We found support for our model using data collected in a longitudinal field study from 2,794 employees at a telecommunications firm over a period of 12 months. Our findings highlight the key role an ES implementation can have in changing the nature of jobs and how those changes can, in turn, drive job performance and job satisfaction. This research also extends classical job characteristics research by arguing for a more complex relationship between the scope and outcomes of technology-supported jobs.

INTRODUCTION

An enterprise system (ES), such as an enterprise resource planning system, is one of the most pervasive organizational change vehicles [7, 38, 41, 56, 66, 72]. Morris and Venkatesh [47] argued that the introduction of ESs not only brings technological change, but also has the potential to radically change the underlying business processes, with a broad impact on employee jobs (see also [3]). With an ES implementation, employees often perceive changes in the workflow and nature of tasks in their jobs [2, 41, 86]. Employees often have a difficult time adjusting to these changes and even resist these implementations [47, 71], thus resulting in lower job satisfaction, lower job performance, and higher turnover [2, 66]. These difficulties lead to a majority of ESs failing, with failure rates reported to be as high as eighty percent [38, 68]. Gartner [24] forecasted spending on ESs to be $426B in 2020, only a drop of 6.9% over the year 2019 despite challenges posed by COVID-19. Such large investments make it imperative for information systems (IS) researchers to develop a deep understanding of the impacts of such pervasive technologies on job performance and job satisfaction, which are critical indicators of implementation success, given that, in addition to being important in their own right, these outcomes have ramifications for other important job outcomes such as turnover and employee well-being.

Organizational behavior research has examined various job outcomes such as job performance, job satisfaction, organizational commitment, and turnover intentions [40, 46, 54, 55]. IS research has also investigated these job outcomes in the context of technology-initiated organizational change [2, 7, 47, 58, 59, 67, 68, 83]. However, much of this prior research has viewed these changes in employee jobs using a linear perspective. We argue that the changes in employee job scope—defined as an employee's perception of the degree of richness, challenge, and complexity inherent in a job [57]—emanating from the introduction of an ES is complex and dynamic, and will be curvilinear. The classical job characteristics model (JCM; [26, 29]), as we present in detail later, posited that well-designed jobs have five core job

characteristics: autonomy, task identity, task significance, skill variety, and feedback. Champoux [11] contended that job scope is represented by "the sum of [these] five core job characteristics" (p. 91).

Traditional models, such as the JCM, tend to view job outcomes, such as job performance and job satisfaction, as a function of various job characteristics at any given point. There is increasing evidence for the complex and dynamic impact from changes in job scope on job outcomes [3, 4, 47, 67]. For instance, Morris and Venkatesh [47] theorized that the relationship between job characteristics and job satisfaction was moderated by an ES implementation. In related work, Bala and Venkatesh [3] argued that some employees may perceive a more rapid change in their job characteristics than others do and some may perceive a greater change in their job characteristics than others do. Similarly, Beaudry and Pinsonneault [4] argued that, following a major technology event, some users begin adapting to the event when they hear about the forthcoming event, some adapt when the event occurs, and others adapt much later. These works were important steps in understanding the impacts of ES implementations on job outcomes. We build upon and go beyond such prior work that has argued that the relationship between job scope and job outcomes is complex [35, 88] by challenging the linearity assumption and presenting theoretical arguments that outline the complex and dynamic polynomial/curvilinear effects of technology-initiated job changes and technology use on key job outcomes.

Despite arguments for a curvilinear relationship, recent literature [3, 59, 68, 82] has viewed the impacts of technology to be linear, simple, and/or moderated. Edwards and his colleagues conducted a series of studies (e.g., [13-15, 39]) to argue that, when complex relationships are oversimplified, they could result in erroneous or ambiguous findings. For example, Lambert et al. [39] challenged the view in psychological contracts research that argued for job outcomes to be negatively related to a psychological contract breach. Allowing for a more complex relationship, Lambert et al. [39] found that job outcomes are more strongly associated with delivered inducements than promised inducements. In a technology adoption and use context, curvilinear effects have been found in predicting system-related outcomes [8, 9, 79]. In

this work, we argue that, although introducing an ES can bring seamless integration of workflow, employees tend to resist adoption because of changes in job scope [47, 68]. As we explain in detail later, using *anchoring*-and-*adjustment* as the underlying theoretical mechanism, we argue that job outcomes are a function of not only pre- or post-implementation job scope, but also the *shift* in job scope from the pre- to the post-implementation stage. The effect of this shift on job outcomes is complex such that, in some cases, it may have a positive effect and in others, it may have a negative effect. Thus, in as noted earlier, oversimplifying such curvilinear relationships will result in erroneous or ambiguous findings.

With some evidence that ES implementations have a curvilinear relationship with job outcomes [2, 68], building on the JCM and using anchoring-and-adjustment as the underlying mechanism [50, 73], we present a more nuanced understanding of the effects of technology-initiated job changes and technology use on key job outcomes—namely, job performance and job satisfaction. Specifically, this research: (a) accounts for changes in job scope stemming from the introduction of an ES; and (b) suggests those changes in job scope have a curvilinear effect on job performance and job satisfaction. Against this backdrop, the objectives of this paper are:

1. To develop a polynomial model of pre- and post-ES implementation job scope and its effects on job performance and job satisfaction; and
2. To empirically test the polynomial model in a 12-month longitudinal study in the context of an ES implementation, with multiple points of measurement including one 4 months prior to the implementation and another 8 months after the implementation.

We expect to make two key theoretical contributions. First, our research builds upon and extends the prior literature on ES implementations and JCM. We outline how and why job outcomes, here, job performance and job satisfaction, are not only a function of pre- and post-implementation job scope, but also the *shift* in job scope from the pre-implementation to post-implementation stage. Prior job characteristics literature is mature and has been instrumental in enhancing our understanding of job outcomes. As a crucial next step, it is important to examine more complex relationships in this literature. To

this end, we theoretically assess how *changes* in job scope, rather than the absolute job scope, can influence important job outcomes. This research extends the job characteristics literature by leveraging *anchoring-and-adjustment* as the mechanism to understand how complex and dynamic changes to job scope determine job outcomes. We also contribute to the JCM literature by presenting examples of synergistic job redesign due to an ES implementation. Specifically, we argue that the effects of such a job redesign can be best explained by incorporating both the pre-implementation—the anchor—and the post-implementation—the adjustment—job scope. For example, examining a curvilinear relationship among pre- and post-implementation job scope allowed us to conclude that a moderate decrease from high post-implementation job scope or a moderate increase from low post-implementation job scope would increase job performance and job satisfaction. From a practitioner perspective, such a nuanced understanding will help in better creating optimal impact of ES implementations on job outcomes. For example, organizations often empower their workers to allow them ownership of a new ES. Our findings, however, suggest caution in light of the possibility that ES implementations could dramatically increase or decrease job scope. Both the increase as well as the decrease in job scope may result in a negative effect on job outcomes.

Second, we challenge the root metaphor assumption of linearity, which is shared by researchers working on topics related to jobs and organizational change including technology-induced change, that the relationship between job scope and job outcomes, especially in the context of an ES implementation, is linear and relatively simple. Alvesson and Sandberg [1] argued that “challenging the assumptions underlying the existing literature is what makes a theory interesting [instead of] gap-spotting" (p. 250). They suggest important theoretical contributions can be achieved by challenging assumptions, with the extent to which assumptions are deeper and more widely shared increasing when going from in-house assumptions to field assumptions. For example, Alvesson and Sandberg [1] contend that challenging paradigmatic assumptions allowed management researchers to question whether a person and the world could exist independent of each other. Such challenges not only present interesting research questions, but also help

provide alternative assumption ground to build new theory. The linearity assumption in the organizational change literature in general and technology-initiated organizational change in particular is a root metaphor assumption that, as outlined by Alvesson and Sandberg [1] in their typology, is related to the shared understanding of the broader images of a subject matter. Specifically, we argue that the relationship between pre- and post-implementation job scope is complex that requires separating the two. Such a separation would provide an expanded view of how pre- and post-implementation job scope influence job outcomes by providing more accurate and less ambiguous predictions. Prior JCM literature and ES implementation literature have argued that high or low levels of post-implementation job scope decrease job outcomes [60, 88]. However, it is not clear if the decrease is the same if the pre-implementation job scope was low, medium, or high. Therefore, using an expanded view that presents a nuanced understanding of how changes in job scope influence job outcomes, we take the next, important step in understanding downstream consequences of technology-initiated organizational change while also challenging the linearity assumption. Linearity is almost implicitly accepted by researchers not only in this domain, but also a variety of domains. Thus, future research in other topics can build on our conceptual ideas and analytical solutions to challenge the linearity assumption.

THEORY

In this section, we first discuss JCM followed by our model development, which is rooted in our challenges to current thought related to JCM.

Job Characteristics Model

Our research draws on the job redesign literature in general, and the JCM in particular, to study the impact of changes in job scope, stemming from an ES implementation, on job outcomes. The JCM [26, 27, 29] has been widely used to study the impact of job characteristics on various job outcomes such as job performance, job satisfaction, job stress, and employee well-being [2, 35, 66-68]. The classical JCM posits that enriched or complex jobs result in positive job outcomes such as better job performance and higher job satisfaction [26, 27, 29]. Well-designed jobs have the following five characteristics: (1) autonomy—defined as the extent to which an employee perceives that the job provides substantial freedom to the employee and provides them with discretion to choose how the job is done and also to set the schedule for completing job activities; (2) task identity—defined as the extent to which an employee perceives that the job requires completion of a "whole" piece of work, or doing a task from beginning to end with a whole identifiable outcome; (3) task significance—defined as an extent to which an employee perceives that the work he or she performs has an effect on the lives and well-being of other people in the organization in particular and society in general; (4) skill variety—defined as the extent to which an employee perceives that the job requires the use of a number of different skills and talents to perform the job; and (5) feedback—defined as the extent to which an employee perceives that the job provides clear information about performance [19, 20, 47, 85].

Brief et al. [6] conceptualized job scope as "the degree of variety, autonomy, task identity, task significance, and feedback perceived by the incumbent to be present in a job" (p. 27). Although job scope is defined as an employee's perception of the degree of richness, challenge, and complexity inherent in a job [83], Hackman and Oldham [28] argued that these employee perceptions are closely related to the five core

job characteristics. Specifically, JCM research stated that these five characteristics can be combined into a single index referred to as job scope that represents the overall potential of the job to influence individual's feelings and behaviors [11, 49, 85, 88]. Stone [65] also defined job scope as "the degree to which a job is enriched" to argue that "jobs that are high on scope have relatively high degrees of variety, autonomy, task identity, and feedback" (p.148). Subsequent research provided empirical evidence of the relationship between job scope and five job characteristics. For example, Champoux [11] contended that job scope can be measured as the "sum of the five core job characteristics" (p. 91; see also, [22, 57]). Further, Xie and Johns [88] argued that job scope can be measured by using an additive index, multiplicative index, or the weighted additive index. Although Hackman and Oldham [27] utilized a multiplicative index, subsequent research (see [18]) raised some concerns about this approach. Therefore, we used an additive index following the approach used by Xie and Johns [88]. Table 1 presents the definitions of our core constructs.

Table 1: Construct Definitions

Construct	Definition
Pre-implementation job scope	An employee's perception of the degree of richness, challenge, and complexity inherent in a job *prior* to an ES implementation [57].
Post-implementation job scope	An employee's perception of the degree of richness, challenge, and complexity inherent in a job *after* an ES implementation [57].
Job satisfaction	The extent of an employee's positive emotional response to the job resulting from an appraisal of the job as fulfilling or congruent with his or her values [2].
Job performance	The extent to which an employee is assessed by his or her supervisor to be performing his or her job duties effectively and efficiently [67].

Challenging Current Thought

Our first point of contention is based on challenging a key root metaphor assumption, as outlined by Alvesson and Sandberg [1] in their typology. As noted earlier, the view that relationships are linear is widely held on a variety of topics related to jobs including technology-driven organizational change. Specifically, we question the assumption in prior JCM and ES implementation literature that job outcomes—here, job performance and job satisfaction—are primarily a function of post-implementation job scope. Incorporating *anchoring-and*-adjustment as the underlying mechanism, we argue that examining the

shift in job scope from pre- to post-implementation stage, rather than just the post-implementation job scope, would allow us to investigate the dynamic nature of the relationship between job scope and job outcomes. Next, based on alternative perspectives [11, 88], we explain how both the anchor and the adjustment in job scope induced by the introduction of a new ES will influence job outcomes.

The basic principle underlying anchoring-and-adjustment is that when people are making judgments in any domain, they tend to base their judgments on initial information—i.e., the anchor—and as new information becomes available, people alter their judgments—i.e., the adjustment—accordingly. Early research on anchoring-and-adjustment viewed it as a heuristic bias affecting human decision-making and judgments [75] such that it affected decisions even when the anchor information was random, mundane, or based on experiences, and frequently led to poor decisions. More recent research, however, has viewed anchoring-and-adjustment as part-and-parcel of how people use information to make decisions. The theoretical perspective of anchoring-and-adjustment has been used extensively in a variety of domains as the core mechanism underlying human decision-making and judgment processes, including people's judgments ranging from the freezing point of vodka, gambles, and negotiation to the apocalypse [46]. Prior IS research has also used anchoring-and-adjustment to understand individual judgment and decision-making [72]. In most cases, anchors play a role due to priming—i.e., people's attention is directed to specific stimuli or information—and adjustments play a role due to recency—i.e., people's attention is directed to current information [18]. Even in research settings, experimental stimuli or administration of questionnaires can cause priming and recency effects [73].

In this work, relevant information—i.e., pre- and post-implementation job scope—can play a substantial role as an anchor and an adjustment [3, 75]. Using anchoring-and-adjustment as a theoretical lens, however, would require a longitudinal trajectory of change in employee job scope because a cross-sectional view of examining job outcomes is not sufficient to gain a complete understanding of job outcomes *shift* in times of ES-initiated change. Using such a longitudinal perspective serves two key

objectives: (1) it allows us to use anchoring-and-adjustment as the theoretical perspective to argue that post-implementation job outcomes, i.e., job performance and job satisfaction, are determined by both pre- and post-implementation job scope as well as the interaction between the two; and (2) it allows us to examine the complex and curvilinear relationship between job scope and job outcomes, as we explain in our second point of contention next.

Our second point of contention is that the relationship between job scope and job outcomes is more complicated than traditional models tend to suggest. Online Appendix A organizes the organizational change literature in two ways. First, it presents how IS research has modeled change in organizations, especially change stemming from a new IT implementation. Second, it presents IS research that has used polynomial modeling to model complex curvilinear relationships. Appendix A provides evidence that the prior research has considered investigating organizational change as a complex, multidimensional, and a messy phenomenon that requires unique theoretical as well methodological perspectives. This appendix also provides examples of how modeling curvilinear relationships using richer approaches, such as polynomial modeling, has allowed researchers to expand boundaries of organizational research. Although prior management research argued for curvilinear relationships (for example, see [88]), in our research, we argue that the relationship is even more complex. Specifically, we contend that, to understand the impact of an ES implementation on job outcomes, it is important to separate pre-implementation job scope from post-implementation job scope. This separation allows us to use anchoring-and-adjustment as the theoretical lens. Because pre-implementation job scope acts as the anchor and post-implementation job scope acts as the adjustment, the shift from pre- to post-implementation job scope helps us to understand how changes in job scope affect job outcomes.

Prior management literature has shown that the expanded view obtained from such a separation not only allows for more accurate predictions, but also avoids ambiguities. Edwards and Harrison [14] contend that, given that the traditional person-environment fit (P-E fit) theory argues for curvilinear

relationship among person, environment, and job outcomes, such as job satisfaction and job strain, separating person from environment provides more clarity. For example, traditional P-E fit theory [21] suggests that job satisfaction decreased when expected workload deviated from experienced workload. Edwards and Harrison [14] clarified that, at low levels of workload, job satisfaction was highest when expected workload *slightly* exceeded experienced workload, whereas, at high levels of workload, job satisfaction was highest when expected workload *notably* exceeded experienced workload. Similarly, in psychological contract research, Lambert et al. [39] noted that, although the traditional literature has argued for curvilinear relationships, the expanded view obtained from separating promised and delivered inducements suggest that relationships for both psychological breach and fulfillment were more complex. For example, contrary to prior psychological contract research, Lambert et al. [39] found that job satisfaction was more strongly related to delivered inducements than promised inducements.

We present specific arguments to develop a polynomial model for how and why technology-induced job scope changes will have complex curvilinear effects on key job outcomes such as job performance and job satisfaction. Evidence for such effects on key outcomes is available both in IS and reference disciplines. For example, Selye's [61] seminal work as well as more recent work by Xie and Johns [88] suggest that there is an optimal level of stress such that high or low level of stress is associated with negative outcomes. Similarly, Venkatesh and Goyal [79] note that there is an optimal level of expectations from a technology that would result in the highest level of positive outcomes. In the current context, we argue that the depending on the level of anchor—i.e., pre-implementation job scope—and the level of adjustment—i.e., post-implementation job scope—employees would react differently to changes in job scope when experiencing an ES implementation. Prior IS research has shown evidence for such effects. Bala and Venkatesh [2], for example, note that, in the context of an ES implementation, some employees may perceive a greater change in their job scope than others do, some employees may perceive a more rapid change in their job scope than others do, and some employees may change their job

scope perceptions more readily than others do. Therefore, we argue that, because of the variability in the employee response due to the shift from the anchor in the pre-implementation to adjustment in the post-implementation stage, the relationship between changes in job scope and job outcomes is expected to be complex and curvilinear. In studies of IS implementations, albeit focused on technology-related perceptions, evidence suggests that imposing linear restrictions on otherwise curvilinear relationship may produce ambiguous or erroneous findings [8, 9, 79].

Our third point of contention is that investigating technology-induced job change is an important context that is often overlooked in IS and management research [36]. As noted earlier, recent research has made significant strides in our understanding of technology-enabled organizational change [62, 67, 68]. Bala and Venkatesh [2] argued that an ES implementation resulted in increasing job demands and decreasing job control, thereby influencing job outcomes such as job satisfaction. Sykes [67, 69] investigated how support structures in organizations helped employees cope with the changes caused by a new ES. Drawing on social network theory, Sykes and Venkatesh [68] examined the positive and negative effects of social ties on ES success. Similarly, Sykes et al. [66] found that the introduction of an ES in an organization altered business processes and their associated workflows (see also [68]). Such intrusive technology-enabled organizational changes have a major influence on post-implementation job outcomes such as job performance and job satisfaction. As the classical JCM was rooted in the examination of conditions that promote job performance and job satisfaction, among other job outcomes [29], examining both important job outcomes of job performance and job satisfaction would lead to a more comprehensive model. However, the research that has presented such a comprehensive model [67] did so using a linear view and/or with a cross-sectional data. As we outlined earlier, using anchoring-and-adjustment as the theoretical perspective allows us to theorize curvilinear relationships to provide a more nuanced understanding of the longitudinal trajectory of employees' perceptions of changes in their job scope following a new ES implementation and its impact on job outcomes**.**

MODEL

Figure 1 presents our research model. Using *Anchoring-and-adjustment* as the theoretical basis for our research model [23, 50, 74], we argue that it is the *shift* in job scope from pre- to post-implementation stage, rather than just the post-implementation job scope, would allow us to best capture the dynamic nature of the relationship between job scope and job outcomes [11, 18, 50, 87]. In our context, *relevant information* can play a substantial role both as an anchor as well as an adjustment [87]. Consequently, there have been calls for research to leverage anchoring-and-adjustment to understand how people make decisions in real-life settings [87]. As noted earlier, we argue that, grounded in the JCM, pre-implementation job scope is the anchor and post-implementation job scope is the adjustment. Therefore, our model suggests that employees' post-implementation job outcomes of job performance and job satisfaction are determined by both pre- and post-implementation job scope as well as the interaction between the two. Specifically, we suggest that: (a) pre-implementation job scope has a curvilinear effect on job outcomes; (b) post-implementation job scope has an inverted-U effect on job outcomes; and (c) the interaction between pre- and post-implementation job scope has a complex curvilinear relationship to impact job outcomes. These complex, joint effects of pre- and post-implementation job scope can be best captured in a polynomial model.

In the next section, we present our hypotheses. H1 presents pre-implementation job scope (H1a) and ES use (H1b) as predictors of post-implementation job scope. H2a through H2d and H3a through H3d focus on the curvilinear relationships between pre-implementation job scope, post-implementation job scope, and the interaction of pre- and post-implementation job scope in influencing post-implementation job outcomes.

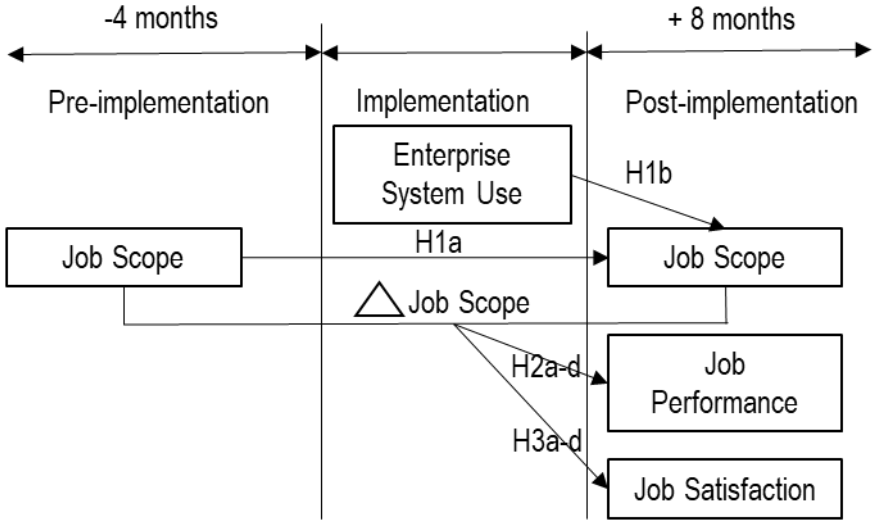
Predicting Post-implementation Job Scope

Employees' perceptions of their jobs are relatively stable over time, particularly in the *absence* of major organizational change events [74]. Although an ES implementation constitutes a substantive change

event that will influence an employee's perception of job scope, the employee's pre-implementation perception, i.e., the anchor, of job scope is still likely to influence the post-implementation perception, i.e., the adjustment. For example, a payroll officer responsible for processing payroll for the entire organization is likely to serve the organization in the same role even after ES implementation. In other words, the roles and the job scope associated with those roles are likely to have a lingering effect on the roles they will have after the ES implementation. Thus, we hypothesize:

H1a: Pre-implementation job scope will have a positive effect on post-implementation job scope.

Figure 1: Research Model



Note: Individual characteristics (i.e., gender, age, organizational position), pre-implementation job performance, and pre-implementation job satisfaction were included as control variables.

An employee's perception of his or her job is tightly coupled to the job environment [26]. In the case of ES implementations, these perceptions will be affected by the implementation. Many organizational systems are labeled process-enabling technologies because they introduce new business processes and workflows for employees throughout the enterprise [2, 66]. Although pre-implementation job scope may influence post-implementation job scope (H1a), the use of the new software will surely alter that job scope after the ES implementation. At the outset, using the ES may result in greater autonomy, as less control may be needed by their supervisor on an activity-by-activity or on a day-to-day basis. Alternatively, system-

enforced constraints could limit the flexibility that an employee has to make decisions. Also, depending on the job and job type, audit trails may get created automatically, reducing autonomy. For example, an employee in accounts receivable may not be able to forgive a debt to maintain the relationship with a customer because the system may not allow him or her to do so. Further, ESs tend to integrate business processes and provide specific documentation guidelines. The more an employee uses the ES, the greater is their perception about changes in their task identity and task significance because they may perceive that their job now influences overall business processes and their work now has an increased impact on their organization. Alternatively, they may not be able to see how their tasks and activities fit in the big picture of the organization, as the ES tends to circumscribe their view. Similarly, the more an employee uses the ES, variety could be greater because of using the new ES for various processes, activities, documentation and reporting. Alternatively, because their activities are specified by the system, variety may be limited to what processes and parts of the software they can access and use. It is also possible that using the ES could create situations where employees receive less feedback. Before the implementation, an employee may have received feedback from his or her supervisor on a regular basis. The ES, however, may not provide such feedback because the system has checks built in to ensure employee actions comply with requirements. Although it is clear from this line of reasoning that using the ES could result in greater or lesser job scope, depending on the design of the ES and specific job roles and concomitant tasks, we suggest that, on balance, the use of modern-day ESs that are designed to support optimized business processes and ensure employees have well-defined tasks and job duties will be more likely to result in lowering post-implementation job scope. Thus, we hypothesize:

H1b: Enterprise system use will have a negative effect on post-implementation job scope.

Predicting Job Outcomes

We argue that changes in job scope, stemming from an ES implementation, influence key job outcomes, here job performance and job satisfaction. There are two relevant streams of literature related to

these job outcomes. The first stream considers these job outcomes to be individual characteristics that are relatively stable over time [64]. The second stream suggests that enriched jobs can enhance job outcomes such as job satisfaction [26, 27, 29]. Collectively, both these streams of literature suggest that job outcomes are a function of employees' past and present experiences. Therefore, we suggest that post-implementation job outcomes would be a function of changes in job scope from pre- (prior experiences) to post-implementation (present experiences).

Several theoretical perspectives, e.g., JCM [29] and sociotechnical systems theory [10, 53], have been used to understand job redesign and enrichment. Most prior empirical and meta-analytic evidence on these theoretical perspectives in general, and JCM in particular, suggests that there is a relationship between an employee's job scope and job outcomes such that increased job scope will lead to favorable outcomes such as increased job satisfaction [20, 26]. Although such linear relationships were a good first step in understanding this phenomenon, as noted earlier, more recent research has shown that reliance on linear models can be problematic when a complex relationship among different variables is expected [8, 9, 79]. For example, the job strain model suggests a curvilinear relationship between "active" jobs, a construct closely related to job scope, and satisfaction [2, 69].

Given the context of our research, the assumption of linearity can be further challenged. Johns [36] has noted that research needs to give greater treatment to the context in theorizing. Given that we focus on the context of ES implementations, and that such systems are used by knowledge workers, we believe that there is likely to be a "floor" for employees' pre-implementation perceptions of job scope. There may be few, if any, jobs that are traditionally considered exceptionally "low status" or "oppressive." For example, Huang [33] and Yan et al. [89] note that, as compared to manual workers, knowledge workers tend to have higher autonomy, task identity, task significance, skill variety, and feedback. Knowledge workers may perceive a new ES as an opportunity for personal growth [4] that would allow them to attain performance gains [3, 76]. For example, employees in rich, challenging, and complex jobs may perceive that the ES will

take over the workflow, allowing them to focus on the business processes, thereby increasing their job performance. As employees' perceptions of richness, challenge, and the complexity of a job increase—i.e., post-implementation job scope increases—job outcomes can also be expected to increase substantially. Thus, with the increase in pre-implementation job-scope, we expect the job outcomes of job performance and job satisfaction to be initially flat-lined (initial floor) and then increase at an increasing rate. In other words, we believe the relationship between pre-implementation job scope and job outcomes of job performance and job satisfaction will be positive and curvilinear. Figure B1 in Online Appendix B presents this relationship. Thus, we hypothesize:

H2a: Pre-implementation job scope will have a positive, quadratic effect on post-implementation job performance such that the positive effect of pre-implementation job scope on post-implementation job performance increases at an increasing rate.

H3a: Pre-implementation job scope will have a positive, quadratic effect on post-implementation job satisfaction such that the positive effect of pre-implementation job scope on post-implementation job satisfaction increases at an increasing rate.

A number of studies have articulated a strong theoretical rationale for the mechanisms underlying an inverted-U relationship between job scope and job outcomes [11, 48, 88]. The key argument here is that job meaningfulness relates to low job outcomes. As job scope increases, workers tend to see an increase in job outcomes up to a point where stress arises from human adaptability for responsibility [13, 60, 88]. For example, Schaubroeck and Ganster [60] argued that extremely high mental and social demands are associated with a high degree of stress that in turn adversely affects job outcomes. Similarly, Irving and Meyer [34] found that there was an optimal point of responsibility at which job satisfaction was maximized beyond which stress had a negative effect on job satisfaction, thus resulting in an inverted-U relationship.

Such an inverted-U relationship is highly likely in the context of major technological changes such as those accompanying ES implementations. More specifically, in the post-implementation stage, virtually all knowledge workers are likely to have to use the implemented ES to some extent, even if it is to a limited extent. These workers are likely to learn new skills in order to use the ES that in turn results in

improving/favorable job outcomes. However, if learning the new skills is too challenging, workers are likely to have lower job performance and lower job satisfaction. For example, Simmering et al. [63] provide evidence of adverse effects with too little or too much autonomy in the workplace. Similarly, Morris and Venkatesh [47] documented such a scenario for too much task significance and skill variety after a new ES implementation, where one employee noted that "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" (p. 154). Further, users might consider too much feedback as intrusive and it might hinder productivity. Some (e.g., [57, 60]) have termed such experiences to be "too much of a good thing." In other words, there is an optimal (medium) level of job scope that will lead to positive outcomes—e.g., higher job performance or job satisfaction—but too much job scope may create overwhelming challenges, thus resulting in lower job performance or job satisfaction [11, 88]. Figure B2 in Online Appendix B shows this relationship. Thus, we hypothesize:

H2b: Post-implementation job scope will have a negative, quadratic effect on post-implementation job performance.

H3b: Post-implementation job scope will have a negative, quadratic effect on post-implementation job satisfaction.

H2a and H3a presented the role of the anchor and H2b and H3b presented the role of the adjustment. Now, we discuss the interplay between the two. Supplementing the notion that job scope may have a complex curvilinear relationship with job outcomes, theory suggests that, in the context of large-scale ES implementations, user perceptions will change over time [5, 70]. For example, building on expectation disconfirmation theory, prior research demonstrated that initial beliefs change with experience [8, 9, 79]. This relationship between job scope and job outcomes and the associated theoretical justification that we develop below goes against the conventional wisdom of linearity and cross-sectional views of organizational change. We contend that, in the face of job changes brought about by ES implementations, both job performance and job satisfaction are a dynamic, curvilinear function of pre- *and* post-

implementation job scope. Specifically, we contend that it is important to investigate an expanded view of these relationships that separate the effects of pre- and post-implementation job scope. Therefore, in situations of technology-induced changes to jobs and work processes, it is the *shift* in scope and not the *absolute* scope that influences post-implementation job outcomes.

Consistent with adaptation level theory [31], depending on their anchor and adjustment, employees are likely to process post-implementation job scope and the technology experiences associated with them differently. Two employees in the same job with identical perceptions of post-implementation job scope may have very different levels of job performance based on their initial job scope perceptions. For one employee, the new job scope may be a minor departure from the pre-implementation reference point. Therefore, his or her post-implementation job outcomes may closely mirror the pre-implementation job outcomes. Conversely, the second employee may experience a significant shift from the pre-implementation level. Therefore, for the second employee, the change in job scope could significantly alter post-implementation job outcomes. Table 2 below presents an overview of the pattern of job outcomes based on pre- and post-implementation job scope perceptions, which we discuss at greater length next.

Table 2. Expected Pattern of Results for Post-implementation Job Outcomes

		Post-implementation job scope		
		Low	*Medium*	*High*
Pre-implementation job scope	*Low*	Low perf / sat	Highest perf / sat (1)	Low perf / sat
	Medium	Lowest perf / sat (3)	High perf / sat	Lowest perf / sat (4)
	High	Low perf / sat	Highest perf / sat (2)	Low perf / sat

Note: Numbers in parentheses correspond to ES implementation scenarios discussed in the text.

The relationships presented in Table 2 reject a rational, "technological imperative" model of implementation and suggest that the influence of a new ES implementation on key job outcomes is neither uniform nor deterministic [52]. To further illustrate the pattern shown in Table 2, we present different ES implementation scenarios (annotated in parentheses in the table). In these scenarios, as we explain below, we contend that the medium job scope is optimal. Using this medium job scope as our focal point, we

theorize that the differences in how technology-induced job scope changes to this medium (optimal) level influence job outcomes in dramatically different ways. We first examine the job outcomes at medium post-implementation job scope followed by job outcomes at medium pre-implementation job scope. Each scenario corresponds to a key area in the table and serves to illustrate the contingent nature of the relationship between job scope and the job outcomes of job performance and job satisfaction.

Job Outcomes at Medium Post-implementation Job Scope

As noted earlier, a medium level of post-implementation job scope is optimum. We argue that: (1) a change to medium post-implementation job scope will maximize job outcomes; and (2) the level of job outcomes at this medium post-implementation job scope would vary depending on the level of the pre-implementation job scope. In Table 2, there are two scenarios (see scenarios 1 and 2 in the table) where job outcomes may be maximized. Building on the job stress and work challenge literature [37, 88], we theorize that a change in job scope from a low or high pre-implementation job scope to medium post-implementation job scope will maximize job outcomes. As we explain next, this impact is not only limited to a positive change—i.e., increasing job scope—but also applicable to a negative change—i.e., decreasing job scope. Thus, the level of job performance and job satisfaction is dependent, in part, on the anchor—i.e., pre-implementation job scope—where the employee was prior to the ES implementation and, in part, on the adjustment—i.e., post-implementation job scope—where the employee was after the ES implementation.

The positive effect of a positive change is somewhat intuitive. Counterintuitively, we expect a negative change in job scope to have a positive effect on job outcomes. In jobs that are highly cognitively demanding, employees will be expected to not only have the knowledge of the overall business processes, but also the knowledge of the workflow embedded within that business process. Prior to an ES implementation, employees were likely expending significant effort to perform various activities embedded in their workflow and overarching business process, whether formally defined or not. Such a diffused, broad focus was likely to reduce their focus on the overall business process. However, with an ES

implementation, employees can likely focus on richer activities because mundane activities are likely now part of the ES. Specifically, in the post-implementation stage, employees may perceive that: (1) tedious tasks have been off-loaded to the ES, thereby allowing employees to focus on more creative or rewarding aspects of their job; (2) the new ES allows employees to focus less on their core role and have a better understanding of the overall business process; (3) employees may feel that they are making an important contribution to the organization by associating with the whole business process instead of a small role that may have been tedious; (4) their jobs are easier and allow them to acquire limited but specialized skills; and (5) certain company policies and procedures are automated in the new ES that allows them to work effectively with less feedback. Overall, these would give employees an optimal adjustment.

For example, if a payroll officer is the only person responsible for the entire payroll process, he or she would be blamed if the employees in the organization did not receive their paychecks on time, resulting in high pressure on the payroll officer. However, the new ES might take over the payroll workflow, thereby sharing the responsibility of the payroll process, thus decreasing the pressure on the payroll officer. Therefore, at medium post-implementation job scope, job performance and job satisfaction are highest when employees perceive either a positive change or a negative change to job scope relative to their pre-implementation job scope. Overall, the shift in job scope from a high or low pre-implementation job scope anchor with an optimal adjustment—i.e., to medium post-implementation job scope—is likely to result in the highest levels of job performance and job satisfaction [11]. Thus, we hypothesize:

H2c: A positive or negative change from a high or low pre-implementation job scope to medium post-implementation job scope will have a positive effect on post-implementation job performance.

H3c: A positive or negative change from a high or low pre-implementation job scope to medium post-implementation job scope will have a positive effect on post-implementation job satisfaction.

Job Outcomes at Medium Pre-implementation Job Scope

As noted earlier, a medium level of pre-implementation job scope is optimum. We argue that: (1) a change from medium pre-implementation job scope will minimize job outcomes; and (2) the level of job

outcomes at this medium pre-implementation job scope would vary depending upon the level of the post-implementation job scope. Scenarios 3 and 4 represent medium pre-implementation job scope that change after the ES implementation. In scenario 3, employees perceive a negative change in job scope. In scenario 4, employees perceive a positive change in job scope. We argue that both the negative (scenario 3) and the positive (scenario 4) change will have an adverse impact on job outcomes. Next, we examine these two scenarios and present our theoretical reasoning.

When employees perceive a negative change from medium pre-implementation job scope (anchor), they may find that the ES implementation strips the job of its stimulating aspects, resulting in tasks being routinized by the system. Specifically, with the ES implementation, employees may perceive that: (1) they have less discretion over some activities than before; (2) the business process integration has blurred lines between various departments and now employees are unable to identify with a task or a process; (3) the ES has taken over large portions of the task and employees have been dissociated from the significant tasks in the organization; (4) they have lost a need to use a variety of skills because the tasks have now been automated, requiring more limited skills than before; and (5) they have become more prone to errors because the new ES does not provide adequate feedback.

Such negative adjustment effects are not uncommon. In their case study of an ES implementation, Boudreau and Robey [5] noted that some users of an older, paper-based system enjoyed a stronger sense of control over transactions due to more information being available in the paper-based system than in the new ES—i.e., job scope was relatively high. Specifically, Boudreau and Robey [5] noted that: "[O]n paper, for a purchase requisition, you see everything: who did it, who it is being charged to, what they are buying, who has done the approving, everything. I mean, the whole nine yards" (p. 10). However, following an ES implementation, Boudreau and Robey [5] reported that users lamented the changes in job scope enforced by the new ES, thus taking away control from the users. Mapping these comments to the negative change in scenario 3, we expect users' post-implementation job performance and job satisfaction to be lower.

In contrast to scenario 3, employees in scenarios 4 perceive a positive change in job scope—i.e., medium job scope perceptions prior to the ES implementation (anchor)—combined with high adjustments—i.e., high post-implementation job scope (adjustment). Such employees are likely to report low or very low job outcomes. These employees may be overwhelmed by the positive change. Specifically, post-implementation, such employees in scenario 4 may perceive that: (1) an increase in autonomy to high levels of pressure on employees [60, 63]; (2) they are identified as solely responsible for a business process along with its success or failure, which they may not fully control, as the new ES has automated certain tasks; (3) they have too much responsibility such that their job has transformed from responsibility for small tasks to responsibility for an entire business process and that may be overwhelming; (4) the ES has increased the need for specialized skills that employees may now need to acquire; and (5) an increase in feedback may cause feedback fatigue (e.g., feedback for every click).

With their job scope moving toward the higher end of the scale, these employees may experience (over)stimulation and associated higher levels of job stress, thus resulting in lower job performance and job satisfaction. Again, users who typified this scenario were also documented by Boudreau and Robey [5] in their case study: "…because 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). Clearly, due in part to the increased job requirements and stress associated with the new system, the type of employee typified in the quote is likely to report low or very low job performance and job satisfaction. Thus, we hypothesize:

H2d: A positive or negative change from medium pre-implementation job scope to a high or low post-implementation job scope will have a negative effect on post-implementation job performance.

H3d: A positive or negative change from medium pre-implementation job scope to a high or low post-implementation job scope will have a negative effect on post-implementation job satisfaction.

METHOD

A few years prior to the study, the telecommunication firm participating in our study realized that

they had a huge potential for growth. However, their aging systems were fragmented and inefficient. The organization decided to implement an integrated ES that would allow the organization to integrate and standardize their business processes, while allowing them to have additional capacity for future scalability. The organization contracted a consulting firm to customize and implement a new ES over a period of one year. This implementation involved upgrading both the software and the hardware infrastructure. The consulting firm spent the last 6 (of the 12) months onsite so that management and employees could participate actively during the ES deployment. In order to facilitate a smooth transition and employee buy-in, employees were allowed to use both the new ES and old systems simultaneously. In the context of this implementation, we collected data at two points in time: 4 months prior to the ES implementation (4 months prior to go-live) and 8 months after the ES implementation (approximately 8 months after go-live). The organization set the timeframes for the various activities related to the ES implementation. The researchers were passive observers and played no role in the ES implementation.

Participants

Our sampling frame of 3,402 employees included employees at all levels of the organizational hierarchy of the firm. Of the total 3,402 surveys sent, we received 2,794 usable responses across all points of measurement (82% response rate). The high response rate is attributed to the strong connection that we had with top management who involved us during the various public sessions about the ES and emphasized to employees that the researchers were external observers who would share summary employee reactions with management to help foster a successful implementation. Despite three reminders over the period of three weeks, 608 employees did not respond to our surveys. Part of this could be attributed to attrition within the organization because the study was conducted over a long period of time and a response was considered usable only if an employee responded to both pre-implementation and post-implementation surveys. The average age of the respondents was 34.7 (S.D. = 6.9). Of the total usable responses, 898 were women (32%). The percentage of women in our sample was similar to the

percentage of women in the sampling frame. Likewise, we found that percentage of employees at different levels of the organizational hierarchy in our sample was similar to the sampling frame.

Measurement

We adapted our measures from prior research and are presented in Online Appendix C. *System use* was a behavioral outcome operationalized as the amount of time an employee actively used the ES. The measure used here was the amount of time per week (in hours) spent using the new ES, an objective measure captured via computer logs, as in much prior research [9, 66, 68, 78]. The logs created a text file with the username and timestamps for when each user logged on and off the ES on a given date as well as periods of inactivity greater than five minutes, which ensured a fairly accurate estimate of the users' active interaction with the ES [70, 78]. A 15-item version of the job diagnostic survey (JDS) [27] was used to measure *job scope*. Job performance was measured using supervisor-rating of employee performance using a widely used scale (for an example, see [66]). Job satisfaction was measured using a standard three-item scale from prior research that has been used in previous IS research [2, 47, 67, 68]. The items were worded appropriately to measure pre- and post-implementation job scope.

Beyond the items measuring the constructs in our model, we measured employee *perceived job transformation* using a four-item scale to use as a manipulation check. In the new ES implementation context, perceived job transformation is defined as the degree to which employees perceive that their job has been changed due to the introduction of the new ES [47]. This measure would help us verify that the employees did indeed perceive a major/transformational change in conjunction with the ES implementation.

Procedure

The study was conducted in a naturally occurring setting in the organization. The organization informed the employees that survey data would be collected confidentially and, as noted earlier, would be used in summary form to foster a successful ES implementation. The first wave of data was collected four months prior to the ES implementation and the second wave of data was collected approximately eight

months after the ES implementation. Our 12-month study timeline was in sync with the annual performance review of the employees in the organization. The 8-month time period after the ES implementation allowed employee reactions to be somewhat more stable though perhaps still in the shakedown phase of the implementation. Therefore, the reactions captured in the second wave of our data collection would be good representations of post-implementation reactions. Perceived job transformation was measured immediately following the training and 8 months post-implementation, thus the first measurement was 4 months after the pre-implementation measure of job scope was done and the second measurement was in conjunction with the post-implementation measure of job scope. Such a measurement timing for transformation was seen as appropriate so the employees could base their responses on their understanding of the ES post-training and after some experience with the ES. The surveys were paper-based and used barcodes to allow for matching participants across the two waves of data collection while maintaining confidentiality.

Employees did not have any prior knowledge about the working of the new ES. The organization contracted a training firm that worked closely with the consulting firm developing and deploying the ES. Because of the size of the organization, training programs were conducted separately for different organizational units. These training programs lasted 2 months. The training team consisted of three members from the training firm and one member from the consulting firm involved in the ES design and development. Typical support structures were deployed by the organizations [67]. Change management consultants were available to the employees for three months after the training and employees had access to central technical support for the organization and technical support of their own organizational unit.

Data Analysis

We used the methodology described by Mackelprang and Malhotra [43] to test our model. We used hierarchical regression analysis. Although H1a and H1b can be tested using traditional regression analysis, H2a through H2d and H3a through H3d hypothesize complex curvilinear relationships. Mackelprang and Malhotra [43] argued that severe multicollinearity problems can be avoided by limiting to equations with

linear interactions instead of curvilinear interactions (e.g., quadratic-quadratic interactions). Edwards [16], in a similar vein, suggests testing for curvilinear effects by using a hierarchical regression analysis. In such an analysis, both Mackelprang and Malhotra [43] and Edwards [16] recommend: (1) a baseline model that regresses only the control variables on the outcome variables; (2) a linear model that regresses linear independent variables on the outcome variables; and (3) a quadratic model that regresses both the linear and the quadratic independent variables on the outcome variables. Therefore, we used four sets of equations. Equations (1) and (2) test the linear model. Equations (3) and (4) test the curvilinear model.

$$POST\_JPERF = \beta_0 + \beta_1 PRE\_SCOPE + \beta_2 POST\_SCOPE + e \quad (1)$$

$$POST\_JSAT = \beta_0 + \beta_1 PRE\_SCOPE + \beta_2 POST\_SCOPE + e \quad (2)$$

$$POST\_JPERF = \beta_0 + \beta_1 PRE\_SCOPE + \beta_2 POST\_SCOPE + \beta_3 PRE\_SCOPE^2 + \beta_4 PRE\_SCOPE * POST\_SCOPE + \beta_5 POST\_SCOPE^2 + e \quad (3)$$

$$POST\_JSAT = \beta_0 + \beta_1 PRE\_SCOPE + \beta_2 POST\_SCOPE + \beta_3 PRE\_SCOPE^2 + \beta_4 PRE\_SCOPE * POST\_SCOPE + \beta_5 POST\_SCOPE^2 + e \quad (4)$$

where POST_JPERF = Post-implementation job performance; POST_JSAT = Post-implementation job satisfaction; PRE_SCOPE = Pre-implementation job scope; POST_SCOPE = Post-implementation job scope

Hypotheses Testing

Tests for Hypothesis #1: H1a and H1b propose direct effects for PRE_SCOPE and ES use (USE) on POST_SCOPE, with significant positive and negative coefficients, respectively, being expected. This is tested via the equation: POST_SCOPE = f (PRE_SCOPE, USE).

Tests for H2a and H3a: These hypotheses suggest that, as pre-implementation job scope increases, job outcomes—here, job performance and job satisfaction—increase at an increasing rate. Therefore, the coefficient for the quadratic term for PRE_SCOPE is expected to be positive and significant in equations 3 and 4. In addition, these hypotheses suggest that with the increase in pre-implementation job-scope, job performance and job satisfaction will initially be a flat-line and then increase at an increasing rate. Therefore, the linear slope of the surface along the line where post-implementation job scope = 0 would be

significant and positive. Hence, the tests:

H2a: $\beta_3 > 0$; a $_{\text{pre-implementation scope}} > 0$ (β_3: coefficient for PRE_SCOPE^2 predicting POST_JPERF in equation 3; a $_{\text{pre-implementation scope}}$: coefficient for linear slope along the line where POST_JPERF = 0)

H3a: $\beta_3 > 0$; a $_{\text{pre-implementation scope}} > 0$ (β_3: coefficient for PRE_SCOPE^2 predicting POST_JSAT in equation 4; a $_{\text{pre-implementation scope}}$: coefficient for linear slope along the line where POST_JSAT = 0)

Tests for H2b and H3b: These hypotheses suggest that, as post-implementation job scope increases, job performance and job satisfaction increase until post-implementation job scope gets to a medium (optimal) level and then decrease resulting in an inverted U-shaped curve. This inverted U-shape requires that the coefficient for the quadratic term for POST_JPERF is negative and significant in equations 3 and 4. Hence, the tests:

H2b: $\beta_5 < 0$ (β_5: coefficient for POST_SCOPE^2 predicting POST_JPERF in equation 3)

H3b: $\beta_5 < 0$ (β_5: coefficient for POST_SCOPE^2 predicting POST_JSAT in equation 4)

Tests for H2c and H2d and H3c and H3d: Curvilinear models—e.g., quadratic models as presented in equations 3 and 4—are helpful in presenting a detailed representation of the theoretical relationships among the variables of interest [79] and yield higher-order equations. Because of their curvilinear nature, coefficients in these equations can be difficult to interpret directly [13]. Following Mackelprang and Malhotra [43] and Edwards [16], we used the response surface methodology as a visual aid to interpret these curvilinear models [8, 9]. We focused on three features of the theoretical response surface presented in Figure 2: stationary point, principal axes, and slopes along various lines of interest. Stationary points are where the slope of the surface is zero in all directions and the principal axes describe the orientation of the surface in reference to the XY plane. We also examined the slopes along two key lines of interest—lines along which the X=Y and the X=-Y. The pre-implementation job scope is equal to the post-implementation job scope for the X=Y line, whereas equal but opposite along the X=-Y line [8, 9, 13, 43].

Figure 2 presents the theoretical constraints, as presented in Table 2 and hypotheses H2c and H2d and H3c and H3d. These constraints, if satisfied, would provide the necessary support for our hypotheses. In contrast to prior, more static conceptualizations of the job scope-job outcomes relationship, Figure 2 highlights a significantly more complex relationship and one that can be better understood by separating pre- and post-implementation job scope. The theoretical constraints presented in Figure 2 are as follows:

(1) Job outcomes are low when both pre- and post-implementation job scope are low or high (H2c and H2d, H3c and H3d). However, at medium post-implementation job scope, job outcomes are high. Taken together, this indicates that the slope of the line along the X=Y is inverted U-shaped. This inverted U-shape along the X=Y line is represented by a significant and negative quadratic slope. Hence the tests:

H2c and H2d: $a_2 < 0$ (a_2: quadratic slope of along the X=Y line for POST_JPERF)

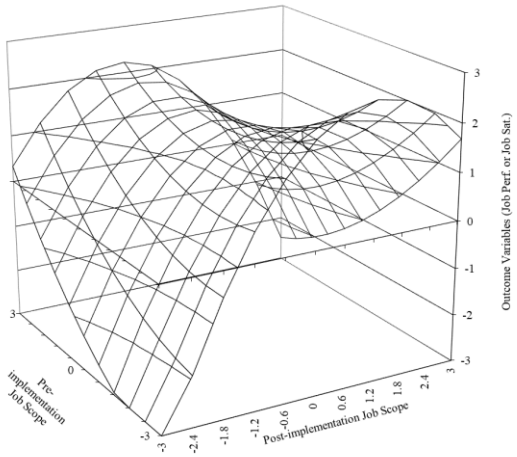
H3c and H3d: $a_2 < 0$ (a_2: quadratic slope of along the X=Y line for POST_JSAT)

(2) Job outcomes are low when pre--implementation job scope is low and post-implementation job scope is high and vice versa (H2c and H2d, H3c and H3d). At medium post-implementation job scope, job outcomes are high. Taken together, this indicates that the slope of the line along the X=-Y line is also inverted U-shaped. This inverted U-shape along the X=-Y line is represented by a significant and negative quadratic slope. Hence the tests:

H2c and H2d: $a_2 < 0$ (a_2: quadratic slope of along the X=-Y line for POST_JPERF)

H3c and H3d: $a_2 < 0$ (a_2: quadratic slope of along the X=-Y line for POST_JSAT)

Figure 2: Response Surface Representing Theoretical Model



RESULTS

We first examined the reliability and validity of the different scales. With the Cronbach's alpha values being greater than .80, both job performance and job satisfaction were reliable. The reliabilities of the additive index for the job score measures were .84 (pre-implementation) and .76 (post-implementation). A factor analysis supported a one-factor solution for job scope, with loadings between .71 and .83 in each of the two points of measurement. We also found that the average variance extracted (AVE) for all constructs exceeded the threshold value of .50, indicating internal consistency. Therefore, our data showed adequate convergent and discriminant validity. Factor loadings for job scope at time t1 and time t2 are presented in Online Appendix D. A confirmatory factor analysis also showed that the single-factor model and a second-order factor with each of the five characteristics being dimensions exhibited good fit in terms of CFI (>.95), RMSEA (<.05), and SRMR (<.06); in contrast, the five-factor model had slightly poorer fit in terms of CFI (.95), RMSEA (.07), and SRMR (.07).

The polynomial models included linear terms and higher-order terms, as set forth in the equations listed earlier. Therefore, we scale-centered our data to reduce the likelihood of multicollinearity in our dataset. Scale-centering was achieved by subtracting the mid-point of the scale from the measured value. Finally, we tested for common method bias. Because of the longitudinal design of our study, we had temporal separation of survey rounds that, to some extent, alleviates concerns about common method bias.

In addition, our data were gathered from multiple sources (e.g., system use measured via system logs), thus again alleviating concerns about common method bias. We also conducted a Harmon's one-factor test and analysis using the marker variable technique. All the variables of interest in our data were entered into a factor analysis. The results of this factor analysis showed that that neither a single factor emerged nor a single factor accounted for a majority of variance in the interdependent and criterion variables. Moreover, we found a meaningful relationship among the variables of interest even after the first factor from the unrotated factor matrix was entered into a linear regression model as a control. For the marker variable technique, we followed Lindell and Whitney [42] and Malhotra et al. [44] and used the second smallest positive correlation among the manifest variables in our data as a proxy for common method variance. Even after adjusting for the second smallest positive correlation, the revised correlations were still significant indicating that the common method bias is not a concern. Our approach and results were consistent with prior research [80]**.** These tests allow us to conclude that common method bias was not a concern in our dataset.

The descriptive statistics and correlation matrix are presented in Table 3. It is interesting to note that both job performance and job satisfaction declined following implementation, and that pre-implementation job scope had negative correlations with post-implementation job performance, post-implementation job satisfaction, and ES use. The negative correlations between job scope and job performance and between job scope and job satisfaction are interesting considering that they have been typically found to be positive in much prior research. Immediately after training, the mean for perceived job transformation was 5.05 (on a 7-point scale) and the standard deviation was .88. In the post-implementation stage, the mean was 5.11 and the standard deviation was .94. Together, this suggests that employee perceptions of the extent of the change caused by the ES implementation was high throughout our study period, suggesting that the employees perceived that the new ES implementation had a significant impact on their jobs.

Table 3. Descriptive Statistics and Correlations

		M	*SD*	1	2	3	4	5	6	7	8	9	10
1	Gender	NA	NA	NA									
2	Age	34.71	6.93	.14*	NA								
3	Org position	NA	NA	-.23**	.40***	NA							
4	Pre-impl job perf.	4.97	1.08	.15*	.19**	.22***	.78						
5	Pre-impl job sat.	5.13	.87	.24***	.21**	.18**	.15*	.79					
6	Pre-impl job scope	4.29	1.04	-.18*	.23***	.21**	.19**	-.33***	.73				
7	ES use	12.41	3.88	.21**	.17*	.16*	.24***	.44***	-.33***	NA			
8	Post-impl job scope	3.67	1.02	-.25***	.28***	.34***	.25***	-.35***	.25**	-.29***	.71		
9	Post-impl job perf.	4.15	1.56	.30***	.19**	.17**	.47***	.17**	-.19**	.18**	-.46***	.77	
10	Post-impl job sat.	4.22	1.02	.21**	.22**	.22**	.13*	.54***	-.24**	.27***	-.29***	.23***	.80

Notes: NA: Not applicable; * p<.05; ** p<.01; *** p<.001; Diagonal elements represent square root of AVE for that construct.

Table 4 presents the results for post-implementation job scope as the dependent variable. Per H1(a) and H1(b), post-implementation job scope was predicted by pre-implementation job scope and ES use, with the latter having the expected negative effect. We found that pre-implementation job scope had a significant and positive impact on post-implementation job scope (.24***), thus supporting H1a. The significant and negative influence of ES use on post-implementation job scope (-.27***) supported H1b.

Table 4. Predicting Post-implementation Job Scope

	R^2	B
Pre-implementation job scope	.27	.24***
Enterprise system use		-.27***

Note: NA: Not applicable; * p<.05; ** p<.01; *** p<.001

Table 5 presents the results for the prediction of both outcome variables—i.e., post-implementation job performance and job satisfaction. The variance explained by only control variables was 16% in job performance and 9% in job satisfaction. The polynomial model predicting job outcomes explained 57% (without control variables) and 70% (with control variables) variance in job performance and 61% (without control variables) and 73% (with control variables) variance in job satisfaction. When control variables were included in the model, a slightly different regression equation is estimated. The results of that analysis are also shown in Table 5. Clearly, although the different control variables explain additional variance in job performance (ΔR^2 = .13) and job satisfaction (ΔR^2 = .12), the magnitude and direction of the beta

coefficients in the models with control variables remained quite similar to the model without the control variables. In order to add to the robustness of our findings, we jackknifed our sample into two random samples and repeated the jackknifing to generate 100 subsamples and tested our model. Only in 2 subsamples did PRE_SCOPE^2 become non-significant, which was consistent with the significance level of $p<.05$. Finally, we followed Edwards [16] and ran the models using 10,000 bootstrap samples to develop confidence intervals for various features of response surfaces that we present next.

Table 5. Predicting Post-implementation Job Outcomes

	Control variables only model		Linear model with control variables		Polynomial model w/o control variables		Polynomial model with control variables	
	Job perf	Job sat	Job perf	Job sat	Job perf	Job sat	Job perf	Job sat
R^2	.16	.09	.37	.38	.57	.61	.70	.73
ΔR^2							$.13^{***}$	$.12^{***}$
Gender	$.32^{***}$ (.02)	$.15^{*}$ (.03)	$.21^{***}$ (.02)	$.17^{**}$ (.03)			$.24^{**}$ (.03)	$.21^{***}$ (.03)
Age	$.34^{***}$ (.01)	$.34^{***}$ (.02)	$.24^{**}$ (.02)	$.28^{***}$ (.02)			$.14^{*}$ (.02)	$.18^{**}$ (.02)
Org. position	$.19^{**}$ (.02)	.15 (.09)	$.13^{**}$ (.02)	.10 (.07)			$.12^{*}$ (.02)	$.16^{**}$ (.02)
PRE_JSAT		$.41^{***}$ (.03)		$.39^{***}$ (.04)				$.24^{***}$ (.04)
PRE_JPERF	$.46^{***}$ (.02)		$.35^{***}$ (.01)				$.30^{***}$ (.02)	
ES Use			$.13^{*}$ (.02)	.10 (.04)	.06 (.02)	.04 (.04)	.10 (.04)	.02 (.03)
PRE_SCOPE			$.87^{*}$ (.08)	$.73^{**}$ (.07)	.09 (.04)	.04 (.05)	.10 (.05)	-.04 (.02)
POST_SCOPE			$.42^{***}$ (.13)	$.40^{***}$ (.16)	$.40^{***}$ (.09)	$.41^{***}$ (.08)	$.37^{***}$ (.11)	$.42^{***}$ (.07)
PRE_SCOPE^2					$.14^{*}$ (.02)	$.12^{*}$ (.01)	$.13^{*}$ (.02)	$.14^{*}$ (.03)
POST_SCOPE^2					$-.47^{***}$ (.02)	$-.42^{***}$ (.02)	$-.43^{***}$ (.03)	$-.40^{***}$ (.03)
PRE_SCOPE X POST_SCOPE					$-.20^{**}$ (.02)	$-.14^{**}$ (.01)	$-.17^{**}$ (.02)	$-.15^{**}$ (.02)

Notes: * $p<.05$; ** $p<.01$; *** $p<.001$; POST_JPERF = Post-implementation job performance; POST_JSAT = Post-implementation job satisfaction; PRE_SCOPE = Pre-implementation job scope; POST_SCOPE = Post-implementation job scope. SEs are presented in parentheses.

The response surfaces for predicting job performance (Figure 3) and job satisfaction (Figure 4) were both saddle shaped. We observed that the stationary point for both surfaces was close to the center

(JPERF: X_0 = .43, Y_0 = -.02; JSAT: X_0 = .42, Y_0 = -.11). According to Edwards [16], a stationary point for a saddle-shaped surface does not indicate a maxima or minima. The first principal axis for JPERF is given by Y = 2.67 - 6.26X and for JSAT is given by Y = 3.70 - 7.84X. The first principal axes for both the job outcomes are rotated clockwise from the X=-Y line such that it is primary in the area where post-implementation job scope is at the medium level. The second principal axis for JPERF is given by Y = -.08 + .16X and for JSAT is given by Y = .05 + .13X. The second principal axes for both job outcomes are rotated clockwise from the X=Y line such that it is primarily in the area where pre-implementation job scope is at the medium level. Edwards [16] contends that for a saddle-shaped surface, the highest upward slope is along the first principal axis and highest downward slope is along the second principal axis. Therefore, the response surfaces have the highest upward slope in the area where we observe low or high pre-implementation job scope and optimal (medium) post-implementation job scope; and the response surfaces have the lowest slopes in the area where we observe optimal (medium) pre-implementation job scope and low or high post-implementation job scope. Collectively, these features support H2c-d and H3c-d. Next, we present further tests for our hypotheses by examining the specific constraints that we identified with the theoretical response surfaces for job performance and job satisfaction.

The coefficients associated with the squared terms of both PRE_SCOPE and POST_SCOPE were significant in explaining both job performance and job satisfaction. H2a-b hypothesized that the pre-implementation job scope will have a positive and quadratic effect on the post-implementation job outcomes, namely job performance and job satisfaction. We found that β_3 was indeed positive and significant (β_3 = .14* for JPERF; β_3 = .12* for JSAT). Moreover, we found that the linear slope along the line where post-implementation job scope = 0 was significant and positive for both job performance and job satisfaction ($a_{\text{pre-implementation scope}}$ = .09* for JPERF; $a_{\text{pre-implementation scope}}$ = .04* for JSAT), thus supporting H2a and H3a. Further, β_5 was negative (β_5 = -.47*** for JPERF; β_5 = -.42*** for JSAT), thus confirming the

hypothesized inverted-U shaped curve between PRE_SCOPE and POST_JPERF (H2b) as well as POST_SCOPE and POST_JSAT (H3b).

Figure 3: Response Surface Predicting Job Performance

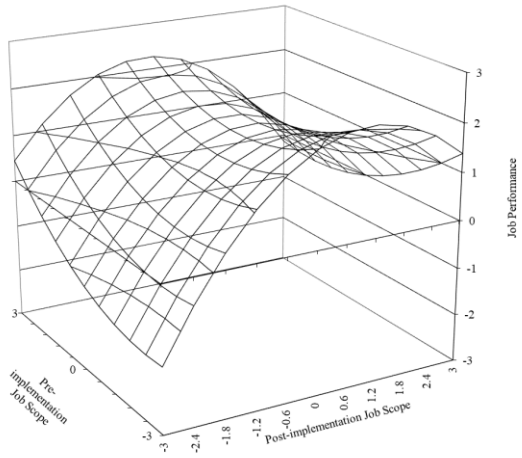
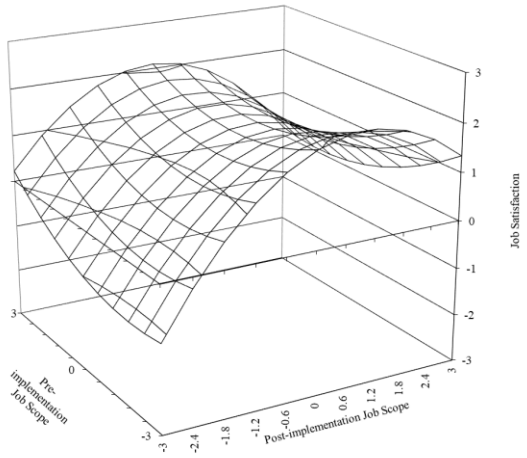


Figure 4: Response Surface Predicting Job Satisfaction



We examined the slopes of the surface along the X=Y and X=-Y lines. The quadratic slope for the X=Y line for both job outcomes was significant and negative (-.53*** for JPERF; -.44*** for JSAT). The quadratic slope for the X=-Y line was also significant and negative for both job outcomes (-.13** for JPERF; -.16*** for JSAT). Taken together, these slopes along the X=Y and X=-Y lines satisfy the theoretical constraints presented earlier and thereby support hypotheses H2c-d and H3c-d. We conducted several robustness checks. Results for these checks are presented in Online Appendix E.

DISCUSSION

Our objective was to develop and empirically test a polynomial model that investigated relationships among pre- and post-implementation job scope, ES use, and key post-implementation job outcomes—i.e., job performance and job satisfaction. Our year-long study among 2,794 employees lent support for the polynomial model predicting post-implementation job performance and job satisfaction. In response to calls for greater and more complex curvilinear relationships [9, 17, 57], this work developed and tested a curvilinear model of technology change and its attendant influence on job outcomes, and explained 70% variance in job performance and 73% variance in job satisfaction.

Viewed through an anchoring-and-adjustment theoretical lens, our results indicated that pre-implementation job scope (anchor), post-implementation job scope (adjustment), and the interaction between the two influenced job performance and job satisfaction. One of the key takeaways from this research is that an ES implementation influences both job design and job outcomes. Further, changes in job scope are one of most important—and often overlooked—factors in predicting post-implementation job performance and job satisfaction. Our results in an ES implementation context are consistent with some suggestions in the broader, related literatures. For example, Hsee and Abelson [32] suggest that satisfaction is a function of both *position* (i.e., the actual value of the satisfaction rating) and its *displacement* (i.e., the directional distance between the outcome and some reference point such as pre-implementation satisfaction). Similarly, Brown et al. [8] found that when comparing expectations and experiences, both the magnitude and the direction of deviations account for the changes in the outcomes. Our results suggest that displacement is important—but, that there are limits to the expected effect. In other words, small to medium displacement (e.g., from low job scope to medium) is likely to result in high post-implementation job performance and job satisfaction ratings. However, high displacement (e.g., from low job scope to high job scope), though positive, will not result in as high a rating of post-implementation job performance and job satisfaction.

The current work extended our understanding beyond a two-dimensional inverted-U relationship between job scope and job outcomes in the classic JCM research (for example, see [88]). Our research took a longitudinal perspective to understand employee reactions to change (see [88]) and developed a polynomial model that helps researchers and managers gain an understanding of the inherently *dynamic* nature of the impacts of organizational change due to an ES implementation. Such a perspective allowed us an expanded view that separated pre- and post-implementation job scope and examined their unique as well as combined effects on job outcomes. In examining the response surfaces represented by the pre- and post-implementation job scope and its effects on job outcomes, there are some key insights. Traditional

JCM research has noted an inverted-U relationship between job scope and job outcomes. Although this is consistent with our findings, we further clarify this relationship. Specifically, we found this relationship to be more complex such that: (1) job outcomes were dependent not only on post-implementation job scope, but also on the changes from pre- to post-implementation job scope; (2) although the medium (optimal) level of post-implementation job scope increased job outcomes, the increase was higher when job scope either increased from low pre-implementation job scope or decreased from high pre-implementation job scope; and (3) although high or low levels of post-implementation job scope decreased job outcomes, the decrease was higher when the pre-implementation job scope was at an medium (optimal) level.

The negative correlation between job scope and post-implementation job satisfaction is surprising and contrary to much prior research [20]. We have two possible explanations. It is possible that there were a large number of people who perceived their job scope to be exceptionally high both before and after the implementation. Technology companies are generally known to be very demanding of employees' time, with employees working long hours and that could have been the case here. Another possible reason is that employees had heard about the ES implementation and that, in turn, depressed job satisfaction from its pre-implementation level because of the impending change and uncertainty. Such a lowering could also have occurred/persisted after the implementation. Although lowered job satisfaction alone cannot cause negative correlations, an uneven job satisfaction across employees with different levels of job scope—i.e., greater depression among those with high job scope—could have produced negative correlations.

Theoretical Contributions and Implications

In highlighting the dynamic and complex influences of a new ES implementation on perceptions of job scope and job outcomes, this research extends current theoretical perspectives associated with technology adoption and use. Integrative efforts, such as the unified theory of acceptance and use of technology (UTAUT) [76, 81], have helped consolidate the theoretical perspectives related to intentions and use. Recent work (for examples, see [2, 56, 67, 68, 90]) has made great strides in moving from such

techno-centric outcomes of new ES implementations to understanding changes in underlying business processes. The current work contributes along these lines by moving beyond a focus on *use* as the end in itself to a focus on downstream *consequences* of technology-initiated organizational change. In doing so, we examined: (1) the dynamic nature of organizational change initiated by an ES implementation; (2) two key job outcomes, namely job performance [67] and job satisfaction [2], to present a more comprehensive model compared to the prior research; and (3) a more nuanced understanding of changes in job scope resulting in changes in job outcomes.

This research adds to the literature on ES implementations by challenging the linearity assumption in the ES implementation literature. Alvesson and Sandberg [1] argued that traditional gap-spotting research—i.e., identifying a research gap—reinforces existing assumptions rather than challenges them. Further, gap-spotting work has a confirmation bias in that it will tend to reinforce rather than challenge existing theories. They further note that challenging assumptions and changes to the fundamental nature of the existing theories is what makes a theory interesting. We challenge the linearity assumption underlying the JCM in general and in the ES implementation context in particular. One of main contributions of this research is that the downstream consequences of technology-initiated organizational change are complex and can be best represented by an expanded view that keeps pre- and post-implementation job scope separate and distinct. More specifically, if researchers were to either rely only on linear relationships or simple inverted-U relationships, it will lead to erroneous or incomplete findings. For example, focusing on linear relationships would have led to an erroneous finding that the key job outcomes of job performance or job satisfaction increased/decreased, as job scope increased following an ES implementation. Similarly, focusing on the inverted-U relationship may have led to an incomplete finding that a medium level of post-implementation job scope was the best, irrespective of the pre-implementation job scope. Relaxing the linearity assumption as well as the polynomial model we used led us to a more nuanced understanding of these curvilinear relationships. We not only found the relationships to be inverted U-shaped, but also found

that it was not the pre- or post-implementation job scope, rather it was the change in job scope, that was a critical determinant of job outcomes.

This research also contributes to the JCM literature by using anchoring-and-adjustment as the underlying theoretical mechanism to argue that job outcomes are not only a function of pre- and post-implementation job scope, but also the interaction between the two. Although research on the JCM is mature, little research in this domain has examined how changes in job scope, rather than the absolute job scope, can influence important job outcomes. Using pre-implementation job scope as the anchor and post-implementation job scope as the adjustment, this research extends the current JCM literature to better understand the complex and curvilinear relationships between job scope and important job outcomes. Specifically, the pattern of our results shows a dramatic variation in the influence of ES-based changes in job scope on both job performance and job satisfaction. In some cases, there was little, if any, impact, whereas, in other cases, the impact was dramatic. Perhaps the most striking finding is that moderate increases in job scope from low pre-implementation job scope (or conversely, moderate decreases from high pre-implementation job scope) resulted in high levels of post-implementation job performance and job satisfaction. Both cases represent examples of synergistic job redesign powered by an ES that can be best explained by incorporating both the pre-implementation—the anchor—and the post-implementation—the adjustment—job scope. Overall, this finding suggests that the relative *shift* in job scope, rather than the *absolute* level itself, has a profound impact on job outcomes.

Future research can build on the current work and focus on a variety of questions. For instance, there are many theories that explain job outcomes and it is important to determine which model best explains the outcomes. However, most of the models do not include any technology-related constructs. It may be possible that certain models, such as the dynamic model presented in the current work, are more appropriate for ES implementations and/or other major organizational change activities, whereas the traditional static models may be more appropriate in a stable organizational environment. Another question

relates to the range of factors that could influence job outcomes. We have focused on job scope and ES use. However, a more micro-level analysis might break down the dimensions of job scope, e.g., skill variety [25], and theorize at a more granular level by examining how that characteristic might influence job performance, job satisfaction, or other outcomes in the context of an ES implementation or a more narrowly defined technology application. Likewise, other job characteristics, such as the ones outlined in the job demands-control model that have been investigated in ES implementation contexts (see [3, 67, 69]), merit further scrutiny to see if the linearity assumptions of those models hold.

The focus of this work was job scope and job redesign. Future research should expand the nomological network to include established determinants of technology use and other outcomes associated with job scope. Our work provides a useful first step, and future research could examine job scope changes in the context of work overload, burnout, or exhaustion and their combined influences on job outcomes such as turnover intentions or actual turnover [45]. For example, Selye [61] in his seminal work posited that low and high levels of stress are often dysfunctional, with the optimal level being in the middle. Surveys of managers further support the notion that stress can have a positive, energizing influence on key outcomes, such as performance and satisfaction, if experienced in moderation [51]. Although stress was not measured directly in this research, it is a plausible mechanism for the complex adjustment effects observed in this research. Given the strong negative relationship between stress and job satisfaction [60], future research should study stress in this context [69].

Our study has three limitations that should be noted. First, organizational factors can influence changes in perceptions, particularly over longer periods of time. However, this constraint is hard to avoid in any field research, as it is an inherent part of studying organizational phenomena longitudinally. For example, our study was conducted in a large organization in the telecommunications industry during the implementation of an ES. Different business units and employees in business units may perceive different degrees of job transformation because of the nature of their job. Some business units may have had

access to the old system longer than the others. But these differences would be typical of virtually any ES implementation of any size and in any industry. We did not model potential differences across modules implemented and that could be a source of interesting future theorizing. Second, we used demographic variables as basic control variables, as is common in the literature. Future research should include specific individual-level variables as predictors of job outcomes because these variables could play an important role in determining employee participation in an organization. Third, although the study reported in this paper is longitudinal and consistent with extant ES implementation research, a more nuanced focus on time is essential to gain a richer understanding of the phenomenon (see [77, 84]). Finally, the current work uses a theory-driven polynomial model based on the decision-making mechanism of anchoring-and-adjustment. However, polynomial modeling as an analytical technique is based on the assumptions of ordinary least squares that the independent variables are measured without error. It is important to be careful of such measurement errors in polynomial modeling, as it involves use of higher-order terms. Although because of high reliabilities of all measures in our study (> .70), the likelihood of any biases because of measurement errors is limited, we recommend future research replicate our findings in other organizational settings.

Practical Implications

Our results are relevant for managers seeking to understand the impacts of an ES implementation on the organization and its employees. Instead of examining the alignment between business processes and technology, managers should consider implementing business processes that are embedded within the ES being implemented in the organization. Recent examples show that organizations now introduce workflow management tools that capture and optimize the business processes embedded within technologies that automate their organizational tasks [30]. These are important given the findings of our research. We found that that large changes in job scope stemming from an ES implementation in either direction were detrimental. As one might expect, employees with high pre-implementation job scope who perceived scope to be significantly lowered (perhaps due to routinization) had low post-implementation job

outcomes. Although counter to what some might expect, significant increases in job scope may result in overstimulation, also leading to relatively low levels of post-implementation job outcomes—exactly the effect that positive changes in job scope are often designed to prevent [88]. Therefore, this suggests that managers must keep the selected ES front-and-center when considering job redesign strategies to effectively manage the impact such implementations could have on employees and their jobs.

Organizations invest in ESs to improve performance [12]. Our results should serve as a caution to managers. Specifically, our results indicate that anticipated efficiency and effectiveness gains from major technology-driven transformations may come with the cost of low post-implementation job outcomes. Such an impact, if not properly managed, can lead to increased employee turnover or other counterproductive or withdrawal behaviors that may, in turn, result in additional costs (e.g., training, hiring) that offset gains reaped. This is particularly relevant to organizations today because technological systems often require constant upgrades. Such upgrades not only change the technological environment, but also have a profound impact on employee jobs. Therefore, practitioners should pay particular attention to the impact of an ES implementation and use on job performance and job satisfaction beyond the standard predictors commonly used in research and practice.

CONCLUSIONS

ESs are often hailed as a tool to make employees more effective and efficient in their jobs. Implementing new ESs in organizations, however, is complicated. Because of their transformational nature, new ES implementations not only alter workflows and business processes, but also have a profound impact on job outcomes. We demonstrated that the effects of such changes cannot be represented by a simple linear or even inverted-U relationships between job scope and job outcomes, as is often the case in classical JCM research. Using anchoring-and-adjustment as the underlying theoretical mechanism, the results here showed complex and curvilinear relationships between job scope and job outcomes such that the job outcomes were a function of the *changes* in job scope from a pre-implementation stage to the post-

implementation stage. The nuanced view presented in our research has implications for researchers as well as practitioners. For example, our results suggested that changes in job scope—even when job scope increased—does not necessarily result in high post-implementation job outcomes. Managers should, therefore, carefully view an ES as a key driver of job redesign and prepare and plan accordingly. To the degree that managers can effectively manage such job scope changes, they can have a positive effect on employees' perceptions about their job and have reason to be optimistic about job outcomes associated with the introduction of a new ES.

REFERENCES

1. Alvesson, M., and Sandberg, J. Generating research questions through problematization. *Academy of Management Review*, 36, 2 (2011), 247-271.
2. Bala, H., and Venkatesh, V. Changes in employees' job characteristics during an enterprise system implementation: A latent growth modeling perspective. *MIS Quarterly*, 37, 4 (2013), 1113-1140.
3. Bala, H., and Venkatesh, V. Adaptation to information technology: A holistic nomological network from implementation to job outcomes. *Management Science*, 62, 1 (2016), 156-179.
4. Beaudry, A., and Pinsonneault, A. Understanding user responses to information technology: A coping model of user adaptation. *MIS Quarterly,* 29, 3 (2005), 493-524.
5. Boudreau, M.-C., and Robey, D. Enacting integrated information technology: A human agency perspective. *Organization Science*, 16, 1 (2005), 3-18.
6. Brief, A.P., Van Sell, M., and Aldag, R.J. Job scope-employee reaction relationships: Methodological considerations. *Journal of Management*, 4, 2 (1978), 27-32.
7. Briggs, R.O., and Nunamaker, J.F. Special Section: The growing complexity of enterprise software, *Journal of Management Information Systems*, 37, 3 (2021), 313-315.
8. Brown, S.A., Venkatesh, V., and Goyal, S. Expectation confirmation in technology use. *Information Systems Research*, 23, 2 (2012), 474-487.
9. Brown, S.A., Venkatesh, V., and Goyal, S. Expectation confirmation in information systems research: A test of six competing models. *MIS Quarterly*, 38, 3 (2014), 729-756.
10. Campion, M.A., and McClelland, C.L. Follow-up and extension of the interdisciplinary costs and benefits of enlarged jobs. *Journal of Applied Psychology*, 78, 3 (1993), 339-351.
11. Champoux, J.E. A multivariate analysis of curvilinear relationships among job scope, work context satisfactions, and affective outcomes. *Human Relations*, 45, 1 (1992), 87-111.
12. Dong, J.Q., Karhade, P.P., Rai, A., and Xu, S.X. How firms make information technology investment decisions: Toward a behavioral agency theory. *Journal of Management Information Systems*, 38, 1 (2021), 29-58.
13. Edwards, J.R., and Parry, M.E. On the use of polynomial regression equations as an alternative to difference scores in organizational research. *Academy of Management Journal*, 36, 6 (1993), 1577-1613.
14. Edwards, J.R., and Van Harrison, R. Job demands and worker health: Three-dimensional reexamination of the relationship between person-environment fit and strain. *Journal of Applied Psychology*, 78, 4 (1993), 628-648.
15. Edwards, J.R. Alternatives to difference scores as dependent variables in the study of congruence in organizational research. *Organizational Behavior and Human Decision Processes*, 64, 3 (1995), 307-324.

16. Edwards, J.R. *Alternatives to difference scores: Polynomial regression analysis and response surface methodology*. San Francisco, CA: Jossey-Bass/Pfeiffer, 2002.
17. Edwards, J.R., and Berry, J.W. The presence of something or the absence of nothing: Increasing theoretical precision in management research. *Organizational Research Methods*, 13, 4 (2010), 668-689.
18. Evans, M.G. The problem of analyzing multiplicative composites: Interactions revisited. *American Psychologist*, 46, 1 (1991), 6-15.
19. Fan, W., Moen, P., Kelly, E.L., Hammer, L.B., and Berkman, L.F. Job strain, time strain, and well-being: A longitudinal, person-centered approach in two industries. *Journal of Vocational Behavior*, 110, 2 (2019), 102-116.
20. Ferris, D.L., Johnson, R.E., Rosen, C.C., Djurdjevic, E., Chang, C.-H., and Tan, J.A. When is success not satisfying? Integrating regulatory focus and approach/avoidance motivation theories to explain the relation between core self-evaluation and job satisfaction. *Journal of Applied Psychology*, 98, 2 (2012), 342-363.
21. French, J.R., Caplan, R.D., and Van Harrison, R. The mechanisms of job stress and strain. New York, NY: Wiley, 1982.
22. Fried, Y., and Ferris, G.R. The validity of the job characteristics model: A review and meta-analysis. *Personnel Psychology*, 40, 2 (1987), 287-322.
23. Furnham, A., and Boo, H.C. A literature review of the anchoring effect. *Journal of Socio-Economics*, 40, 1 (2011), 35-42.
24. Gartner. Gartner Says Global IT Spending to Decline 8% in 2020 Due to Impact of COVID-19. *https://www.gartner.com/en/newsroom/press-releases/2020-05-13-gartner-says-global-it-spending-to-decline-8-percent-in-2020-due-to-impact-of-covid19*, 2020. Last accessed: January 25, 2021.
25. Griffin, R.W., Moorhead, G., Johnson, B.H., and Chonko, L.B. The empirical dimensionality of the job characteristic inventory. *Academy of Management Journal*, 23, 4 (1980), 772-777.
26. Hackman, J.R., and Lawler, E.E. Employee reactions to job characteristics. *Journal of Applied Psychology*, 55, 3 (1971), 259-286.
27. Hackman, J.R., and Oldham, G.R. The job diagnostic survey: An instrument for the diagnosis of jobs and the evaluation of job redesign projects (Report No. 4). New Haven, CT: Yale University, Department of Administrative Sciences, 1974.
28. Hackman, J.R., and Oldham, G.R. Motivation through the design of work: Test of a theory. *Organizational Behavior and Human Performance*, 16, 2 (1976), 250-279.
29. Hackman, J.R., and Oldham, G.R. *Work redesign*. Reading, MA: Addison-Wesley, 1980.
30. Hanna, T. Camunda Launches New Workflow Technology, Camunda Cloud. *https://solutionsreview.com/business-process-management/camunda-launches-new-workflow-technology-camunda-cloud/*, 2019. Last accessed: September 16, 2021.
31. Helson, H. *Adaptation-level theory*. New York, NY: Harper & Row, 1964.
32. Hsee, C.K., and Abelson, R.P. Velocity relation: Satisfaction as a function of the first derivative of outcome over time. *Journal of Personality and Social Psychology*, 60, 3 (1991), 341-347.
33. Huang, T.P. Comparing motivating work characteristics, job satisfaction, and turnover intention of knowledge workers and blue-collar workers, and testing a structural model of the variables' relationships in China and Japan. *International Journal of Human Resource Management*, 22, 4 (2011), 924-944.
34. Irving, P.G., and Meyer, J.P. Reexamination of the met-expectations hypothesis: A longitudinal analysis. *Journal of Applied Psychology*, 79, 6 (1994), 937-949.
35. Janssen, O., Lam, C.K., and Huang, X. Emotional exhaustion and job performance: The moderating roles of distributive justice and positive affect. *Journal of Organizational Behavior*, 31, 6 (2010), 787-809.
36. Johns, G. The essential impact of context on organizational behavior. *Academy of Management Review*, 31, 2 (2006), 386-408.

37. Konradt, U., Hertel, G., and Schmook, R. Quality of management by objectives, task-related stressors, and non-task-related stressors as predictors of stress and job satisfaction among teleworkers. *European Journal of Work and Organizational Psychology*, 12, 1 (2003), 61-79.
38. Lai, V.S., Lai, F., and Lowry, P.B. Technology evaluation and imitation: Do they have differential or dichotomous effects on ERP adoption and assimilation in China? *Journal of Management Information Systems*, 33, 4 (2016), 1209-1251.
39. Lambert, L.S., Edwards, J.R., and Cable, D.M. Breach and fulfillment of the psychological contract: A comparison of traditional and expanded views. Personnel Psychology, 56, 4 (2003), 895-934.
40. Lee, K., and Duffy, M.K. A functional model of workplace envy and job performance: When do employees capitalize on envy by learning from envied targets? *Academy of Management Journal*, 62, 4 (2019), 1085-1110.
41. Liang, H., Saraf, N., Hu, Q., and Xue, Y. Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 31, 1 (2007), 59-87.
42. Lindell, M.K., and Whitney, D.J. Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, 86, 1 (2001), 114-122.
43. Mackelprang, A.W., and Malhotra, M.K. The impact of bullwhip on supply chains: Performance pathways, control mechanisms, and managerial levers. *Journal of Operations Management*, 36 (2015), 15-32.
44. Malhotra, N.K., Kim, S.S., and Patil, A. Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management Science*, 52, 12 (2006), 1865-1883.
45. Moore, J.E. One road to turnover: An examination of work exhaustion in technology professionals. *MIS Quarterly*, 24, 1 (2000), 141-168.
46. Morin, A.J.S., Meyer, J.P., McInerney, D.M., Marsh, H.W., and Ganotice Jr., F.A. Profiles of dual commitment to the occupation and organization: Relations to well-being and turnover intentions. *Asia Pacific Journal of Management*, 32, 3 (2015), 717-744.
47. Morris, M.G., and Venkatesh, V. Job characteristics and job satisfaction: Understanding the role of enterprise resource planning system implementation. *MIS Quarterly*, 34, 1 (2010), 143-161.
48. Mowday, R.T., and Spencer, D.G. The influence of task and personality characteristics on employee turnover and absenteeism incidents. *Academy of Management Journal*, 24, 3 (1981), 634-642.
49. Mushtaq, R., Raja, U., and Khan, M.B. Unpacking the combined effects of job scope and supervisor support on in-role performance. *Journal of Management Development*, 36, 9 (2017), 1170-1179.
50. Mussweiler, T., and Englich, B. Subliminal anchoring: Judgmental consequences and underlying mechanisms. *Organizational Behavior and Human Decision Processes*, 98, 2 (2005), 133-143.
51. Newbegin, C. The stress epidemic. *InnovAiT: Education and Inspiration for General Practice*, 7, 1 (2014), 36-40.
52. Orlikowski, W.J. CASE tools as organizational change: Investigating incremental and radical changes in systems development. *MIS Quarterly*, 17, 3 (1993), 309-340.
53. Parker, S.K., Wall, T.D., and Cordery, J.L. Future work design research and practice: Towards an elaborated model of work design. *Journal of Occupational and Organizational Psychology*, 74, 4 (2001), 413-440.
54. Peltokorpi, V., Allen, D.G., and Froese, F. Organizational embeddedness, turnover intentions, and voluntary turnover: The moderating effects of employee demographic characteristics and value orientations. *Journal of Organizational Behavior*, 36, 2 (2015), 293-312.
55. Porter, C.M., Posthuma, R.A., Maertz Jr, C.P., Joplin, J.R.W., Rigby, J., Gordon, M., and Graves, K. On-the-job and off-the-job embeddedness differentially influence relationships between informal job search and turnover. *Journal of Applied Psychology*, 104, 5 (2019), 673-689.
56. Qahri-Saremi, H., and Turel, O. Ambivalence and coping responses in post-adoptive information

systems use. *Journal of Management Information Systems*, 37, 3 (2020), 820-848.
57. Raja, U., and Johns, G. The joint effects of personality and job scope on in-role performance, citizenship behaviors, and creativity. *Human Relations*, 63, 7 (2010), 981-1005.
58. Ramasubbu, N., and Kemerer, C.F. Controlling technical debt remediation in outsourced enterprise systems maintenance: An empirical analysis. *Journal of Management Information Systems*, 38, 1 (2021), 4-28.
59. Robert Jr, L.P., and Sykes, T.A. Extending the concept of control beliefs: Integrating the role of advice networks. *Information Systems Research*, 28, 1 (2017), 84-96.
60. Schaubroeck, J., and Ganster, D.C. Chronic demands and responsivity to challenge. *Journal of Applied Psychology*, 78, 1 (1993), 73-85.
61. Selye, H. *The stress of life*. Toronto, Canada: McGraw-Hill, 1956.
62. Shaw, J.D., and Gupta, N. Job complexity, performance, and well-being: When does supplies-values fit matter? *Personnel Psychology*, 57, 4 (2004), 847-879.
63. Simmering, M.J., Colquitt, J.A., Noe, R.A., and Porter, C.O.L.H. Conscientiousness, autonomy fit, and development: A longitudinal study. *Journal of Applied Psychology*, 88, 5 (2003), 954-963.
64. Staw, B.M., and Cohen-Charash, Y. The dispositional approach to job satisfaction: More than a mirage, but not yet an oasis. *Journal of Organizational Behavior*, 26, 1 (2005), 59-78.
65. Stone, E.F. The moderating effect of work-related values on the job scope-job satisfaction relationship. *Organizational Behavior and Human Performance*, 15, 2 (1976), 147-167.
66. Sykes, T.A., Venkatesh, V., and Johnson, J.L. Enterprise system implementation and employee job performance: Understanding the role of advice networks. *MIS Quarterly*, 38, 1 (2014), 51-72.
67. Sykes, T.A. Support structures and their impacts on employee outcomes: A longitudinal field study of an enterprise system implementation. *MIS Quarterly*, 39, 2 (2015), 473-496.
68. Sykes, T.A., and Venkatesh, V. Explaining post-implementation employee system use and job performance: Impacts of the content and source of social network ties. *MIS Quarterly*, 41, 3 (2017), 283-302.
69. Sykes, T.A. Enterprise system implementation and employee job outcomes: Understanding the role of formal and informal support structures using the job strain model. *MIS Quarterly*, 44, 4 (2020), 2055-2086.
70. Szajna, B., and Scamell, R.W. The effects of information system user expectations on their performance and perceptions. *MIS Quarterly*, 17, 4 (1993), 493-516.
71. Thatcher, J.B., McKnight, D.H., Baker, E.W., Arsal, R.E., and Roberts, N.H. The role of trust in postadoption IT exploration: An empirical examination of knowledge management systems. *IEEE Transactions on Engineering Management*, 58, 1 (2010), 56-70.
72. Thong, J.Y., Yap, C.S., and Seah, K.L. A consolidated methodology for business process reengineering. *International Journal of Computer Applications in Technology*, 17, 1 (2003), 1-15.
73. Tversky, A., and Kahneman, D. Judgment under uncertainty: Heuristics and biases. *Science*, 185, 4157 (1974), 1124-1131.
74. Van den Berg, P.T., and Feij, J.A. Complex relationships among personality traits, job characteristics, and work behaviors. *International Journal of Selection and Assessment*, 11, 4 (2003), 326-339.
75. Venkatesh, V. Determinants of perceived ease of use: Integrating perceived behavioral control, computer anxiety and enjoyment into the technology acceptance model. *Information Systems Research*, 11, 4 (2000), 342-365.
76. Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 3 (2003), 425-478.
77. Venkatesh, V., Maruping, L.M., and Brown, S.A. Role of time in self-prediction of behavior. *Organizational Behavior and Human Decision Processes*, 100, 2 (2006), 160-176.
78. Venkatesh, V., Brown, S.A., Maruping, L.M., and Bala, H. Predicting different conceptualizations of

system use: The competing roles of behavioral intention, facilitating conditions, and behavioral expectation. *MIS Quarterly*, 32, 3 (2008), 483-502.
79. Venkatesh, V., and Goyal, S. Expectation disconfirmation and technology adoption: Polynomial modeling and response surface analysis. *MIS Quarterly*, 34, 2 (2010), 281-303.
80. Venkatesh, V., Thong, J.Y.L., and Xu, X. Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36, 1 (2012), 157-178.
81. Venkatesh, V., Thong, J.Y.L., and Xu, X. Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of Association for Information Systems*, 17, 5 (2016), 328-376.
82. Venkatesh, V., Windeler, J.B., Bartol, K.M., and Williamson, I.O. Person-organization and person-job fit perceptions of new IT employees: Work outcomes and gender differences. *MIS Quarterly*, 41, 2 (2017), 525-558.
83. Venkatesh, V., Sykes, T.A., Chan, F.K.Y., Thong, J.Y.L., and Hu, P.J.-H. Children's internet addiction, family-to-work conflict, and job outcomes: A study of parent-child dyads. *MIS Quarterly*, 43, 3 (2019), 903-927.
84. Venkatesh, V., Sykes, T.A., Aljafari, R., and Poole, M.S. The future is now: Calling for a focus on temporal issues in Information System research. *Industrial Management & Data Systems,* 121, 1 (2021), 30-47.
85. Wegman, L.A., Hoffman, B.J., Carter, N.T., Twenge, J.M., and Guenole, N. Placing job characteristics in context: Cross-temporal meta-analysis of changes in job characteristics since 1975. *Journal of Management*, 44, 1 (2018), 352-386.
86. Weske, M. Evolution of enterprise systems architectures, *Business Process Management,* Berlin, Heidelberg: Springer, 2019.
87. Whyte, G., and Sebenius, J.K. The effect of multiple anchors on anchoring in individual and group judgment. *Organizational Behavior and Human Decision Processes*, 69, 1 (1997), 74-85.
88. Xie, J.L., and Johns, G. Job scope and stress: Can job scope be too high? *Academy of Management Journal*, 38, 5 (1995), 1288-1309.
89. Yan, M., Peng, K.Z., and Francesco, A.M. The differential effects of job design on knowledge workers and manual workers: A quasi-experimental field study in China. *Human Resource Management*, 50, 3 (2011), 407-424.
90. Zhao, X., Tian, J., and Xue, L. Herding and software adoption: A re-examination based on post-adoption software discontinuance. *Journal of Management Information Systems*, 37, 2 (2020), 484-509.

ONLINE APPENDIX A
SUMMARY OF ORGANIZATIONAL CHANGE LITERATURE

Information Systems (IS) research often investigates complex organizational phenomena. Sarker et al. [27], for example, recently provided an example of a complex, multidimensional, and a messy phenomenon with which IS researchers have to contend. Such complexity often arises because different users may appropriate the same technology in different ways. Valacich et al. [32] and Valacich et al. [33], for example, note that people often have different preferences for technology features in different evaluation contexts. Because of such complexity, IS researchers tend to use cutting-edge tools to test hypotheses. Califf et al. [9], for example, recently examined technostress among healthcare workers using a mixed-methods design. In this appendix, we summarize prior IS research relevant to the current research.

Complementing our literature review section, this appendix presents an organization and associated summary of literature primarily on the methodology used in the organizational change, job characteristics, and the enterprise system (ES) implementation literature. We conducted extensive searches using Web of Science and Google Scholar. We focused primarily on leading journals in IS, such as *Journal of Management Information Systems,* because these journals not only represent leading journals of the field, but also present cutting-edge theoretical advances in our field. In order to find the relevant research, we searched for keywords, such as organizational change, enterprise systems and IT implementations, and selected research published in the last decade. To help underscore the appropriateness of our approach and the value of our approach, we organize and summarize the studies that we found in two ways. The first organization and associated summary presents how IS research has modeled change in organizations. In particular, we focus on change stemming from a new IT implementation, similar to the context of the current work. The second organization and associated summary presents IS research that has used polynomial modeling to model complex curvilinear relationships.

Table A1 summarizes several modeling techniques IS research has used to study organizational change. The spectrum of modeling techniques used to examine change has ranged from ordinary least squares to more sophisticated analytical techniques such as econometric modeling [1, 3], generalized linear mixed modeling [5], hierarchical linear modeling [28], latent growth modeling [2, 37], mixed-methods [35], polynomial modeling [28], qualitative modeling [24], and social network analysis [13, 28, 31]. Valacich and his colleagues (for examples, see [14] and [16]) have argued that each scientific method has its strengths and its weaknesses. Valacich and his colleagues further contend that, because all research methods are imperfect, it is not wise to claim any one method is better than the other and "no single method can provide a complete picture of the phenomena we study" ([16]; p. 214). In a similar vein, Sarker et al. [25] recently recommended investigating IS phenomena from multiple theoretical as well as methodological perspectives to expand the boundaries of a theory.

In calling for a quest for scientific advancement, Dennis and Valacich [15] encouraged IS researchers to re-examine prior theories using new context and analytical techniques. One way IS researchers have done so is by examining complex relationships in order to better understand organizational change. For example, in advocating for the use of a qualitative approach, Strong and Volkoff [29] note that "misfits [between an ES and its users] can be experienced differently by different people, but in all cases will be observed as incidents of individuals feeling that the ES is impeding the proper execution of organizational operations" (p. 733). Similarly, in examining the effects of the introduction of a new patient portal IT, Bao et al. [3] used two different econometric models because the traditional models would not allow them to model the complexities of the patient-provider relationships. Atasoy et al. [1], Bala and Venkatesh [2], Deng and Chi [13], Sasidharan et al. [28], and Sykes and Venkatesh [31] all examined how an ES implementation will influence the organization over time. However, the modeling techniques used in these studies varied. Perhaps this is because these researchers viewed an ES implementation as the complex phenomenon that it is and, as some (e.g., [2, 14, 16, 26]) note different analytical techniques help

answer different questions and shed light on the phenomenon in different ways. Zheng et al. [37], for example, argue that the "notions of time lag, duration, and rate of change are key parameters when integrating time into research hypotheses" (p. 548). Zheng et al. [37] encourage IS researchers to consider latent growth modeling to study relationships among variables that change over time. In the context of an ES implementation, Bala and Venkatesh [2] used latent growth modeling to examine changes in employee job characteristics during an ES implementation. Similarly, Venkatesh and Goyal [34] present polynomial modeling as an approach to study change when the outcome variable is a factor of both the pre- and post-implementation variables. The anchoring and adjustment theoretical perspective we used in the current research argues that the job outcomes are a factor of both the pre- and post-implementation job scope, thus making polynomial modeling appropriate for the current work, as it specifically allows to keep pre- and post-implementation measures separate and allows the examination of complex interactions between pre- and post-implementation variables in influencing outcomes, which we elaborate upon next.

Table A2 summarizes several IS phenomena studied using polynomial modeling. Sarker et al. [26] note that "the boundaries of IS research continue to expand due to the rapid development of information technology, the acceptance of new research paradigms, the emergence of newer research methodologies and models" (p. 1903). Over the last decade, many researchers have expanded the boundaries of IS research by using new techniques, such as polynomial modeling, to model organizational change [1, 7, 20, 34]. A common theme across this literature is that when studying change, it is critical to accurately account for user perceptions at different points of time because these perceptions would have a unique impact as well as a combined impact on organizational outcomes [7, 34]. For example, using polynomial modeling and response surface methodology, Brown et al. [6] challenged the traditional expectation disconfirmation literature and modeled drivers of technology use. Allowing for complex curvilinear relationships, Brown et al. [6] found that behavior was driven by both the direction as well as the magnitude of deviations of the experiences from the expectations (see also, [7]). Similarly, Chatterjee et al. [10] found that their non-linear

analyses revealed relationships that were often very different from what linear analysis revealed. Recently, Chau et al. [11] used moderated polynomial modeling to investigate the synergistic effects of business–IT strategic alignment, misalignment, and effectiveness of IT governance. Again, finding support for complex curvilinear relationships, Chau et al. [11] noted that the governance in proactive organizations positively moderated the curvilinear relationship between (mis)alignment and firm performance. The key underlying theme in these studies is that oversimplifying complex curvilinear relationships might result in ambiguous and in some cases mask the true relationships among variables. For example, Chau et al. [11] note that "if we do not go beyond studying linear relationships from IT governance to alignment, we may mask critical elements of the interplay between these concepts" (p. 1681). Complex curvilinear relationships allow IS researchers to test a full range of hypotheses explaining the outcome variables and allow practitioners to develop more targeted interventions [34]. Perhaps this is one of the reasons why polynomial modeling has been used recently to study several other important IS phenomena. For example, recently Nishant et al. [23] used polynomial modeling to investigate how consumers respond to gaps in service quality perceptions of e-government sites and Maruping et al. [21] used polynomial modeling to study the contribution activity among open-source developers. In the current research, polynomial modeling allowed us to model the unique as well as joint influence of pre- and post-implementation job scope on job outcomes. Such a model incorporated complex curvilinear relationships and helped us challenge the rational "technological imperative" to suggest that the influence of a new ES implementation on key job outcomes is neither uniform nor deterministic.

Table A1: Summary of prior IS research studying change

Research Study	Independent Variable	Dependent Variable	Key Findings
Atasoy et al. (2016) [1]	Enterprise system use and web application use	Firm employment	Using a firm fixed effects model, examined the effects of the use of enterprise systems and web application systems on firm-level employment over time.
Bala and Venkatesh (2013) [2]	Perceived technology complexity, perceived process complexity, job demands, and job control	Job satisfaction	Using latent growth modeling, examined changes in employee job characteristics during an enterprise system implementation.
Bao et al. (2020) [3]	Effective use of patient portal	Number of patient visits	Using two econometric models—i.e., two-way fixed effects model with instrumental variables and difference-in-difference analysis—examined the impact of the introduction of patient portal IT on patient's health outcomes.
Brohman et al. (2020) [5]	Technology feedback	Outcome, corrective, and personal feedback	Using generalized linear mixed modeling, examined the impact of the introduction of telemonitoring technology on the treatment of patients with chronic diseases.
Brown et al. (2012) [6]	Expectations, posteriori evaluations of perceived usefulness	Technology use	Using polynomial modeling, investigated the complex interactions between expectations and experiences in determining technology use. Found that both magnitude and direction of deviations were relevant to determine outcome of technology use.
Chen et al. (2010) [12]	CIO human capital, structural power, org. support for IT	IT contribution to firm efficiency/ strategic growth	Using partial least squares, developed a staged maturity relationship between CIO supply-side and demand-side leadership.
Deng and Chi (2012) [13]	Problem records and personal interviews	System-use problems	Using a combined method of revealed causal mapping and in-depth network analysis, investigated user-reported problems with a new enterprise system in a large organization.
Krancher et al. (2018) [19]	Platform-as-a-service capabilities	Team agility	Using a grounded theory approach, investigated the impact of Platform-as-a-Service on software development.
Sarker and Lee (2003) [24]	Leadership, communication, and empowerment	ERP implementation success	Using a qualitative approach, found that committed leadership, open and honest communication, and a balanced and empowered implementation team contribute to ERP implementation success.

Sasidharan et al. (2012) [28]	Social network measures of centrality and centralization	Information quality, task impact, unit level work impact	Using hierarchical linear modeling and social network analysis, examined the effects of social network structure on the enterprise system implementation success.
Strong and Volkoff (2010) [29]	Open-ended interviews	Types of misfits	Using qualitative analysis, examined misfit between an organization and enterprise system implementation.
Sun (2013) [30]	Predictors of technology adoption	Intentions to use	Using a path model tested using partial least squares, examined the conditions under which consumers make technology adoption over time.
Sykes and Venkatesh (2017) [31]	Content and source of social network ties	Deep structure use and job performance	Using social network analysis, examined how changes in social network ties from an enterprise system implementation affect deep structure use and job performance.
Venkatesh and Goyal (2010) [34]	Expected and experienced perceived usefulness and attitude	Behavioral intention	Used polynomial models to investigate how and why user reactions change over time. Arguing for complex curvilinear relationships, provided a richer and more accurate understanding of the expectation disconfirmation in the technology adoption research. Confirmation at high-level resulted in better outcomes than confirmation at lower-levels.
Yaragi et al. (2015) [36]	Degree centrality and between centrality	Access, time to adopt, and practice efficiency	Using linear regression, examined the transition from traditional systems to health information exchange as a multisided platform over time.
Zheng et al. (2014) [37]	E-commerce data such as release date, price	Sales rank and sales volume	Proposed latent growth modeling to study change over time in IS research.

Table A2: Summary of prior IS research using polynomial modeling

Research Study	Independent Variable	Dependent Variable	Key Findings
Benlian (2013) [4]	Expected and perceived IS service quality	User satisfaction	Using polynomial modeling, examined the nonlinear and asymmetric effect mechanisms arising from perceptual congruence that may affect user satisfaction. Results showed that the direction of incongruence impacts user satisfaction.
Brown et al. (2014) [7]	Expectations, experiences of perceived usefulness	Behavioral intention, use, satisfaction	Using polynomial modeling, addressed ambiguities in the expectation confirmation research in IS. Comparing various expectations disconfirmation models, investigated drivers of technology use.

Bruccoleri et al. (2019) [8]	Group decision consensus, shared leadership	Group project Performance	Using moderated polynomial modeling, investigated the nonlinear relationship among group decision consensus, shared leadership, and group project performance.
Chau et al. (2020) [11]	IT governance and proactiveness	Firm performance	Used moderated polynomial models to investigate the synergistic effects of business–IT strategic alignment, misalignment, and effectiveness of IT governance on firm performance. Found that effective IT governance in proactive organizations positively moderated the curvilinear relationship between alignment, misalignment, and firm performance.
Gefen and Pavlou (2012) [17]	Perceived effectiveness of institutional structures, trust, risk	Purchasing Intention	Using a moderated polynomial model, investigated the moderation effects of trust and risk on the complex nonlinear relationship between perceived effectiveness of institutional structures and transaction activity.
Goode et al. (2017) [18]	Expected and experienced compensation	Service quality, continuance intentions	Using polynomial modeling, demonstrated that a modified assimilation–contrast model explained perceptions of service quality and continuance intention while a generalized negativity model explained repurchase intention. Found that magnitude of disconfirmation has implications for service quality and continuance intentions.
Lankton et al. (2016) [20]	Expectation and experiences technology trust	Trusting intention	Using polynomial modeling, demonstrated that the nonlinear relationship of disconfirmation with trusting intention is dependent upon the level of expectation maturity.
Maruping et al. (2019) [21]	OSS values	Developer contributions	Using moderated polynomial modeling, investigated how value congruence and incongruence impact commitment and contribution activity among OSS developers.
Narayanas-wamy et al. (2013) [22]	Influence tactics	Control loss	Using polynomial modeling, examined the relationship between project manager and team members to argue that the level of agreement and degree of shared understanding will influence control loss.
Nishant et al. (2019) [23]	Expected and perceived IS Service Quality	Continued use intention	Used polynomial modeling to investigate how users respond to the service quality perception-expectation gap in e-government websites. Found that e–government service quality had a more complex relationship with outcomes such that higher perceived service quality and higher expected service quality both contribute to greater continued use intentions.

REFERENCES

1. Atasoy, H., Banker, R.D., and Pavlou, P.A. On the longitudinal effects of IT use on firm-level employment. *Information Systems Research*, 27, 1 (2016), 6-26.
2. Bala, H., and Venkatesh, V. Changes in employees' job characteristics during an enterprise system implementation: A latent growth modeling perspective. *MIS Quarterly,* 37,4 (2013), 1113-1140.
3. Bao, C., Bardhan, I.R., Singh, H., Meyer, B.A., and Kirksey, K. Patient–provider engagement and its impact on health outcomes: A longitudinal study of patient portal use. *MIS Quarterly*, 44, 2 (2020) 699-723.
4. Benlian, A. Effect mechanisms of perceptual congruence between information systems professionals and users on satisfaction with service. *Journal of Management Information Systems*, 29, 4 (2013), 63-96.
5. Brohman, K., Addas, S., Dixon, J., and Pinsonneault, A. Cascading feedback: A longitudinal study of a feedback ecosystem for telemonitoring patients with chronic disease. *MIS Quarterly*, 44, 1 (2020) 421-450.
6. Brown, S.A., Venkatesh, V., and Goyal, S. Expectation confirmation in technology use. *Information Systems Research*, 23, 2 (2012), 474-487.
7. Brown, S.A., Venkatesh, V., and Goyal, S. Expectation confirmation in Information Systems research. *MIS Quarterly*, 38, 3 (2014), 729-757.
8. Bruccoleri, M., Riccobono, F., and Größler, A. Shared leadership regulates operational team performance in the presence of extreme decisional consensus/conflict: Evidences from business process reengineering. *Decision Sciences*, 50, 1 (2019), 46-83.
9. Califf, C.B., Sarker, S., and Sarker, S. The bright and dark sides of technostress: A mixed-methods study involving healthcare IT. *MIS Quarterly*, 44, 2 (2020) 809-856.
10. Chatterjee, S., Sarker, S., and Valacich, J.S. The behavioral roots of information systems security: Exploring key factors related to unethical IT use. *Journal of Management Information Systems*, 31, 4 (2015), 49-87.
11. Chau, D.C.K., Ngai, E.W.T., Gerow, J.E., and Thatcher, J.B. The effects of business–IT strategic alignment and IT governance on firm performance: A moderated polynomial regression analysis. *MIS Quarterly*, 44, 4 (2020) 1679-1703.
12. Chen, D.Q., Preston, D.S., and Xia, W. Antecedents and effects of CIO supply-side and demand-side leadership: A staged maturity model. *Journal of Management Information Systems*, 27, 1 (2010), 231-271.
13. Deng, X., and Chi, L. Understanding post-adoptive behaviors in Information Systems use: A longitudinal analysis of system use problems in the business intelligence context. *Journal of Management Information Systems*, 29, 3 (2012), 291-325.
14. Dennis, A.R., and Valacich, J.S. Conducting experimental research in Information Systems. *Communications of the Association for Information Systems*, 7, 5 (2001), 1-4.
15. Dennis, A.R., and Valacich, J.S. A replication manifesto. *AIS Transactions on Replication Research*, 1, 1 (2014), 1-4.
16. Dennis, A.R., Valacich, J.S., and Brown, S.A. A comment on “Is Information Systems a Science?”. *Communications of the Association for Information Systems*, 43, 4 (2018), 211-216.
17. Gefen, D., and Pavlou, P.A. The boundaries of trust and risk: The quadratic moderating role of institutional structures. *Information Systems Research*, 23, 3 (2012), 940-959.
18. Goode, S., Hoehle, H., Venkatesh, V., and Brown, S.A. User compensation as a data breach recovery action: An investigation of the Sony PlayStation network breach. *MIS Quarterly*, 41, 3 (2017), 703-727.
19. Krancher, O., Luther, P., and Jost, M. Key affordances of platform-as-a-service: Self-organization and continuous feedback. *Journal of Management Information Systems*, 35, 3 (2018), 776-812.
20. Lankton, N.K., McKnight, D.H., Wright, R.T., and Thatcher, J.B. Using expectation disconfirmation theory and polynomial modeling to understand trust in technology. *Information Systems Research*, 27, 1 (2016), 197-213.

21. Maruping, L.M., Daniel, S.L., and Cataldo, M. Developer centrality and the impact of value congruence and incongruence on commitment and code contribution activity in open source software communities. *MIS Quarterly*, 43, 3 (2019), 951-976.
22. Narayanaswamy, R., Grover, V., and Henry, R.M. The impact of influence tactics in Information System development projects: A control-loss perspective. *Journal of Management Information Systems*, 30, 1 (2013), 191-225.
23. Nishant, R., Srivastava, S.C., and Teo, T.S. Using polynomial modeling to understand service quality in e–government websites. *MIS Quarterly*, 43, 3 (2019), 807-826.
24. Sarker, S., and Lee, A.S. Using a case study to test the role of three key social enablers in ERP implementation. *Information & Management*, 40, 8 (2003), 813-829.
25. Sarker, S., Chatterjee, S., Xiao, X., and Elbanna, A. The sociotechnical axis of cohesion for the IS discipline: ITs historical legacy and its continued relevance. *MIS Quarterly*, 43, 3 (2019), 695-720.
26. Sarker, S., Palvia, P., Oguz, A., Wu, C., and Xiao, X. A brief retrospective (2013-2019). *Journal of the Association for Information Systems*, 20, 12 (2019), 1901-1915.
27. Sarker, S., Suprateek, S., Jensen, T., and Hedman, J. The use of blockchain as a resource for combating corruption in global shipping: An interpretive case study. *Journal of Management Information Systems* (forthcoming).
28. Sasidharan, S., Santhanam, R., Brass, D.J., and Sambamurthy, V. The effects of social network structure on enterprise systems success: A longitudinal multilevel analysis. *Information Systems Research*, 23, 3 (2012), 658-678.
29. Strong, D.M., and Volkoff, O. Understanding organization-enterprise system fit: A path to theorizing the information technology artifact. *MIS Quarterly* 34, 4, (2010), 731-756.
30. Sun, H. A longitudinal study of herd behavior in the adoption and continued use of technology. *MIS Quarterly* 37, 4, (2013), 1013-1041.
31. Sykes, T.A., and Venkatesh, V. Explaining post-implementation employee system use and job performance: Impacts of the content and source of social network ties. *MIS Quarterly*, 41, 3 (2017), 917-936.
32. Valacich, J.S., Wang, X., and Jessup, L.M. Did I buy the wrong gadget? How the evaluability of technology features influences technology feature preferences and subsequent product choice. *MIS Quarterly* 42, 2 (2018), 633-644.
33. Valacich, J.S., Parboteeah, D.V., and Wells, J.D. The online consumer's hierarchy of needs. *Communications of the ACM*, 50, 9 (2007), 84-90.
34. Venkatesh, V., and Goyal, S. Expectation disconfirmation and technology adoption: Polynomial modeling and response surface analysis. *MIS Quarterly* 34, 2 (2010), 281-303.
35. Xiao, X., Sarker, S., Wright, R.T., Sarker, S., and Mariadoss, B.J. Commitment and replacement of existing SAAS-delivered applications: A mixed-methods investigation. *MIS Quarterly*, 44, 4 (2020), 1811-1857.
36. Yaraghi, N., Du, A.Y., Sharman, R., Gopal, R.D., and Ramesh, R. Health information exchange as a multisided platform: Adoption, usage, and practice involvement in service co-production. *Information Systems Research*, 26, 1 (2015), 1-18.
37. Zheng, Z., Pavlou, P.A., and Gu, B. Latent growth modeling for information systems: Theoretical extensions and practical applications. *Information Systems Research*, 25, 3 (2014), 547-568.

ONLINE APPENDIX B
FIGURE B1. PRE-IMPLEMENTATION JOB SCOPE AND JOB OUTCOMES

FIGURE B2. POST-IMPLEMENTATION JOB SCOPE AND JOB OUTCOMES

ONLINE APPENDIX C
CONSTRUCTS AND MEASURES

Job characteristics

Autonomy

1. 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? (1 = very little, 7 = very much)
2. The job gives me considerable opportunity for independence and freedom in how I do the work. (1 = strongly disagree, 7 = strongly agree)
3. The job gives me a chance to use my personal initiative and judgment in carrying out the work. (1 = strongly disagree, 7 = strongly agree)

Task identity

1. 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? (1 = very little, 7 = very much)
2. The job provides me the chance to completely finish the pieces of work I begin. (1 = strongly disagree, 7 = strongly agree)
3. The job is arranged so that I can do an entire piece of work from beginning to end. (1 = strongly disagree, 7 = strongly agree)

Task significance

1. 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? (1 = very little, 7 = very much)
2. This job is one where a lot of other people can be affected by how well the work gets done. (1 = strongly disagree, 7 = strongly agree)
3. The job itself is very significant and important in the broader scheme of things. (1 = strongly disagree, 7 = strongly agree)

Skill variety

1. 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? (1 = very little, 7 = very much)
2. The job requires me to use a number of complex or high-level skills. (1 = strongly disagree, 7 = strongly agree)
3. The job is complex and nonrepetitive. (1 = strongly disagree, 7 = strongly agree)

Feedback

1. To what extent 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? (1 = very little, 7 = very much)
2. Just doing the work required by the job provides many chances for me to figure out how well I am doing. (1 = strongly disagree, 7 = strongly agree)
3. After I finish a job, I know whether I performed well. (1 = strongly disagree, 7 = strongly agree)

Job satisfaction (1 = completely dissatisfied, 7 = completely satisfied)

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

Job performance (1 = needs much improvement, 7 = excellent)
Note: The following items were not present on the survey instruments, instead they were filled out by a supervisor for each employee at the time of the employee's annual evaluation.

1. Quantity of work output.
2. Quality of work output.
3. Accuracy of work.
4. Liaising well with suppliers.

Perceived job transformation (1 = strongly disagree, 7 = strongly agree)

1. The system changed my job significantly.
2. The system altered my job substantially.
3. The system made my job very different.
4. The system transformed my job greatly.

ONLINE APPENDIX D
JOB SCOPE FACTOR LOADINGS WITH DIRECT OBLIMIN ROTATION

	Job Scope (Time t1)	**Job Scope (Time t2)**
Job Scope A1	.74	.78
Job Scope A2	.74	.77
Job Scope A3	.73	.74
Job Scope TI1	.81	.80
Job Scope TI2	.71	.82
Job Scope TI3	.83	.71
Job Scope TS1	.80	.76
Job Scope TS2	.79	.80
Job Scope TS3	.75	.74
Job Scope SV1	.76	.75
Job Scope SV2	.78	.80
Job Scope SV3	.74	.82
Job Scope F1	.75	.79
Job Scope F2	.71	.78
Job Scope F3	.76	.77

Notes: Time t1: Four months prior to the ES implementation; Time t2: Eight months after the ES implementation; Job Scope A1-3: Measures for autonomy; Job Scope TI1-3: Measures for task identity; Job Scope TS1-3: Measures for task significance; Job Scope SV1-3: Measures for skill variety; and Job Scope F1-3: Measures for feedback.

ONLINE APPENDIX E
ROBUSTNESS CHECKS

As a robustness check, we computed job scope using all three indexes. We found the correlations among these three indexes were high (greater than 0.90). We further tested to see if using multiplicative index or the weighted additive index would yield different results. We did not find that to be the case indicating that the use of additive index, as was done by Raja and Johns [2], was appropriate and the results were not a function of the index calculation approach.

Following Mackelprang and Malhotra [1], we also conducted seemingly unrelated regressions (SUR) to test our hypotheses, as it allows for testing of a system of equations. The pattern of results in terms of direction, magnitude, and significance was similar to what we have reported in our primary results. Perhaps we did not find any difference in pattern of results because the only independent variable different in our system of equations was one single control variable—i.e., PRE_JPERF for equation with job performance as the dependent variable and PRE_JSAT for equation with job satisfaction as the dependent variable. Therefore, our use of the hierarchical regression analysis to test our hypotheses was appropriate.

REFERENCES

1. Mackelprang, A.W., and Malhotra, M.K. The impact of bullwhip on supply chains: Performance pathways, control mechanisms, and managerial levers. *Journal of Operations Management*, 36 (2015), 15-32.
2. Raja, U., and Johns, G. The joint effects of personality and job scope on in-role performance, citizenship behaviors, and creativity. *Human Relations*, 63, 7 (2010), 981-1005.