SUPPORT STRUCTURES AND THEIR IMPACTS ON EMPLOYEE OUTCOMES: A LONGITUDINAL FIELD STUDY OF AN ENTERPRISE SYSTEM IMPLEMENTATION[1]

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Despite the impressive progress in understanding the benefits and challenges related to enterprise system (ES) implementations—such as enterprise resource planning (ERP) systems—little is known about how the support structures traditionally used by organizations to help employees cope with a new ES affect employee outcomes related to the system and their jobs. Likewise, little is known about how existing peer advice ties in the business unit influence these outcomes after an ES implementation. Understanding employee outcomes is critical because of their ramifications for long-term ES success. This paper examines the impacts of four traditional support structures (namely, training, online support, help desk support, and change management support), and peer advice ties on four key employee outcomes (namely, system satisfaction, job stress, job satisfaction, and job performance). This paper also seeks to show that it is peer advice ties that best fill the complex informational needs of employees after an ES implementation by providing the right information at the right time and in the right context. The proposed model was tested in a field study conducted in one business unit of a large telecommunications company and gathered data from 120 supplier liaisons over the course of a year. Both traditional support structures and peer advice ties were found to influence the various outcomes, even after controlling for pre-implementation levels of the dependent variables. In all cases, peer advice ties was the strongest predictor, thus underscoring the importance of this critical internal resource.

Keywords: Enterprise systems, ES implementation, peer advice ties

Introduction

A recent Gartner worldwide IT spending forecast (June 2014) projects enterprise system (ES) spending to grow to U.S. $320 billion in 2014, up from U.S. $300 billion in 2013, with even greater growth expected for 2015 and 2016. This is despite a downgrade to the spending forecast for all other sectors of IT spending (Gartner 2014). ES implementations are also one of the most common modes by which integrated IT solutions are introduced into organizations. In fact, they are one of the most common organizational change events (Herold et al. 2007). For some time now, ESs have been seen as a key way to integrate information and processes across organizational functions, thus increasing organizational efficiency and effectiveness (Davenport 1998; He et al. 2003; He and Wei 2004; Kohli 2007; Kohli and Devaraj 2004a, 2004b; Markus and Tanis 2000; Zhu et al. 2004). By improving organizational efficiency and effectiveness, successful ES implementations result in substantial improvements in firm performance (see Kohli and Hoadley 2006). For instance, for the last two decades, successful ES implementations, such as those at Cisco, Tektronix,[2] BMW, and MindWorks, have resulted in

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[1]Rajiv Kohli was the accepting senior editor for this paper.

The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

[2]Cisco (McAfee et al. 2004) and Tektronix (Austin et al. 1999) were written up as Harvard Business School cases.

enormous improvements in business processes that in turn saved the companies billions of dollars. In contrast, given the high cost of the implementations, as evident from the $160 million ES implementation that failed at Hewlett-Packard (Koch 2004), unsuccessful ES implementations result in huge financial losses or even result in companies going out of business, as was the case with Rich-Con Steele[3] and American LeFrance. Consequently, it is clear that ES implementations are expensive, complex, and take time (Devadoss and Pan 2007), thus making them a fairly risky proposition (Markus and Tanis 2000; Morris and Venkatesh 2010), with failure rates estimated to be greater than 60 percent (Devadoss and Pan 2007). The problems and likelihood of potential abandonment of a new ES is greatest during the shakedown phase of an ES implementation, which is when the most drastic changes are experienced by employees (Markus and Tanis 2000; Morris and Venkatesh 2010; Sykes et al. 2014).

Prior research on the effects of ES implementations on employees suggests that they create disenchantment among employees that, in turn, leads to substantial challenges in yielding performance benefits (e.g., Chae and Lanzara 2006; Gibson 2003; Robey et al. 2002). Given the high-risk, high-reward nature of ES implementations and their high failure rate, organizations make large investments in various support structures (see Appendix A), such as training (e.g., Puhakainen and Siponen 2010), online support (e.g., Beaudry and Pinsonneault 2010), help desk support (e.g., Ravishankar et al. 2011), and change management support (e.g., Venkatesh et al. 2011), to increase the likelihood of implementation success (Govindarajulu 2002; He 2005; Markus and Tanis 2000; Sykes et al. 2009; see Kohli and Devaraj 2003). However, despite large investments in these traditional support structures (TSS), little is known about their collective effectiveness in improving employee outcomes. An understanding of the impacts of support structures on employee outcomes will help us gain a richer understanding of the phenomenon of ES implementations and will create the possibility for more effective investments in support structures and consequent implementation success. Such support can be expected to be most critical in helping employees deal with the shakedown phase given, as noted earlier, the great extent of change they face in this phase.

Although not explicitly identified as a complement to TSS provided by an organization, more recent research has suggested that information system (IS) success can be fostered by access to information internal to the organization, such as that provided by informal employee networks (Davis et al. 2009; He 2005; He and Wei 2006; Singh et al. 2002; Sykes et al.

2009; see also Alavi and Leidner 2001). A type of such informal support that has gained in importance in organizations is employee peer advice ties. Unlike TSS, employee peer advice ties, sometimes called advice networks, are self-organizing entities that cost little in the way of organizational resources and provide significant rewards (Sparrowe et al. 2001; Sykes et al. 2009). This work posits that such employee peer advice ties will provide vital support during the shakedown phase. Further, this work seeks not only to compare traditional support structures with one another in terms of their relative effectiveness in predicting key employee outcomes, but also to compare employee peer advice ties as a possible alternative support structure. Thus, in addition to understanding the impact of support structures on employee outcomes, identifying the most effective support structure(s) will help organizations make better resource allocation decisions to foster ES success. The importance of this issue can also be made from the perspective of the broad organizational change literature. For instance, Herold et al. (2007) called for more research on the impacts of organizational change on individuals.

Based on a review of the literature, shown in Appendix A, much prior work has focused on a single type of support structure, such as Furneaux and Wade's (2011) examination of change management support, or deals with several support structures peripherally, such as in Ravishankar et al. (2011) where that main focus was on various types of online support with a lesser focus on help desk support**.** However, in reality, organizations most often implement a portfolio of support structures to help employees with ES implementations. Likewise, much prior work studying ES implementations has typically not examined job outcomes (e.g., Sykes et al. 2009 studied system use) or examined outcomes in isolation from one another (e.g., Au et al. (2008) studied end user satisfaction). However, the complex nature of ES implementations and the portfolio of support structures implemented to combat difficulties raised by ESs require a more complete examination of outcomes. Taken together, this work seeks to provide a holistic examination of the entire set of support structures typically deployed in organizations and their impacts on multiple employee outcomes in the context of the shakedown phase of an ES implementation.

It is important to examine employee outcomes in keeping with what an ES can affect, both in terms of planned (hoped for) benefits and unintended outcomes. To this effect, the appropriate choice of employee outcomes is essential. Drawing on Delone and McLean's (1992, 2003) work on IS success, system satisfaction represents a key construct related to employees' perceptions of a newly implemented system. If an employee is satisfied with a new system, he or she is more likely to continue to use it (Delone and McLean 2003). Further, many problems regarding ES implementations grow

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[3]Rich-Con Steele (McAfee 1999) was also written up as a Harvard Business School case.

out of increased job stress due to new processes and new software (Davenport 2000), making it an important construct to track during an implementation. Job stress has also been an outcome of interest in much organizational behavior research, especially related to organizational change (Griffin and Moorhead 2011; Judge et al. 1999). Finally, the most commonly studied organizational behavior outcomes are job satisfaction and job performance, and these outcomes have been the outcomes on which recent studies on ES implementations have focused: job satisfaction (Morris and Venkatesh 2010) and job performance (Sykes et al. 2014). Job satisfaction and job performance also represent distal downstream outcomes that can aggregate up from individual-level to organizational-level outcomes (see Podsakoff et al. 2009). The impacts of these key outcomes in the shakedown phase will have a critical bearing on continued use (or abandonment) and potential success of ES implementations.

Against this backdrop, the current paper has the following objectives:

(1) To develop a model that explains and compares the impact of various support structures, namely, training, online support, help desk support, change management support, and peer advice ties, on employee outcomes in the context of the shakedown phase of an ES implementation. Specifically, the system-related construct of system satisfaction, job stress, and commonly studied employee outcomes of job satisfaction and job performance will be examined as dependent variables.

(2) To empirically test the model in a longitudinal field study of an ES implementation, with data collected both before and after an ES implementation, with a particular focus on the shakedown phase.

By linking support structures to employee outcomes, this work is expected to contribute to research on ES implementations. This work responds to the call to move beyond technology-centric constructs as dependent variables by examining outcomes of broader relevance to organizations (He 2005; He and King 2008; Kohli and Grover 2008; Markus and Robey 1988; Morris and Venkatesh 2010; Venkatesh et al. 2003). The importance of understanding the impact of pre- and post-implementation interventions, such as training and other support structures, especially in the shakedown phase, has been underscored in prior research (e.g., Venkatesh and Bala 2008). By identifying the effect of support structures on employee outcomes, which in turn can lead to positive organizational outcomes, this work is expected to contribute to our understanding of interventions to foster IS success in general and ES success in particular. Finally, this work will contribute to the organizational change

literature by examining the impact of organizationally provided change-related support structures on employee outcomes (see Karasek and Theorell 1990) and, in turn, this will contribute to our understanding of how organizational change can improve, rather than worsen, employees' lives.

Theory

This section first presents a discussion and justification of the constructs in the model, both the independent variables (i.e., support structures) and the dependent variables (i.e., employee outcomes). Then, the model and justification for the various relationships in the model are presented.

Construct Identification

Traditional Support Structures (TSS)

Organizations typically provide support structures to aid employees in coping with new ES implementations (Boudreau and Robey 2005; see also He 2005). The literature in two of the leading information systems journals—namely, *MIS Quarterly* and *Information Systems Research*—since 2006 was reviewed in order to identify the most commonly studied support structures in our discipline. Appendix A shows the relevant papers. Six possible support structures were identified (namely, training, online support, help desk support, change management support, top management support, and expert users). Training, online support, help desk support, and change management support were identified for inclusion in the model because they are TSS used by organizations. However, top management support was excluded because it facilitates the provision of other support and signals employees about management's interest in the new ES. With regard to expert users, expertise is achieved only after significant direct experience with the system (Lucas and Spitler 1999) and the context under study here is the shakedown phase of a new ES before users have such direct experience. Yet, as will be discussed later, employees as a source of advice are important. Appendix A shows that there have been several studies that examined or used support structures in their theorizing. However, it also shows that the vast majority of studies have been limited to one or two support structures. Further, the review of this literature suggested that there was no single study that compared the predictive ability of various support structures against one another.

This work thus examines four TSS: training, online support, help desk support, and change management support (Markus and Tanis 2000; Puhukainen and Siponen 2010; Ragunathan et al. 2008; Sykes et al. 2009; Venkatesh et al. 2011). These

support structures largely aim to provide the necessary information to allow employees to work effectively in a new ES environment. Organizations spend enormous time and resources to provide these support structures, especially in the shakedown phase of the ES implementation (He 2005; Markus and Tanis 2000; Morris and Venkatesh 2010; Zhu et al. 2006). The shakedown phase characterizes the period when the shock due to the introduction of new processes and software is the greatest and employees are most in need of help to cope and adapt (Markus and Tanis 2000). Although all four of the TSS provide information, they differ in terms of three key aspects. First, the traditional support structures provide information at *different points in time* in the implementation process. For instance, training is often provided before an implementation begins or very early during an implementation, whereas help desk support is offered after the implementation and at the request of an employee. Second, the TSS *differ in terms of the content or type of information* they provide. For instance, help desk support often provides information related to working with software applications, whereas change management support is typically designed to address concerns related to new business processes. Finally, the TSS provide information in different contextual settings. For instance, help desk support is often lacking in contextual elements, including business processes and downstream actions necessary, whereas change management consultants can provide better help in the right context but usually lack a deeper understanding of organizational norms.

Related to each of the four TSS, this paper focuses on the quality of the support structures assessed by employees' perceived satisfaction with each support structure. Consistent with prior research, satisfaction with a support structure is defined as the extent to which an employee believes the particular type of support structure (e.g., training) is adequate (see also Venkatesh et al. 2011).

Peer Advice Ties

Social networks are the relationships and interactions within social units in which an actor is embedded. Actors can be individuals, groups, or even organizations. Social networks have been used to explain intentions, behaviors, and attitudes (Brass et al. 1998; Sparrowe et al. 2001). At the individual level, an employee's position in social networks has been linked to performance (Ahuja et al. 2003) and been shown to provide advantages, such as organizational assimilation (Sparrowe and Liden 1997) and promotion (Burt 1992). The structure of social interactions enhances or constrains access to valued resources, such as information (Brass 1984; Ibarra 1993a, 1993b). There is a large body of research that has examined many different social networks in work settings,

such as advice, communication, and friendship networks (Ibarra and Andrews 2001; Kilduff 1992; Rogers and Kincaid 1981). Advice networks in particular represent the type of network that is most associated with the transmittal of information and resources. There are two general ways to examine advice ties: getting advice and giving advice (Zagenczyk and Murrell 2009). Getting advice focuses on information and resources coming to a focal actor (ego), whereas giving advice focuses on information and resources flowing out of a focal actor.

Peer advice ties act as sources of information available to employees on the job. Organizational behavior research has examined how peer advice ties can influence employee attitudes, perceptions, behaviors and even, job outcomes (Ibarra and Andrews 1993; Sparrowe et al. 2001). In fact, it has recently been suggested that one of the most prevalent sources of information that is used by employees is their fellow employees (Davis et al. 2009; He 2005; Sykes et al. 2009). Reasons for this include (1) ease of access—it is often easier to query a coworker for information than to locate a specific technical or business process information provider (e.g., help desk employee, change management support consultant); (2) promptness—help desks and consultants are often busy during the shakedown phase of an ES implementation, with several requests for help being received at the same time, whereas fellow employees can be tapped for information relatively quickly and with an expectation of a quick turnaround; and (3) fellow employees typically better understand the job context and can frame the information they provide in terms of the employees' old and new job tasks, thus making the information better understood and more applicable/usable.

Employee Outcomes

There exists a wide range of employee outcomes that are relevant to organizational change contexts, such as ES implementations. These include key behaviors, such as system use, overall perceptions of the system, such as system satisfaction and various objective, and subjective job outcomes, such as job stress, job satisfaction, and job performance. Delone and McLean's (1992, 2003) work on the need to study IS success using suitable success metrics highlights system satisfaction and system use as appropriate for assessing IS success (see also Brown et al. 2002; Thong and Yap 1996). Although use of a new system has been studied extensively in IS research (see Venkatesh et al. 2003), this work focuses on system satisfaction as the key system-related outcome as it represents the intersection of people and technology—insofar as the more satisfied with the system, the more likely an individual is to use the new system (Thong and Yap 1996; Wixom and Todd 2005). System satisfaction, rather than use, is also the most

appropriate dependent variable when use is perceived to be mandatory (Brown et al. 2002; Brown et al. 2008; Venkatesh et al. 2007). Besides system satisfaction, three constructs commonly examined in organizational behavior and management studies (job stress, job satisfaction, and job performance) were also studied. Rhoades and Eisenberger (2002) presented a meta-analysis of perceived organizational support that helped identify appropriate dependent variables. Related to their discussion, job stress represents strains, job satisfaction represents job-related affect, and job performance represents performance. Job stress is a critical negative outcome that can occur in times of organizational change (see Karasek and Theorell 1990). Job stress has also been shown to lead to many other negative outcomes, such as increased turnover intention, negative impacts on employees' health, and overall lowered organizational effectiveness (Beehr and Newman 1978; Lam et al. 2010; Xie et al. 2008). Understanding how various support structures influence job stress in the context of the shakedown phase of a new ES implementation is, therefore, extremely important as it can, in turn, influence various other outcomes. The two most well-researched job outcomes in organizational behavior are job satisfaction and job performance (Judge et al. 2001; Riketta 2008). Knowing how support structures influence employees' job satisfaction and job performance will, in part, help determine how successful the ES is in that the ES is being implemented in order to create efficiency and effectiveness gains for the organization (Morris and Venkatesh 2010). If such gains can be achieved or, at least, leverage points to achieve the same in the shakedown phase can be identified, the potential to achieve long-term implementation success increases.

Each of the four outcomes is defined consistent with prior research. *System satisfaction* is defined as the IS end-user's overall affective and cognitive evaluation of the pleasurable level of consumption-related fulfillment experienced with the system (Au et al. 2008; Thong and Yap 1996). *Job stress* is the feeling of a person who is required to deviate from normal or self-desired functioning in the workplace as the result of opportunities, constraints, or demands relating to potentially important work-related outcomes (Janssen 2004; Parker and DeCotiis 1983). *Job satisfaction* is the degree to which an employee is happy with his or her job (Li et al. 2010; Morris and Venkatesh 2010). *Job performance* is how well an employee performs his or her job (Beal et al. 2003; Grant and Wrzesniewski 2010; Welbourne et al. 1998).

Model Development

The proposed research model is shown in Figure 1. The rest of this section presents the rationale for the various relationships shown in the model.

Comparing the Support Structures: Right Information, Right Time, Right Context

Underlying the arguments regarding the effects of various support structures on job outcomes are their relative strengths and weaknesses. The various support structures will help an employee perform their work duties after an ES implementation, but will have varying levels of influence on outcomes of interest due to different levels of information, time, and context. *Right information* is having access to the piece(s) of information necessary to perform one's work such that all relevant information is available. *Right time* is having the information necessary to do one's work when one needs it such that the information is available in a timely manner. *Right context* is having the information situated in the appropriate work context such that it is likely to be most effective. Building on the earlier discussion, Table 1 presents the strengths and weaknesses of the traditional support structures and peer advice ties in terms of the right information, right time, and right context.

Training usually involves classroom sessions, with employees in the role of students. Typically, training takes place before or directly after a new ES is fully rolled out and training is meant to prepare the employees for use of the ES (e.g., Devaraj et al. 2008; Sharma and Yetton 2007; Venkatesh 1999). Training can take anywhere from a couple of hours to several days depending on the needs of the organization and the complexity of the ES being implemented. Training provides information and technical knowledge (Au et al. 2008; Sykes et al. 2009) before the implementation and ideally covers all information that the employees will need in order to use the ES effectively (see Gallivan et al. 2005; Sharma and Yetton 2007). However, given the scope of changes introduced by an ES implementation, this is rarely fully achieved, especially because employees can seldom grasp and comprehend all the information in a few training sessions. As a result, employees are often unable to fully appreciate how the ES fits into the context of their jobs and the flow of their daily work, thus leaving the employees dependent on support structures that are available post-implementation. Despite this shortcoming, training usually provides a good deal of the basic information that employees require for getting started working with a new ES.

Online support refers to online real-time technical information and can be provided by the organization in the form of help files, help from technical advisors via online chat sessions, and online copies of operating and technical manuals. Because technical advisors and manuals can be accessed from any device with Internet accessibility, such as a home computer or a mobile device, this support structure provides real-time information and is not dependent on location and, in
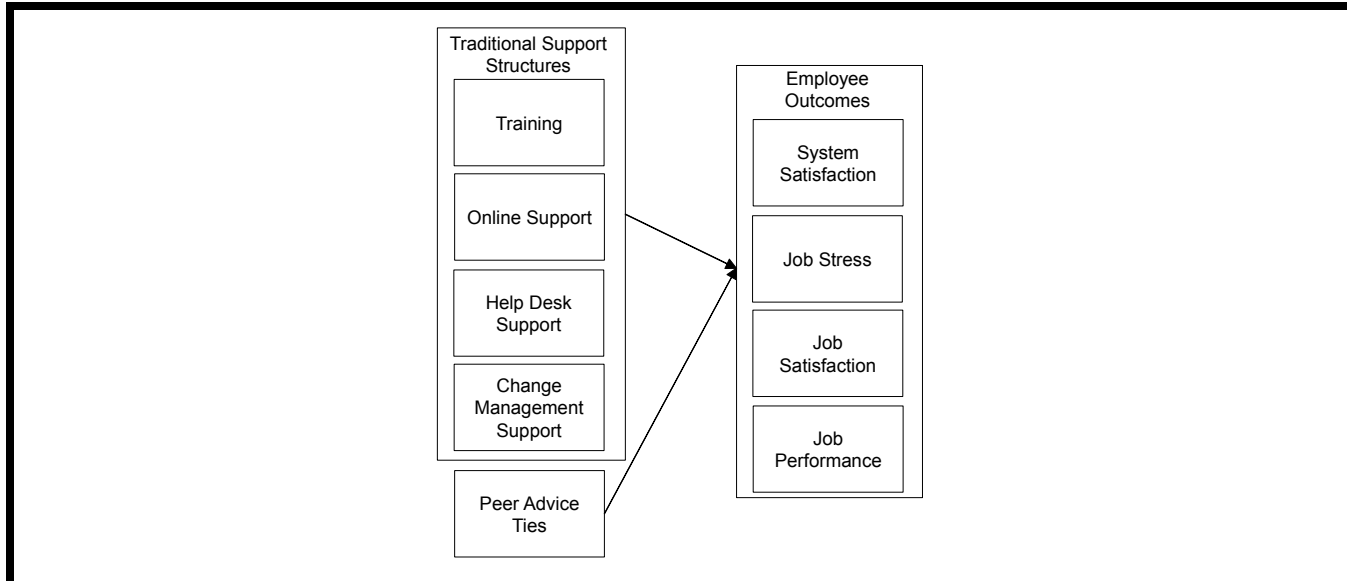
Figure 1. Research Model

Table 1. Strengths and Weaknesses of Support Structures					
	Training	**Online Support**	**Help Desk Support**	**Change Management Support**	**Peer Advice Ties**
Right information	◗	◗	◗	◗	●
Right time		●	◗	◗	●
Right context	◗			◗	●

●:   Full provision

◗:   Partial provision

some cases, is not hindered by the availability of personnel (Seddon et al. 2010; Venkatesh et al. 2011), thus making possible support that is available when and where it is needed (Karimi et al. 2007). Such online support can span both business process and software aspects of the ES but is typically geared toward the software (e.g., Beaudry and Pinsonneault 2010).

Help desk support refers to a dedicated internal organizational resource that provides technical or functional application problem-solving help to employees (e.g., Gray and Durcikova 2006; Halverson et al. 2004; Kim and Kankanhalli 2009). The term help desk support is used to refer to the on-site face-to-face and phone resources dedicated to providing technical help with organizational systems, including the ES. This support structure provides help on the ES after the roll-out of the ES. Help desk workers possess technical knowledge about the ES and are typically able to help employees with software-related problems faced when using the new ES

(Gray and Durcikova 2006; Ravishankar et al. 2011). Help desk employees usually have access to manuals for the new software packages associated with the ES and can provide detailed information from these manuals and other reference materials.

Change management support refers to on-site support provided by change management consultants in the form of coaching, workshops, and one-on-one assistance (e.g., Furneaux and Wade 2011). This type of support is often provided by the ES vendor or the consulting firm implementing the ES. For instance, SAP offers change management services to help the organization and its employees adapt to a new ERP system (Strong and Volkoff 2010). This support is provided on-site after the roll-out and in-person. The advantage of these consultants is that they can provide information about the new business processes (Furneaux and Wade 2011; Nah et al. 2001) and situate the new processes in the context of the new software, thus making it a more holistic type of

support. Change management consultants also represent on-going support by the organization and, to some extent, the organization's commitment to employees succeeding in using the new system (Furneaux and Wade 2011). However, the duration the change management support is available varies and usually does not extend beyond a few months.

In the case of an employee needing to perform a specific unfamiliar task (say, adding to a previously completed sales order) using the new ES, there is a specific need for the right information, at the right time, and it needs to be in a form that is easily understood and applicable to the task (i.e., the right context). Formal *training* may or may not have covered the specific task. However, given the temporal separation of the training from when the task is to be performed, the informa-tion may be remembered incorrectly or forgotten (e.g., Seddon et al. 2010). It is also likely that the specific context in which the employee finds himself or herself does not match what is discussed in the training (i.e., partial right context; e.g., Venkatesh et al. 2011). Another avenue of obtaining the necessary information involves using the *online support* provided by the organization. This support has the advantage of being available immediately, thus granting access at the right time (e.g., Beaudry and Pinsonneault 2010). However, the information is likely only to address a specific action, here adding the addendum to the order, without explaining the other actions that this will impact (partial right information; Sykes et al. 2009) and manuals are typically disjointed from the broader business process (lack of right context) that can make it difficult to follow and execute.

Calling the *help desk* might allow the employee to know the keystrokes to perform an unfamiliar task, but help desk workers are typically not familiar with the documentation or other business rules that relate to specific work tasks (partial right information; Ragunathan et al. 2008). Also, help desk personnel are unlikely to provide information regarding the business process needed for any follow-up procedures/actions (lack of right context). Further, there are often delays be-tween placing a help desk request and the provision of help (partial right time). A *change management consultant* could provide the required information. Information so obtained is likely to be broadly couched within a general business process (partial right context; e.g., Furneaux and Wade 2011). There is also likely to be a time constraint to obtaining information from change management consultants, given that they are a scarce resource and are outnumbered greatly by possible information requestors, as well as being typically limited to normal business hours (partial right time). Information from this source would be correct insofar as the business process is concerned because the consultant is likely an expert in the business process, but less so in terms of the software (partial right information).

Finally, information regarding unfamiliar tasks can be obtained through coworkers (e.g., Sykes et al. 2009). Co-workers are often easily accessible (sitting in adjacent cubicles or offices, or via e-mail or telephone), thus making for a quick turnaround with information (right time). Co-workers are themselves embedded within the exact same business unit (right context) and are thus likely to have the information that is necessary (right information). Even if one coworker does not have the right information, the more connected an employee is, the larger the number of coworkers that can be queried quickly to obtain information (right information).

Based on Table 1, peer advice ties appear to have only strengths and no obvious weaknesses. It is possible to argue that, in some cases, this may not be true. For instance, an employee might not be able to find his peers when he or she wants to ask a question, whereas he or she can potentially always access online support. Also, peers may typically be familiar with the use of an ES only for their specific work tasks. If, however, a person encounters questions covering a wide range of tasks, he or she may not be able to get appro-priate answers from peers. In such a case, change manage-ment consultants may provide better support because they have knowledge about the software and the processes in a broad array of work tasks. These two illustrative scenarios are particularly more likely in cases where an employee has a limited pool of potential peer advisors. As an employee's peer advice ties increase, the likelihood of accessing the right information at the right time and in the right context will also increase. For example, with many ties, an employee is likely to be able to reach out via e-mail or phone to a peer advisor if they are not physically colocated with the focal individual at the time of the information need (see Zhang and Venkatesh 2013). Likewise, if one peer advisor does not have the right information or have the information in the right context, the peer could refer the employee to someone else who is likely to have the right information in the right context—that is, being able to access the ties of one's ties, which is one aspect of social networks that make them so powerful a tool in terms of getting information. With the increasing use of a variety of media, access to coworkers any time and any place through online and offline networks has increased substantially (Zhang and Venkatesh 2013).

Effects of Traditional Support Structures (TSS)

System Satisfaction: By educating employees on the use of a new ES, an organization hopes to increase employees' understanding of both how to use the ES and how the use of the ES leads to efficiency and effectiveness gains (Seddon et al. 2010). The different TSS are designed to provide technical

assistance to employees when they use the ES (Kim and Kankanhalli 2009; Venkatesh et al. 2011). These support structures are especially important in the shakedown phase of the implementation when both the novelty of the system and extent of change being experienced are at their highest (Morris and Venkatesh 2010). As shown in Table 1 and discussed earlier, each of the four TSS provide information that will aid the use of a new ES. Although they may vary in terms of the timing of the availability of information and the adequacy of the context in which the information is delivered, the satisfaction with the system will be driven by the information available to aid in the use of the system as more information can help in filling knowledge gaps, provide ideas to effectively use the system, teach shortcuts, and provide step-by-step guidance. For instance, although training provides information far too early (i.e., not at the right time), satisfaction with the training will shape an employee's expectations about the system (see Brown et al. 2002). By making information available to employees, TSS increase the likelihood of effective use of a new ES. Employees who are satisfied with the TSS are more likely to use the information received from them. The provision of information necessary to use the ES effectively and the benefits resulting from the effective use of the ES are likely to increase employees' satisfaction with the ES (Robey 1979). Thus, it is hypothesized that

H1a: Satisfaction with training on the new system will have a positive effect on an employee's system satisfaction.

H1b: Satisfaction with online support will have a positive effect on an employee's system satisfaction.

H1c: Satisfaction with help desk support will have a positive effect on an employee's system satisfaction.

H1d: Satisfaction with change management support will have a positive effect on an employee's system satisfaction.

Job Stress: As noted earlier, an ES implementation is associated with large-scale changes in the technology and business processes, and is, therefore, a major shock to employees (Markus and Tanis 2000; Morris and Venkatesh 2010). Organizational shocks have been shown to increase employee job stress because they drastically change the nature of an employee's work. ES implementations bring novelty to a job and such novelty has been shown to increase job stress (Beaudry and Pinsonneault 2010; Ilies et al. 2010; Xie and Johns 1995). When an employee's job changes, there is increased uncertainty in how to do the job. Because ES implementations introduce new business processes that dictate

the manner in which the job is to be performed (Morris and Venkatesh 2010; Nelson 1990), they lead to lowered perceptions of autonomy and control. The TSS are designed to help employees cope with a new ES (Ragunathan et al. 2008) by providing information about effective use of the ES. These support structures decrease uncertainty by increasing employees' familiarity with the ES and, therefore, decrease the magnitude of the shock (Liang et al. 2007; Puhakainen and Siponen 2010). For instance, in the context of learning to use new software, Yi and Davis (2003) demonstrated that training increases self-efficacy, which would decrease employee uncertainty with the new ES and lead to performance enhancement. Training helps users overcome inertia that in turn should lower job stress related to using the new ES (see Seddon et al. 2010). Online support is expected to lower job stress in that it offers ongoing access to repositories of useful knowledge that is not limited to working hours or being on organizational premises (Vaast and Walsham 2009). Help desk support has been shown to reduce technostress, thus reducing overall job stress (Ragunathan et al. 2008). Change management support is yet another informational resource signaling an organization's support of its employees experiencing change (Furneaux and Wade 2011). Perceptions of support, depending on whether it is positive or negative, can serve as a catalyst or creator of stress (Leather et al. 1998; see also Karasek and Theorell 1990). Employees who are satisfied with TSS are likely to have access to information for effectively using the ES and would not be as negatively affected by the shock of the ES implementation, thus resulting in low job stress (Frank et al. 2004; Kim and Kankanhalli 2009). Thus, it is hypothesized that

H2a: Satisfaction with training will have a negative effect on an employee's job stress in the context of a new ES implementation.

H2b: Satisfaction with online support will have a negative effect on an employee's job stress in the context of a new ES implementation.

H2c: Satisfaction with help desk support will have a negative effect on an employee's job stress in the context of a new ES implementation.

H2d: Satisfaction with change management support will have a negative effect on an employee's job stress in the context of a new ES implementation.

Job Satisfaction: The information that TSS provide will enable employees to overcome the uncertainty following an ES implementation and perform their new jobs (i.e., jobs after the ES implementation; see Morris and Venkatesh 2010). Job satisfaction can be affected by a myriad of factors including:

individual differences, role perceptions, supervisory behaviors, and job/task characteristics (see Brown and Peterson 1993; Judge et al. 2002). As noted earlier, one reason to implement an ES is to attain efficiency and effectiveness gains (Devadoss and Pan 2007; Markus and Tanis 2000). However, a new ES alters employees' jobs and can adversely affect employee job satisfaction (Morris and Venkatesh 2010). When organizations provide high quality TSS to aid employees in the execution of their new jobs, employees are likely to feel that the organization is caring (see Rhoades and Eisenberger 2002) and interested in helping employees be more effective with the new ES (see Bajwa et al. 2004). Because TSS will be viewed as an investment to foster employees' successful use of the new ES (Furneaux and Wade 2011; Ravishankar et al. 2011; Seddon et al. 2009), they can positively influence job satisfaction. Also, TSS should help employees feel that they have control of their work as they have the necessary information to do work tasks, even in the changed environment. Feeling in control when doing one's job has a positive effect on job satisfaction (Hackman and Oldham 1980; Karasek 1979). Training is also a way to provide feedback to an employee working with a system (Sharma and Yetton 2007) and feedback has been shown to increase job satisfaction (Hackman and Oldham 1980). Thus, it is hypothesized that

H3a: Satisfaction with training will have a positive effect on an employee's job satisfaction in the context of a new ES implementation.

H3b: Satisfaction with online support will have a positive effect on an employee's job satisfaction in the context of a new ES implementation.

H3c: Satisfaction with help desk support will have a positive effect on an employee's job satisfaction in the context of a new ES implementation.

H3d: Satisfaction with change management support will have a positive effect on an employee's job satisfaction in the context of a new ES implementation.

Job Performance: From the earlier discussion related to Table 1, all TSS provide information and the effectiveness of such TSS, especially in the shakedown phase, will likely drive the effective use of the new ES that can in turn result in fostering better employee job performance. Satisfaction with various TSS is likely to be the underlying driver of the extent of assimilation and more meaningful/effective use of information by employees. The literature, both academic and trade press, is starting to see arguments related to the importance of effective use and more meaningful use (see Burton-Jones and Straub 2006; Sykes and Venkatesh forthcoming). Such use

will contribute to better job performance. Thus, it is hypothesized that

H4a: Satisfaction with training will have a positive effect on employee job performance in the context of a new ES implementation.

H4b: Satisfaction with online support will have a positive effect on employee job performance in the context of a new ES implementation.

H4c: Satisfaction with help desk support will have a positive effect on employee job performance in the context of a new ES implementation.

H4d: Satisfaction with change management support will have a positive effect on employee job performance in the context of a new ES implementation.

Effect of Peer Advice Ties

System Satisfaction: Advice from an employee's coworkers will encompass knowledge of the new ES in both the software and business process aspects of the new ES (i.e., right information and right context; see Sykes et al. 2014). An employee's peer advice ties represent the extent to which an employee can access work-related information. In the context of an ES implementation, work-related interactions among employees are likely to include information about how to use the new ES (He 2005; He and Wei 2006). Employees with greater peer advice ties will have greater access to their peers and the information they could provide, thus being able to use the ES more effectively than employees who have less peer advice ties because of which will have limited access to information from peers. More information about the ES is likely to lead an employee to be able to more fully explore and exploit the ES. Given the design of an ES is to provide benefits to employees and their work flow, employees with access to more information will be more satisfied with the system in large part due to their ability to use the system more completely and in the manner in which it was intended. Also, advice from peers generally comes upon request. This right-time aspect of advice from peers will allow users to overcome various hurdles, such as system glitches and lack of knowledge in using the system, and get solutions at the time when a problem occurs.[4] As a result, greater peer advice ties and the resulting access to information will allow employees to use the ES relatively uninterrupted and. consequently, they will have satisfaction with the ES. Thus, it is hypothesized that

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[4]Not always possible (Zhang and Venkatesh 2013).

H5:   Peer advice ties will have a positive effect on an employee's system satisfaction.

Job Stress: Several factors have been identified as contributing to job stress including too high a workload (Ahuja et al. 2007), too little control over work (Xie 1996; Xie et al. 2008), perceptions of inadequate organizational support (Van Yperen and Hagedoorn 2003), and organizational change (Morris and Venkatesh 2010). An ES implementation is expected to increase employee job stress as implementations of such systems often cause increased cognitive burden on employees as they do their work (i.e., increasing workload; Jasperson et al. 2005), perceptions of decreased control in how they do their jobs (Nelson 1990; see also Karasek and Theorell 1990), and are a major type of organizational change (Markus and Tanis 2000). Employees with greater peer advice ties can obtain information from a larger number of peers to do their work. These employees will have access to information that has been tailored to their specific needs as it incorporates specific business domain knowledge: the right information and the right context. This will decrease the cognitive burden that occurs due to using the new system and would decrease job stress. Also, beyond informational support, advice from peers provides social support. In times of change, such as during an ES implementation, social support can alleviate some of the job stress related to the organizational change. Thus, it is hypothesized that

H6:   Peer advice ties will have a negative effect on an employee's job stress in the context of a new ES implementation.

Job Satisfaction: Advice from coworkers will be given in the right context (much more so than is the case of TSS) in terms of being attuned to both the new business processes and software comprising the new ES and as they relate to the old system (Karimi et al. 2007; see Sykes et al. 2014). An employee and his or her peers are also likely to perform similar job tasks and use similar system features. Therefore, peers are in a position to provide the employee with the right information in the right context. As noted earlier, employees with greater peer advice ties will have greater access to information from peers, thus enabling employees to attain greater benefits by using the ES (above and beyond what TSS can facilitate). Advice from peers is also likely to provide more and better (contextually relevant) feedback to users. Increased feedback in doing one's job has been shown to have a positive effect on job satisfaction (Hackman and Oldham 1980; Morris and Venkatesh 2010). Employees with more peer advice ties will be able to receive more information from peers that will allow them to do their jobs with less reliance on organizationally provided TSS, thus enhancing their autonomy partly because of the right time aspect of peer advice

ties. Increased autonomy has also been shown to have a positive effect on job satisfaction (Hackman and Oldham 1980; Morris and Venkatesh 2010). Thus, it is hypothesized that

H7:   Peer advice ties will have a positive effect on an employee's job satisfaction.

Job Performance: A new ES often dictates how employees must complete their job tasks. An ES dictates a complex choreography of who performs tasks, how they perform them, and when they perform them. Due to this confluence of factors, employees with greater peer advice ties will be more likely to reap the optimal efficiency and effectiveness benefits by getting the right information at the right time and in the right context. Greater efficiency and effectiveness when performing one's job are direct contributors to higher job performance. Thus, it is hypothesized that

H8:   Peer advice ties will have a positive effect an employee's job performance.

Comparing the Effects of Support Structures

As suggested by Table 1 and discussed earlier, peer advice ties offer optimal support as it provides the right information at the right time in the right context. Specifically, those with greater peer advice ties, as already discussed, will have the greatest level of benefits. In contrast, TSS offer more limited benefits given that they are suboptimal in terms of information, time, and/or context. The various hypotheses to this point have detailed positive effects for all types of support structures. Implicit in the discussion and what is shown in Table 1 is that there is an element of comparative benefits of peer advice ties versus TSS. Based on the discussion thus far, peer advice ties will have a stronger favorable effect on the various outcomes, compared to the effects of the different traditional support structures. Thus, it is hypothesized that

H9a: Peer advice ties will have a stronger positive effect on system satisfaction, compared to the effects of each of the traditional support structures.

H9b: Peer advice ties will have a stronger negative effect on job stress, compared to the effects of each of the traditional support structures.

H9c: Peer advice ties will have a stronger positive effect on job satisfaction, compared to the effects of each of the traditional support structures.

H9d: Peer advice ties will have a stronger positive effect on job performance, compared to the effects of each of the traditional support structures.

Method

This study was conducted in a large multinational telecommunications company. Data were collected over the course of one year from knowledge workers in one business unit in the context of an ES module implementation. The data were collected five months prior to rollout, as well as three and six months after roll-out of the system. Data were collected via an employee survey and from supervisor ratings of employee job performance.

Participants

The participants were supplier liaisons in a single business unit of the organization. Job duties of supplier liaisons were to interface with various suppliers in all phases of the process of ordering materials in support of the manufacturing activities of the organization. Their tasks included requests for quotes, negotiating with suppliers, placing orders, and internal coordination with inventory control, accounts payable, and manufacturing. The list of all 145 supplier liaisons within the business unit was the sampling frame for this study. Secretarial staff and managers within the unit were excluded. Using the business unit as the boundary for the network under study is appropriate as the supplier liaisons shared the same job description and duties, and interacted with one another in the context of the interdependent processes and shared symbol system of their work (see Laumann et al. 1983). Of the 145 supplier liaisons, 120, including 30 women (25 percent), gave usable responses at all points of measurement. The response rate was 83 percent, which is above the threshold of 80 percent for primary social network studies (Knoke and Yang 2008). The demographics of the respondents matched those of the business unit, with the average age being about 40 years old and the average organizational tenure being about 5 years. Nonresponses were due to a few different reasons, with unwillingness to participate and incomplete responses being the two most common. The matching demographic profile of the sample and the business unit as well as the high response rate alleviates concerns about nonresponse bias.

New ES Module

Prior to the implementation of the ES module, the supplier liaisons (participants) had the discretion to use any method at their disposal in order to manage information in the course of their work. As can be expected in such a scenario, the job of the supplier liaison was designed to be mostly autonomous, even though the business unit had collective targets and goals. Prior to the new ES module implementation, employees used various off-the-shelf content management software, as well as less technologically sophisticated methods, such as paper files

and faxes. These individual solutions did not facilitate content sharing and did not support communication across systems. In an effort to standardize the management of content/information, the organization implemented an ERP system. The ES module for the supplier liaison unit, which was part of an ERP system of the organization, was designed to give better access to information that, in turn, would lead to better management of back-end processes, such as delivering content, and standardizing, defining, controlling, staging, routing, storing, and delivering informational content (see Guenther 2001). The new ES module also helped to manage and integrate multimedia content. For example, it helped to manage various sources of information ranging from voice mail to faxes and text documents. The ES module was designed to streamline managing content through work flows and templates. The ES module included a core database that stored information assets, such as templates and multimedia content. Together, all of these features of the ES module aimed to help the supplier liaisons to perform their job duties, described earlier, more effectively and efficiently.

The ES module was designed and developed over the course of 8 months. The ES module included new business processes, software, and a new hardware platform. The ES module was designed so that suppliers interfaced with the front-end of the system and supplier liaisons worked on the back-end to configure the content made available to suppliers. Top management in the organization and in the particular business unit were publicly supportive of the new ES module, which is generally considered an important prerequisite for success and is referred to as "top management support" (see Appendix A). Use of the ES module in the first year was voluntary. After the first year, management expected to make an assessment of whether to continue with the system, make changes to the system, or even abandon the system.

Measurement

The various constructs were operationalized in the context of an ES module implementation. Seven-point Likert-type scales were used for all individual-level perceptual measures. The peer advice ties (social network) question was measured on a seven-point scale of frequency. Job performance, obtained from supervisor ratings of employee performance during employees' annual evaluations, was measured on a seven-point scale from "excellent" to "needs improvement." All items are shown in Appendix B.

Dependent Variables

The scale for system satisfaction was adapted from prior literature (Brown et al. 2002; Brown et al. 2008). The mea-

surement of job stress in the organizational behavior literature is quite complex and varied, with a focus on both stressors and outcomes (Spector et al. 1988). In some cases, the measurement focuses on employee health and safety comprising questions that span over 30 pages. Due to data collection limitations, for this project, the specific attribute of stress of interest was chosen. This work focused on a particular outcome (i.e., emotional exhaustion) that has been studied in the context of stress in prior organizational behavior research (e.g., Lee and Ashforth 1996). The measure used was Maslach and Jackson's (1986) widely employed emotional exhaustion scale (see Lam et al. 2010). Job satisfaction was measured consistent with much prior organizational behavior literature, with the specific scale used in this work being one that was previously used in conjunction with the study of an ES implementation (see Morris and Venkatesh 2010). Job performance was supervisor-rated performance obtained from the organization's employee record archives (annual job evaluations) and measured using the job effectiveness scale related specifically to the job (as compared to career or innovation[5]) (Welbourne et al. 1998). Each supplier liaison had their performance rated by their product line supervisor. There were 16 such supervisors in the business unit. The results of the various product lines and product groups were compared and no differences in average performance ratings were found across them. Further, dummy variables were used to code for supervisor ID and the dummy variables were not found to be significant.[6]

Traditional Support Structures

The four TSS (i.e., training, online support, help desk support, and change management support) were measured consistent with the definition of the constructs (i.e., the extent to which an employee felt that the support structure was satisfactory). The specific items used were adapted from the measurement of various satisfaction-related constructs in the IS literature (e.g., Brown et al. 2002; Brown et al. 2008; Thong and Yap 1996). Most recently, training satisfaction and change management support satisfaction were measured and reported in Venkatesh et al. (2011). These items were adapted to the context of this work to measure satisfaction with all four TSS. Each of the four TSS were modeled using reflective indicators.

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[5]Career and innovation components were included but not studied here.

[6]Because the use of dummy variables for supervisors introduces many dummy variables, aggregate-level dummy variables were created based on supervisor gender, supervisor age group, and supervisor organizational tenure. None of these dummy variables was found to have any effects on the outcomes, either directly or in combination. Further, these dummy variables did not have any significant moderating effects. Given their nonsignificance, these dummy variables were dropped from the analysis.

Peer Advice Ties

To study the role of information received from fellow employees, prior work on advice networks (Cross et al. 2001) was examined. Specifically, get-advice network centrality was used and defined as the extent to which an employee is connected to peers so as to obtain advice within the network (Sparrowe et al. 2001). Using get-advice network centrality to represent the peer advice ties is consistent with prior research in organizational behavior (Kilduff and Tsai 2003; Sparrowe et al. 2001) and IS (Sykes et al. 2009; Venkatesh et al. 2011). Supplier liaisons were given a roster that included the names of every supplier liaison in the business unit. Specifically, advice network centrality for each employee was calculated from his or her responses to the question concerning from whom he or she receives advice.

Employees' peer advice ties were operationalized as eigenvector centrality within the get-advice matrix (Bonacich 1972), which takes into account both direct and indirect sources of information from advisors (e.g., Kane and Alavi 2008). Eigenvector centrality quantifies how important an employee is within the network compared to all others within the network based on how well connected his/her ties are compared to others' ties. The quality of a tie is taken into account in that the value of a tie is determined by how connected the connecting employee is compared to others within the network (Borgatti 2005). For example, two employees could each have four (different) peers to whom they turn for advice. However, the first employee may have connections to four peers who are themselves well connected, whereas the second employee could be connected to four peers who are not well connected. In this case, the first employee will have a higher eigenvector centrality than the second.

Control Variables

Drawing from the vast body of organizational behavior and IS literatures, age, gender, organizational tenure, organizational position, and computer self-efficacy were controlled for as all of these have been shown to possibly have an effect on one or more of the dependent variables in prior studies in organizational behavior and IS (e.g., Judge and Bono 2001; Rafferty and Griffin 2006; Morris and Venkatesh 2010; Sykes and Venkatesh forthcoming; Sykes et al. 2014; Zhang and Venkatesh 2013). Further, pre-implementation levels of job stress, job satisfaction, and job performance were included as the strongest predictors of employee outcomes are often prior levels of the same variables (Hunter and Hunter 1984; Morris and Venkatesh 2010). It should be noted that given that the ES was new, there was no pre-implementation level of system satisfaction.

Data Collection

Five months prior to the roll-out of the new ES module, control variables, including pre-implementation data about employee outcomes (except system satisfaction), were collected. Immediately prior to the roll-out of the ES module, the business unit provided 10 three-day training sessions over the course of a month. Every supplier liaison was required to attend at least one session. Three months after the implementation of the ES module, data about the TSS and employee advice networks were collected, as this would represent a measurement during the shakedown phase (see Markus and Tanis 2000; Morris and Venkatesh 2010). Six months after the roll-out of the ES module, coinciding with the employees' latest annual performance reviews, system satisfaction, job stress, and job satisfaction were collected via an employee survey. Job performance data were collected from the annual supervisors' evaluations of employees.

Data Analysis Strategy

UCINET 6.29 was used to analyze the social network data (Borgatti et al. 2002) and to calculate the get-advice network eigenvector centrality scores for all participants. Measurement and structural model tests were conducted using partial least squares (PLS) as the technique and Smart-PLS 2.0 as the tool (Ringle et al. 2005). PLS was considered appropriate to analyze the data because it does not make assumptions about the distributional properties of the data and does not place significant sample size requirements (Ringle et al. 2012). Given the nature of the items, which were expected to covary, all multi-item scales were modeled using reflective indicators.

Results

An examination of the loadings and cross-loadings, not shown here due to the clean structure, indicated that all loadings associated with the various multi-item scales were greater than .70 and all loadings were greater than the cross-loadings. Higher cross-loadings were observed across the pre- and post-implementation scales of the same construct, which is to be expected, to some extent, given that these variables can be expected to covary. These results supported internal consistency and discriminant validity. Table 2 shows the average variance extracted (AVEs), internal consistency reliabilities (ICRs), descriptive statistics, and correlations. All ICRs for multi-item scales were greater than .70, thus supporting reliability. All AVEs were greater than the correlations, thus supporting discriminant validity.

Table 3 shows the results of the structural model testing for each of the four dependent variables of interest. The prediction of each of the dependent variables was examined in three blocks. The first block comprised only control variables including the pre-implementation value of the dependent variable in the case of three of the four dependent variables (i.e., except system satisfaction). In addition to the control variables, the second block comprised the four traditional support structures (i.e., training, online support, help desk support, and change management support) as predictors. The third block comprised the control variables, the traditional support structures, and peer get-advice eigenvector centrality as predictors. Because PLS reestimates latent variable scores each time a model with a new set of predictors is tested, the full model was first estimated and the latent variable scores were saved and used for the estimation of the subset of the models. In other words, all model 3's in Table 3 were tested simultaneously for all dependent variables.

Of the five control variables, age was the only significant predictor. The variance explained by the control variables only model was 4 percent. In model 2, with the addition of the TSS, three of which were significant (except online support), the variance explained increased to 10 percent. Thus, H1 was partially supported. Finally, as seen in model 3, H5 was supported as get-advice network eigenvector centrality was a strong predictor of system satisfaction and the variance explained increased to 20 percent. Interestingly, with the inclusion of get-advice network eigenvector centrality, only change management support stayed significant.

Of the six control variables, age, gender, and pre-implementation job stress were the significant predictors in model 1, with pre-implementation stress being the strongest predictor. The variance explained by the control variables only model was 17 percent. In model 2, with the addition of the TSS, three of which were significant, the variance explained increased to 25 percent. Thus, H2 was mostly supported. Finally, as seen in model 3, H6 was supported as get-advice network eigenvector centrality was a strong predictor of job stress and the variance explained increased to 38 percent. Interestingly, in contrast to system satisfaction, even with the inclusion of get-advice network eigenvector centrality, all three previously significant TSS stayed significant although the magnitude of the coefficients dropped.

Of the six control variables, age, gender, and pre-implementation job satisfaction were the significant predictors in model 1, with pre-implementation job satisfaction being the strongest predictor. The variance explained by the control variables only model was 20 percent. In model 2, with the addition of the TSS, three of which were significant (except

	Table 2. Average Variance Extracted, Reliabilities, Descriptive Statistics, and Correlations											
		Mean	**SD**	**ICR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Age	37.3	8.84	NA								
2	Gender (1 = women)	.76	.43	NA	.16*	-						
3	Organizational tenure	5.1	2.6	NA	.17**	-.17**	-					
4	Organizational position	9.55	4.52	NA	.29***	-.25***	.28***	-				
5	Computer self-efficacy	4.40	1.51	.73	.16**	-.29***	.17**	.19**	.78			
6	Pre-impl. job stress	3.98	1.64	.75	.08	.07	.10	.05	.08	.73		
7	Pre-impl. job satisfaction	4.10	1.19	.75	-.24***	.17**	-.23***	-.22***	.13*	-.28***	.76	
8	Pre-impl. job performance	5.01	0.88	.77	.17**	-.14*	.20**	.22***	.03	-.30***	.20**	.82
9	Training	4.70	1.51	.79	-.05	-.15*	-.08	-.05	.10	.08	.10	.13*
10	Online support	4.17	1.28	.70	-.21**	-.15*	-.20**	-.22***	.05	-.13*	.10	.14*
11	Help desk support	4.42	1.37	.75	-.14*	-.17**	-.15*	-.16**	.07	.07	.12*	.15*
12	Change management support	4.44	1.38	.73	-.16**	-.20**	-.17**	-.19**	.08	.05	.07	.20**
13	Peer advice ties	14.33	5.05	NA	.16**	-.22***	.20**	.21**	.02	-.20**	.15*	.20**
14	System satisfaction	4.22	1.30	.75	-.17**	-.17**	-.19**	-.20**	.13*	.17**	.08	.15*
15	Post-impl. job stress	5.13	1.28	.77	.19**	.13*	.17**	.16**	.05	.40***	-.20**	-.24***
16	Post-impl. job satisfaction	3.80	1.75	.79	.14*	.22***	.17**	.14*	.10	-.28***	-.44***	.28***
17	Post-impl. job performance	4.66	1.05	.71	.19**	-.17**	.20**	.21***	.02	-.25***	.29***	.28***

		ICR	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
9	Training	.79	.77								
10	Online support	.70	.17**	.73							
11	Help desk support	.75	.20**	.23***	.75						
12	Change management support	.73	.24***	.14*	.20**	.78					
13	Peer advice ties	NA	.17**	.19**	.20**	.22***	NA				
14	System satisfaction	.75	.20**	.13*	.20**	.19**	.43***	.71			
15	Post-impl. job stress	.77	-.20**	-.22***	-.22***	-.30***	-.50***	.20**	.75		
16	Post-impl. job satisfaction	.79	.13*	.19**	.19**	.20**	.44***	.22***	-.38***	.79	
17	Post-impl. job performance	.71	.14*	.10	.10	.22***	.50***	.17**	-.34***	.32***	.79

Notes: Diagonal elements are AVEs and off-diagonal elements are correlations.
NA: Not applicable.
*p < .05; **p < .01; ***p < .001.

Table 3. Structural Model Results

Dependent variables ➜	System Satisfaction			Job Stress			Job Satisfaction			Job Performance		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
R^2	.04	.10	.20	.17	.25	.38	.20	.28	.40	.13	.20	.35
ΔR^2		.06*	.10**		.08*	.13**		.20***	.12*		.07*	.15**
Control variables:												
Age	-.11*	-.07	-.04	.13*	.10	.08	.10	.05	.04	.04	.03	.02
Gender (1: women)	.07	.05	.03	.12*	.07	.05	.07	.04	.03	.04	.02	.02
Organizational tenure	.08	.04	.02	.05	.04	.03	.14*	.07	.05	.15*	.12*	.08
Organizational position	.02	.02	.01	.04	.03	.02	.08	.05	.04	.03	.02	.02
Computer self-efficacy	.10	.08	.05	.07	.05	.04	.02	.01	.00	.04	.03	.02
Pre-impl. job stress				.35***	.34***	.32***						
Pre-impl. job satisfaction							.40***	.30***	.26***			
Pre-impl. job performance										.30***	.28***	.25***
Traditional support structures:												
Training		.13*	.03		.02	.02		.02	.01		.03	.02
Online support		.08	.07		-.17**	-.13*		.12*	.10		.04	.03
Help desk support		.12*	.08		-.14*	-.13*		.12*	.10		.07	.05
Change mgmt. support		.13*	.12*		-.23***	-.17**		.13*	.11*		.16*	.13*
Advice network support:												
Get-advice centrality			.30***			-.34***			.35***			.38***

Notes: Dependent variables are post-implementation values.
Shaded cells are not applicable.
*p < .05; **p < .01; ***p < .001.

training), the variance explained increased to 28 percent. Thus, H3 was mostly supported. Finally, as seen in model 3, H7 was supported as get-advice network eigenvector centrality was a strong predictor of job satisfaction and the variance explained increased to 40 percent. Interestingly, quite like system satisfaction and in contrast to job stress, with the inclusion of get-advice network eigenvector centrality, only change management support stayed significant.

Of the six control variables, organizational tenure and pre-implementation job performance were the significant predictors in model 1, with pre-implementation job performance being the strongest predictor. The variance explained by the control variables only model was 13 percent. In model 2, with the addition of the TSS, only change management support was significant, the variance explained increased to 20 percent. Thus, H4 was partially supported. Finally, as seen in model 3, H8 was supported as get-advice network eigenvector centrality was a strong predictor of job performance and the variance explained increased to 35 percent. In terms

of the TSS, even with the inclusion of get-advice network eigenvector centrality, change management support stayed significant.

Comparing the Effects of Traditional Support Structures Versus Peer Advice Ties

H9 theorized that the effect of get-advice network eigenvector centrality on the various outcomes of interest would be stronger than the effects of each of the four TSS. In the case of each of the outcome variables, four beta differences tests (Chow 1960) were conducted to compare the coefficient of get-advice network eigenvector centrality with the coefficient of each of the four TSS (see also Venkatesh et al. 2003). Each of the beta differences tests confirmed that the magnitude of the effect of get-advice network eigenvector centrality on the outcome variable was greater than each of the TSS on the outcome variable, thus supporting H9. For instance, in predicting system satisfaction, the effect of get-advice net-

work eigenvector centrality (.30***) is statistically significantly higher than training (.03), online support (.07), help desk support (.08), and change management support (.12*).

Power Analysis

When controlling for peer advice ties, many of the relationships between TSS and the outcome variables became nonsignificant. This is an interesting finding, given that the TSS are those on which organizations typically rely to help employees overcome the hurdles posed by ES implementations. The findings suggest that these TSS in which organizations invest are not as effective as believed. In fact, they may be of little or no value in the presence of adequate peer support. However, drawing such a conclusion calls for us to rely on null findings, thus making adequate statistical power a critical element. A *post hoc* power analysis was conducted (Cohen 1988). The results of the various power tests (associated with the various models tested) indicated that in all models, medium effects would have been detected with a power greater than .80, which is considered adequate given the typical α level of .05. This suggests that the TSS are not as effective as perhaps previously believed, especially as it relates to the four outcomes studied here.

Robustness Checks

Before beginning a discussion of the additional structural model testing and testing approaches used, tests for potential common method bias were conducted. Appendix C reports this discussion, which confirms that common method bias is not a significant concern in this work. Prior research has suggested interrelationships among some of the employee outcomes. For instance, the IS success model suggests that system satisfaction can have positive performance impacts (Delone and McLean 1992). Likewise, prior organizational behavior research has suggested that job satisfaction can influence job performance—that is, "a happy worker is a productive worker" (Wright et al. 2002). Similarly, job stress could have negative impacts on both job satisfaction and job performance (Cooper et al. 1989; Jex 1998). In order to ensure that the observed effects of TSS on the various outcomes were robust, these possible interrelationships among the employee outcomes were included and the model reestimated. The results of these analyses are shown in the Appendix D and confirm that although the interrelationships are significant, the effect of the support structures remain fairly consistent with what was shown in Table 3, with only one coefficient going from significant to nonsignificant (i.e., change management support as a predictor of job satisfaction).

As a study that examines social networks in conjunction with job performance, there is the possibility that endogeneity exists. Two situations that suggest endogeneity are (1) get-advice network eigenvector centrality is influenced by poor satisfaction with TSS, and (2) prior job performance could influence employees to be more active and central in their advice networks in order to improve their job performance. In the first case, if true, it would be expected that there would be negative correlations between satisfaction with the different TSS and get-advice network eigenvector centrality. However, examining the correlation matrix shows that all correlations were positive, thus alleviating the potential for this type of endogeneity to exist in the dataset. As for the pre-implementation job performance driving employees to be more central in the get-advice network, the strong positive relationship suggests that those who are better performers potentially position themselves to get more advice to continue to be high performers. The latter part of this argument is borne out by the fact that get-advice network eigenvector centrality has a positive effect on post-implementation job performance above and beyond pre-implementation job performance. In any case, a re-analysis using Heckman's (1979) approach to correct for endogeneity revealed no change in the pattern of findings.

A third issue that calls for additional analysis to ensure robustness of the results is the fact that multiple dependent variables are being predicted by the same set of independent variables, thus creating the possibility of correlated errors of prediction. Although PLS already accounts for this by estimating the entire model at one time, the model was also tested using seemingly unrelated regressions and the results, shown in Appendix E, were found to be nearly identical to what is reported in Table 3 and Appendix D. This further underscores the robustness of the findings.

Summary

Overall, the results support the proposed model. The TSS do indeed predict the various outcomes. But, clearly, peer advice ties are a much stronger predictor of all four outcomes. These results are robust to the theory-driven interrelationships among the outcomes and correlations of errors in prediction. Based on these results, there is evidence for the importance of peer advice ties as a key resource that can not only help employees view a new ES favorably, but also have a favorable impact on key employee outcomes.

Discussion ▮▮▮▮▮▮▮▮▮▮▮▮▮▮

This work aimed to understand the role of support structures, both traditional and peer advice ties, in the context of one of

today's most common organizational change activities (i.e., an ES implementation) and their impacts on job outcomes in the shakedown phase. TSS were conceptualized as the most common approaches that organizations employ to provide information to allow their employees to perform their work in the context of a new ES implementation. This work examined an outcome related directly to employees' perceptions of the new system (i.e., system satisfaction) and three job outcomes (i.e., job stress, job satisfaction, and job performance). The results confirmed the predictions that the TSS and peer advice ties influenced these outcomes. Peer advice ties were stronger predictors of these outcomes due to the ability to fill the complex nature of the information needs employees experience in the context of ES implementations. When get-advice network eigenvector centrality was included as a predictor, some of the relationships between the four TSS and the outcome variables became weaker or even nonsignificant. The proposed model explained between 20 percent and 40 percent of the variance in each of the four outcomes.

Theoretical Implications

This paper contributes to the body of work dedicated to helping us better understand ES implementations. It complements the primarily macro-level examinations of ES implementations (e.g., Gattiker and Goodhue 2005; Kohli and Devaraj 2003, 2004a, 2004b; Markus and Tanis 2000) by building on our understanding of the phenomenon at the individual level. Specifically, this paper examined TSS in which organizations invest for the purpose of helping their employees cope with the shock that a new ES implementation brings, especially in the shakedown phase (Markus and Tanis 2000; Morris and Venkatesh 2010; Zhu et al. 2006). This work identifies strengths and weaknesses of TSS in terms of providing the right information at the right time, and in the right context. Further, this paper takes the first step to identifying how TSS can be augmented or even replaced by employees' peer advice networks in terms of satisfying their information needs after the shock of an ES implementation. This work complements the extant IS research that has discussed the role of support in the context of system implementations (see Appendix A).

This work illustrates how encompassing the effects of support structures are on key employee outcomes. Specifically, peer advice ties and the TSS were shown to influence system satisfaction, job stress, and job satisfaction. Although job performance was not influenced by three of the four TSS (except for change management support), it was strongly influenced by peer advice ties. One reason that three of the TSS might not have been significant in predicting job performance could be that they operate through their influence on the other job outcomes, especially job stress and job satisfac-

tion, that have been shown to influence job performance in this work and in prior research (AbuAlRub 2005; Judge et al. 2001). Taken together, these results present a holistic understanding of the relative impacts of different support structures on four different outcomes.

Many of the relationships between traditional support structures and the outcomes became weaker or nonsignificant when get-advice network eigenvector centrality was included as a predictor. This finding is potentially important given that organizations invest a great deal of resources into TSS during and after an ES implementation. The findings suggest, in fact, that organizational spending on TSS might be wasted in the presence of effective employee peer advice ties. The nonsignificant effect of TSS on employee outcomes may not necessarily be a worry as peer advice ties may act as conduits through which the right information at the right time in the right context can flow most easily (see Venkatesh and Sykes forthcoming). One implication of this finding is that organizations might be better served to utilize resources for engineering employee peer advice ties, perhaps by making helping one's peers a part of competent employees' work, beyond investments in traditional expenditures on training, online support, help desk support, and change management support.

It is interesting to note that the pattern of results associated with job stress is different from the pattern of results associated with the other three outcomes. Whereas training became nonsignificant in all four cases with the inclusion of get-advice network eigenvector centrality, online support and help desk support remained significant when predicting job stress, but not when predicting the other three outcomes. It is speculated that in the case of job stress, any ongoing support is viewed favorably by the employees. However, in the case of system satisfaction, job satisfaction, and job performance, it appears that with greater get-advice network eigenvector centrality, online support and help desk support may not be particularly beneficial. This suggests that job stress can indeed be alleviated by increasing both the amount and type of support because the different types of support appear to have additive effects, compared to the substitution effect that appears to be prevalent in the case of the other three outcomes.

This work contributes to the organizational change literature by responding to recent calls to study organizational change at the micro (individual) level (Herold et al. 2007). Given that higher-level outcomes are aggregated from lower levels (e.g., individual to organizational), this work helps enrich our understanding of organizational interventions and how they can lead to positive individual outcomes that will in turn contribute back to organizational success, especially the success of change initiatives. This work specifically speaks to the role of support in the context of organizational change by

studying the role of formal and informal support structures and their impacts on key employee outcomes.

Limitations and Future Research Directions

This work has a few limitations that should be acknowledged so that the results can be interpreted with the necessary caution. ES implementations are complex and take time to complete (Markus and Tanis 2001; Volkoff et al. 2007). However, this study was restricted to the shakedown phase of the implementation, which is widely acknowledged to be the most critical in terms of continuation or abandonment of an ES (see Morris and Venkatesh 2010). It could be that these findings might change over time, with some support structures gaining or losing influence on the outcomes of interest. Work that gives greater consideration to time would enrich our understanding of this phenomenon. Thus, an area for possible future work would be to examine ES implementations and support structures over a significantly longer period of time— that is, across all phases of an implementation.

Advice networks are not the only type of social network to be found in organizations. Although this paper examined peer advice ties, future work should build upon this by examining other existent employee peer networks. Some networks that could prove useful to study are communication, friendship, and hindrance networks (e.g., Sparrowe et al. 2001; Sykes and Venkatesh forthcoming). Learning how best to leverage the different networks will be in the best interest of organizations. These networks could have positive or negative effects on job outcomes in the context of new ES implementations. Further, researchers can overlay these networks and understand their interactive influence on key outcomes.

The outcomes that were studied in this work, although representative, are certainly not exhaustive. Future work should also study other key employee outcomes. Also, much work is now done in teams, both colocated and virtual (Wuchty et al. 2007). Examining team-level outcomes, such as cohesion and performance, and the impacts of TSS and peer advice ties on such outcomes in the context of ES implementations will be a valuable addition to the literature. Further, there are many types of systems, including different types of ESs, implemented within organizations. Work that examines whether these findings generalize to other system contexts and other types of organizations would be of value in building a more robust understanding of ES implementations and IS success.

In relating various support structures to employee outcomes, informational, timing, and contextual bases were suggested as critical mediating mechanisms. The role of these mechanisms

should be investigated in the context of other theoretically proposed causal chains, such as the technology acceptance model 3 (Venkatesh and Bala 2008), that suggest that interventions will influence perceptions about systems that in turn will influence behaviors, such as system use, that in turn will influence employee outcomes. Such future work can also be related to research that has conceptualizations of use that go beyond simplistic views to focus on rich use (see Burton-Jones and Straub 2006) and used as a key mediator to achieving improved job performance (see Sykes and Venkatesh forthcoming).

Given the nascent state of research on holistic investigations of the effects of support structures on various employee outcomes, developing the rationale to relate five different support structures to four different outcomes was focused on in this work. Naturally, the first step is to theorize about potential direct effects, as was done here. Next steps should involve an examination of possible interaction effects across the different support structures. For example, peer advice ties could complement the value derived from training or help desk use by providing real experiences from peers. Likewise, it is possible that peer advice ties could substitute for online support because an employee has access to several ties whom he or she can access at any time.

Practical Contributions

Beyond the theoretical advances that this work presents, it has implications for practitioners. If organizations could harness the naturally occurring employee peer advice ties, they could potentially maximize the likelihood of ES success or at least minimize negative outcomes of ES implementations, such as increased job stress, lowered job satisfaction, and lowered job performance. As peer advice ties already exist in organizations, they represent a key resource that could and should be leveraged to enhance the likelihood of success of organizational change efforts. The results of this work suggest that when controlling for peer advice ties, TSS (except for change management support) are no longer significant in terms of system satisfaction, job satisfaction, and job performance. The reason change management support remains a significant predictor (although less than when not controlling for peer advice ties) could be that change management consultants do offer valuable information that complements peer advice ties. Taken together, this suggests change management support, more than other TSS, is perhaps the second most valuable support after peer advice ties.

In highlighting the complex nature of informational needs that employees have during an ES implementation, this work represents a first step in identifying factors related to TSS that

could be leveraged to help organizations shepherd their employees through the minefield-filled shakedown phase of an ES implementation. For example, one problem with training is that it often occurs prior to interactions with a new ES. Although this makes sense, in that to use a new ES, one must first know how to do so, it might be that a lagged form of training (i.e., one that is broken down into phases) might be optimal. A familiarization phase that focuses on keystroke-level training on use of the new ES as well as identifying the key features of the new ES for the employees could be given before roll-out. This could be followed by training sessions tailored to work processes during the first few weeks of the actual roll-out. An alternative to current traditional help desks might be to assign one or more power users to the help desk, especially in the shakedown phase of an ES implementation, so that when problems are reported, the appropriate information can be provided that is couched in the appropriate context of new business processes relevant to a particular business unit and/or particular groups of employees. Also, one or more power users could help to educate help desk personnel on key elements of useful information so that help desk personnel could provide better help that is tailored to the context.

Conclusions ▆▆▆▆▆▆▆▆

This research studied the impacts of TSS and peer advice ties on four key job outcomes. Strong evidence was found to suggest that peer advice ties have a favorable impact on employee outcomes in the shakedown phase of an ES implementation. This work advances the ES implementation literature by underscoring that the complex informational needs of employees in the context of an ES implementation may help to explain why TSS have been less than successful in many ES implementations. This work suggests that peer advice ties are a potential resource, above and beyond TSS, that organizations can and should leverage in order to increase the likelihood of success of new ESs.

Acknowledgments

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SUPPORT STRUCTURES AND THEIR IMPACTS ON EMPLOYEE OUTCOMES: A LONGITUDINAL FIELD STUDY OF AN ENTERPRISE SYSTEM IMPLEMENTATION

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Appendix A

Review of Research Related to Support Structures in *MIS Quarterly* and *Information Systems Research*

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
MISQ	2011	Furneaux and Wade	Large-scale IS	System support	System support availability is defined as the availability of the vendor and other support capabilities considered important to the continued use of an information system.	Change management support	Discontinuance/ Replacement intentions
MISQ	2010	Puhakainen and Siponen	Email (implementation of IS security policy)	Training	The training program must provide necessary information to the educators, so the educators know the theory of how the training program helps people learn. In the case of IS security training, the underlying theories should not only explain how people learn, but also what learning principles are expected to change user compliance with IS security policies. As a second requirement, the underlying theory should provide guidelines for how successful training is to be delivered in practice.	Training	Employees' compliance with IS security policies

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
MISQ	2010	Beaudry and Pinsonneault	Suite of applications developed in-house for a bank	Social support	Sympathy, understanding, encouragement, advice and moral support from family, friends and colleagues.	Peer advice ties	IT use
				Instrumental support	Looking for help from colleagues or from online or manual support to enhance ones usage of a given IT.	Peer advice ties, online support	
				Negative social support (mentioned in footnote)	Social undermining/hindrance network.	N/A to the present paper	
MISQ	2010	Strong and Volkoff	ES (SAP)	Power users	Employees seconded from operations to the ES team to help with testing, training and subsequent support, but ultimately expected to return to their jobs.	Peer advice ties	Identified six domains of misfit between the organization and ES
MISQ	2010	Seddon et al.	ES	Overcoming organizational inertia	The extent to which the employees of the organization are motivated to learn, use, and accept the new system. This includes training, and change management effort and support.	Training, change management support	Organizational benefits from ES use
				Improved access to information	Any step taken to increase provision of timely, accurate, relevant information to key organizational decision makers.	Online support	
MISQ	2009	Kim and Kankanhalli	New ES developed by company	Organizational support	The perceived facilitation provided by the organization to make users' adaptation to the new IS-related change easier. Organizational support includes various mechanisms, such as training and providing resources relevant for learning.	Training, online support, help desk support	User resistance, perceived value [of changing to new system], switching costs, switching benefits
MISQ	2009	Sykes et al.	ES	IT help desks	Formal support mechanisms, such as IT help desks, are often overwhelmed and, in most cases, IT support staff lack business domain expertise that is crucial in fully resolving users' problems. Prior research has shown that employees in organizations are often dissatisfied with formal channels of support such as help desks. IT help desks are particularly hindered by a lack of domain expertise needed for effective use of business applications.	Help desk support	System use

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
				Training	In general, the facilitating conditions construct in IS research has focused on formal training, guidance, infrastructure, and help desk support that is available to employees, and these facilitating conditions can foster or hinder system use.	Training	
				Peer support	An employee may introduce a colleague to a useful feature or a shortcut in an application or walk them through a complex processing step that the colleague may not be able to learn on his or her own.	Peer advice ties	
				Power users	The organization used a power user concept for training users. They identified users in each of the business units that were influential in their units and that were interested in the system, and trained them extensively in how to do transaction processing as well as in how processes were changing and being integrated.	Training, peer advice ties	
MISQ	2008	Au et al.	IS used by representatives from airline and hotel industries	End-user support	*IS performance* is defined as the perceived outcome from IS use. The commonly used IS attributes in many previous studies can be classified into three groups: system quality, information quality and support services quality. It has been suggested that EUS is a product of information satisfaction, system satisfaction and support satisfaction.	Help desk support	End user IS Satisfaction
MISQ	2007	Sharma and Yetton	Meta-analysis	Training	Experts explain the application to novice users in classroom settings, demonstrate how to use its technical features, observe the learners practicing and provide feedback.	Training	IS implementation success
MISQ	2007	Liang et al.	ERP system	Top management support (beliefs and participation)	Top management beliefs refers to the subjective psychological state regarding the potential of ERP. Top management participation refers to the behaviors and actions performed to facilitate ERP assimilation.	N/A to the present paper	ERP assimilation

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
ISR	2011	Venkatesh et al.	E-healthcare system	Training	A key barrier to success of such systems is the availability of adequate training and support. Typically e-healthcare systems are inflicted on healthcare professionals with little or no training or process change support, thus resulting in adoption taking much longer than expected and benefits not being realized for a long time. By reflecting the connectedness of an individual, in this context, network centrality is the extent to which an individual can obtain information about system features, procedural details, and activities in the new process; knowledge, such as tips and tricks, shortcuts, and details related to the integration of the process and software; and other tangible resources, such as training resources, manuals and tutorials, that can greatly help with using the system.	Training	Quality of care, patient satisfaction
				Process change support	Change management support is also a key factor that fosters successful system implementation. Process change support is mentioned in text and change management support is measured and controlled, but not described in detail.	Change management support	
				Online support	Other tangible resources, such as training resources, manuals and tutorials, can greatly help with using the system.	Online support	
ISR	2011	Ravishankar et al.	KMS	Support of senior executives for IS	KMS was promoted by the CEO and was supported by senior executives in all units.	N/A to the present paper	Implementation success
				Full-time KM team comprising software developers and marketing personnel	The KM team's mandate was to try and make sure that the client facing sales and business development personnel in the corporate unit had the requisite up-to-date information when meeting potential clients. Therefore, the focus of the KMS was on building repositories that contained case studies of past projects, presentations to clients, organizational best practices, etc.	Online support	

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
				Document support (Repository)	Contains knowledge resources classified according to category (e.g., best practices, domain, technology). Also contains project profiles, ITS patents and an online library.	Online support	
				Phone support (K-Phone)	K-Phone is an off-the-shelf SMS (mobile messaging) technology to facilitate requesting of key documents by members while on the move. This document-request-and-delivery service is automated with inexpensive technology and small programming effort.	Help desk support	
				Online support (K-Transmit)	Members at all levels in the organization spend significant time reading and responding to e-mails. The KM team latched on to this practice and modeled the "K-Transmit" service around it. Through "K-Transmit," queries posted by members are channeled to the mailboxes of the right audience, and their e-mail replies are tracked and logged in the repository. Thus, with "K-Transmit," the knowledge otherwise floating around gets logged at one place.	Online support	
				Help desk	A dedicated team attends to the queries and requests of the members, thus trying to make this initiative more reachable and useful.	Help desk support	
ISR	2009	Vaast and Walsham	Environmental health exchange network (EHEN)	Training	Access to and use of the EHEN during the formal EH training phase contributed to making the practices related to the EHEN "second nature" for new EH members. The EHEN became available to all students of the National School of Public Health one year after its implementation. They relied on the use of the EHEN during their formal training and this contributed to the subsequent integration of the use of the system in new graduates' regular work practices.	Training	Sharing resources through networks of practice, engaging with peers based on shared practices
				Document support (online repository)	Meetings took place among peers. After these meetings, minutes and other documents were posted on the EHEN and electronic discussions were triggered.	Online support	

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
ISR	2008	Ragunathan et al.	ICT	Technostress inhibitors (includes literacy facilitation, technical support provision and involvement facilitation)	Represents organizational mechanisms, such as end user training, support and participation, which are relevant in the context of ICT implementation and use.	Training, help desk support	Job satisfaction, organizational commitment, continuance commitment
				Literacy facilitation (documentation, training and knowledge sharing among team members)	Describes mechanisms that encourage and foster the sharing of ICT-related knowledge within the organization.	Online support	
				Technical support provision (help desk)	Describes activities related to end-user support that reduce the effects of technostress by solving users' ICT problems.	Help desk support	
				Involvement facilitation (encouraging users to explore technology features)	Helps alleviate technostress by keeping users informed about the rationale for introducing new ICTs by letting them know about the effects of such introductions and by encouraging them to use and experiment with new ICTs.	Training	
ISR	2008	Devaraj et al.	eProject (collaboration system)	Training	All subjects received the same hands-on training covering all anticipated uses of eProject.	Training	System use
				Technical support	Technical support was provided foreach core course to automatically maintain the related eProjects so that all assignments appeared as tasks assigned to students and all documents appeared in the projects for electronic distribution.	Help desk support	
ISR	2007	Bala and Venkatesh	RosettaNet PIPs	Training	These are mentioned as important factors for assimilation. For example, extensive business process training (simulation- and game-based) and support programs were used (by Manufacturer K) to teach employees new processes and the fit of different PIPs to help combat employee resistance.	Training	Assimilation of interorganizational business processes standards (IBPS)

Journal	Year	Authors	Type of system	Type of support	Definition/description of type of support (from article)	Corresponding support structure	Dependent Variable(s)
				On-site support	A firm was able to overcome these inertial forces with support from its top management and dominant trading partners who provided not only technical support, but also training and on-site support.	Training, help desk support	
				Top management support	Overcoming resource rigidity in the context of IBPS assimilation requires top management support, technological capability and readiness, and the ability to mobilize resources, i.e., financial and/or human capital.	N/A to the present paper.	
				Employee support	Employee support is mentioned in the paper as an important factor for assimilation.	Peer advice ties	

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Appendix B

Items Used to Measure Key Constructs ▪

Unless otherwise noted, all scales are seven-point Likert scales with anchors strongly disagree, moderately disagree, slightly disagree, undecided, slightly agree, moderately agree, and strongly agree.

Training satisfaction
 1. Overall, I was satisfied with the training.
 2. The training provided comprehensive coverage of the system and how I would use it in my job.
 3. The training materials were comprehensive.

Change management satisfaction
 1. The change management support was available whenever I needed it.
 2. The change management consultants understood my problems well.
 3. The change management consultants resolved the problems I faced.

Online support satisfaction
 1. The online support was available whenever I needed it.
 2. The online support consultants understood my problems well.
 3. The online support consultants resolved the problems I faced.

Help desk satisfaction
 1. The help desk support was available whenever I needed it.
 2. The help desk consultants understood my problems well.
 3. The help desk consultants resolved the problems I faced.

Advice networks
Indicate which of the following individuals are important sources of work-related advice or whom you approach if you have a work-related problem:
<Name 1>
…
<Name n>
Note: Scale ranging from 1 to 7, where 1 = never; 2 = rarely (less than once a month); 3 = a few times a month; 4 = weekly; 5 = daily; 6 = a few times a day; 7 = hourly or more.

System satisfaction
 1. I am an enthusiastic user of <system>.
 2. All things considered, my continuing to use <system> in my job is… (Extremely Negative to Extremely Positive).
 3. All things considered, my continuing to use <system> in my job is… (Extremely Bad to Extremely Good)
 4. All things considered, my continuing to use <system> in my job is… (Extremely Harmful to Extremely Beneficial).

Job stress (seven-point Likert scale with anchors never, a few times a year or less, once a month or less, a few times a month, once a week, a few times a week, and every day)
 1. I feel emotionally drained from my work.
 2. I feel used up at the end of the workday.
 3. I feel fatigued when I get up in the morning and have to face another day on the job.
 4. Working with people all day is really a strain for me.
 5. I feel burned out from my work.
 6. I feel frustrated by my job.
 7. I feel I'm working too hard on my job.
 8. Working with people directly puts too much stress on me.
 9. I feel like I'm at the end of my rope.
 10. Working at this job is emotionally exhausting.

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

Job performance (1 = needs much improvement, 7 = excellent)
1. Quantity of work output.
2. Quality of work output.
3. Accuracy of work.
4. Liaising well with suppliers.

Appendix C

Common Method Bias

As discussed in the method section, all constructs were measured using a survey, thus raising concerns about common method bias. Although the independent and dependent variables were measured at different points in time and job performance being measured from a different source alleviates this concern to some extent, common method bias is still a potential threat to the validity of our results (Podsakoff et al. 2003). To test for common method bias, the marker variable technique was employed (Lindell and Whitney 2001; Malhotra et al. 2006) and then the hypotheses based on the corrected correlations were tested. Specifically, the third smallest positive correlation among the constructs was chosen as a conservative estimate of common method variance (CMV) to produce the CMV-adjusted correlation matrix (Lindell and Whitney 2001). Following Malhotra et al. (2006), the CMV-adjusted correlation matrix to estimate CMV-adjusted path coefficients and explained variance was used. The results showed that even after controlling for CMV effects, all of the path coefficients that were originally significant remained significant, although the magnitude of the coefficients dropped slightly in some cases. These results demonstrate the robustness and the validity of our findings.

References

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Appendix D

Robustness Analysis in PLS: Interrelationships among Outcomes ▄▄▄▄▄

	System Satisfaction	Job Stress	Job Satisfaction	Job Performance
R²	.20	.39	.46	.44
Control variables:				
Age	-.04	.07	.03	.02
Gender (1: women)	.03	.04	.03	.01
Organizational tenure	.02	.03	.03	.05
Organizational position	.01	.02	.04	.01
Computer self-efficacy	.05	.04	.00	.02
Pre-impl. job stress		.31***		
Pre-impl. job satisfaction			.23***	
Pre-impl. job performance				.20**
Employee outcomes				
System satisfaction		-.13*	.07	.03
Job stress			-.20**	-.17**
Job satisfaction				.15*
Traditional support structures:				
Training	.03	.01	.01	.02
Online support	.07	-.12*	.04	.02
Help desk support	.08	-.12*	.05	.04
Change mgmt. support	.12*	-.15*	.07	.12*
Advice network support:				
Get-advice centrality	.30***	-.32***	.33***	.34***

Notes: 1. Dependent variables are post-implementation values.

2. Shaded cells are not applicable.

3. *p < .05; **p < .01; ***p < .001.

Appendix E

Robustness Analysis in SUR (Still Including Interrelationships among Outcomes) ▮▮▮▮▮

	System Satisfaction	Job Stress	Job Satisfaction	Job Performance
R^2	.19	.37	.43	.41
Control variables:				
Age	-.03	.04	.02	.00
Gender (1: women)	.03	.03	.03	.01
Organizational tenure	.02	.03	.03	.04
Organizational position	.01	.02	.01	.01
Computer self-efficacy	.04	.02	.02	.02
Pre-impl. job stress		.29***		
Pre-impl. job satisfaction			.19**	
Pre-impl. job performance				.17**
Employee outcomes				
System satisfaction		-.12*	.04	.02
Job stress			-.19**	-.15*
Job satisfaction				.14*
Traditional support structures:				
Training	.03	.01	.01	.01
Online support	.07	-.12*	.04	.02
Help desk support	.05	-.12*	.03	.02
Change mgmt. support	.13*	-.14*	.05	.12*
Advice network support:				
Get-advice centrality	.28***	-.29***	.32***	.31***

Notes: 1. Dependent variables are post-implementation values.

2. Shaded cells are not applicable.

3. *p < .05; **p < .01; ***p < .001.