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RESEARCH ARTICLE

EXPLAINING POST-IMPLEMENTATION EMPLOYEE SYSTEM USE AND JOB PERFORMANCE: IMPACTS OF THE CONTENT AND SOURCE OF SOCIAL NETWORK TIES[1]

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This paper draws from communication research and negative asymmetry theory to examine how employee social network ties at work affect deep structure use and job performance in the context of an enterprise system (ES) implementation. Specifically, we examine how the content (i.e., advice and impeding) and source (i.e., friends and acquaintances) of social network ties interact with one another to influence both deep structure use of the new ES and employee job performance. A longitudinal field study was conducted, with data collected from 145 employees and their supervisors in a business unit of a large multinational telecommunications firm. Results show that both source and content of social network ties influenced deep structure use of the new ES as well as employee job performance. This work contributes to the ES implementation literature by examining the influence of both positive and negative social ties. This work also identifies an important boundary condition of negative asymmetry theory by showing that not all negative stimuli influences behavior equally.

Keywords: Enterprise systems, ERP, job outcomes, advice networks, friendship networks

Introduction

Enterprise systems (ESs) are complex, enterprise-wide systems incorporating software, hardware and business processes (Markus and Tanis 2000). The implementation of an ES is one of the most common and expensive types of organizational change events (Herold et al. 2007; Morris and Venkatesh 2010). Gartner (2011) reports that the global spending on ESs reached U.S. 2.5 trillion dollars in 2011 and is expected to continue to grow. ESs are often advertised as being able to produce efficiency and effectiveness gains to organizations that implement them (Morris and Venkatesh 2010). However, in order for these benefits to be realized, employees must use the system (Venkatesh et al. 2003). Further, fitting tasks with system functionalities appropriately is expected to lead to greater performance and use of the system (Goodhue and Thompson 1995). For all the potential benefits of ESs, there are enormous challenges present when implementing them (e.g., Chae and Lanzara 2006; Robey et al. 2002), with a majority of these implementations failing (Lapointe and Rivard 2005). Taken together, this suggests that it is important to examine not only how often a person uses a system, but how they use the system.

Much of the challenge of implementing ESs stems from employees' inability to adjust to the new business processes and software, and consequently their new (i.e., completely redesigned) jobs that are part and parcel of a new ES implementation (e.g., Morris and Venkatesh 2010; Robey et al. 2002). Employees' abilities to deal with these challenges in the early stages of an implementation are critical, particularly in the shakedown phase of the implementation that typically lasts between 6 to 12 months after the roll-out (see Markus and Tanis 2000; Morris and Venkatesh 2010; Sykes 2015;

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Sykes et al. 2014). When employees successfully deal with the challenges posed by the new business processes and software, they are more likely to use the new system as it was designed to be used and the expected benefits of improved performance will accrue. Such benefits are critical to ensuring the long-term success of an ES implementation and in preventing the abandonment of the system or catastrophic consequences that sometimes follow such an implementation (Peppard and Ward 2005). Thus, research that can help us to understand the factors contributing to employees' use of the new system and their job performance following an implementation, especially in the shakedown phase, will be of value to organizations. As new systems are introduced, traditional approaches used by organizations to help employees adjust to the new system are training (Marler et al. 2006) and ongoing support, such as help desks and manuals (Compeau and Higgins 1995; Sykes et al. 2009). However, such training and support have their limitations (see Edmondson et al. 2001; Sharma and Yetton 2007; Sykes 2015) and it can be argued, these traditional types of support are relatively ineffective given the high failure rates of ESs. For example, soon after a major ES implementation, help desks are not only overwhelmed with a greater than normal call volume, but also are often staffed by employees who, although competent with the system, lack specific domain/business knowledge (Davis et al. 2009). In contrast, fellow employees can act as sources of work-related information. Further, the information they provide has the benefit of being framed in the appropriate business domain context (Sykes 2015; Sykes et al. 2014). Workplace peers can contribute positively to ES use among fellow employees facing and dealing with organizational change due to a new ES implementation, especially in the shakedown phase (Davis et al. 2009; Sykes 2015; Sykes et al. 2009; Sykes et al. 2014). Fellow employees (peers) have knowledge and understanding of underlying business processes and interrelationships (Borgatti and Cross 2003), both past and present, that can be leveraged to better understand how to use the new ES. Although ties to such peers can have positive effects, it has been shown that there is also a negative side of the social ledger that can have a strong influence on behavior (Labianca and Brass 2006; Mehra et al. 2006). Given the potential critical role peers can play, social network theory offers us the means to dissect the complex interdependencies among employees in terms of the social ties that are present and their impacts (Gargiulo and Benassi 2000; Sparrowe and Liden 2005).

We delve deeper into social ties and their impacts by drawing from multiple related yet distinct bodies of work: communications research and negative asymmetry theory focusing on knowledge transfer. This work incorporates ideas from communications research on knowledge transfer that suggest that it is not only the message content, but also the source of the message that is important in transferring information to others (Joshi et al. 2007). We also draw from negative asymmetry theory that suggests that negative stimuli are often more influential than positive, especially in times of stress (Labianca and Brass 2006). We argue that positive and negative social ties will influence ES use and job performance. Thus, in order to gain a holistic understanding of social ties, we examine not only the positive and negative content (i.e., advice versus impeding) but also the source of the advice and impeding (i.e., friends—expressive ties—versus acquaintances—instrumental ties). We theorize that the interaction of source and content is key to employee outcomes. With regard to system use, we contend that in order to achieve necessary levels of use and, consequently, obtain positive benefits in terms of job performance, the role of social networks will be critical as it does "take a village" to achieve such benefits given the complexity of ESs and the extent of change they bring in terms of new business processes and software. We argue that advice networks (i.e., connections with other employees with the purpose of seeking information/knowledge; Cross et al. 2001) and impeding networks (i.e., interconnections with other employees who make it difficult to do one's job; adapted from Sparrowe et al. 2001) will play opposing positive and negative roles in driving post-implementation job performance through deep structure use. Further, we argue that the source of ties (i.e., ties to friends and ties to acquaintances) in the context of advice versus impeding networks will play different roles in driving post-implementation job performance through deep structure use of the new ES. In sum, this paper has the following objectives:

(1) Develop a model using the content and source of social network ties to explain deep structure use and employee job performance in the shakedown phase following an ES implementation.

(2) Empirically validate the proposed model.

This work is expected to make contributions to both IS and social networks research. In terms of IS research, by integrating social networks into a nomological network of ES use and consequent job performance, we expect to provide a richer understanding of ICT-driven, particularly ES-driven, organizational change. By drawing on prior research and making the case for the differential roles for different types of network ties, which are distinguished on the basis of the combination of content and source, on a key job outcome (i.e., job performance) in the context of an organizational change event (i.e., performances implementation), we enrich social networks research by gaining a holistic understanding of the impact of positive and negative social network ties on employees in times of organizational change.

Theory

Background

In this section, we discuss the key dependent variables (i.e., employee job performance and deep structure use) and the theoretical lens (i.e., social networks).

Job Performance

Job performance represents the key performance outcome at the individual level that an ES is expected to enhance and is thus our ultimate dependent variable of interest. Job performance is how well an employee performs his or her job and is often an external assessment (e.g., supervisor assessment) of an employee's execution of his or her assigned job duties (Barrick and Mount 1991; Judge et al. 2001). It is a critical outcome variable given that an organization is dependent on its employees performing their assigned jobs well. The body of research on job performance in management is vast (for a review, see Rotundo and Sackett 2002). There are several different theoretical perspectives that have been employed to explain and predict job performance, for example, personality (Tett and Burnett 2003), job characteristics (Fried and Ferris 1987; Hackman and Oldham 1980), and social networks (Cross and Cummings 2004; Mehra et al. 2001; Sparrowe et al. 2001). However, research that examines this outcome in light of ICT implementations is relatively rare (see Parker et al. 2001).

Deep Structure Use

For some time now, one of the most mature and active areas of IS research has focused on predicting employee system use (for reviews, see Venkatesh et al. 2007; Venkatesh et al. 2003). Lean conceptualizations of system use were most often based on number of logins to a system in a given time period or in terms of how long a user was logged onto the system in a given time period (Venkatesh et al. 2008; Venkatesh et al. 2003), whereas richer conceptualizations reflect the nature of the use by considering the interplay of the system, user, and task (Burton-Jones and Straub 2006). Burton-Jones and Straub (2006) noted that a majority of the work explaining individual-level use has employed lean conceptualizations and measures. It would even be fair to say that seldom were the use constructs conceptually defined, rather they were simply a measure of use (e.g., duration and/or frequency). Drawing from Burton-Jones and Straub, we employ a rich conceptualization of use: deep structure use.

Deep structure use as a key behavioral outcome is especially appropriate for several reasons. First, in his editorial comments to DeSanctis and Poole's (1994) seminal work, Robert Zmud noted that IT systems and work systems both have deep structures. Further, ESs are typically complex, designed to handle a preponderance of employees' work tasks and have a goal of increasing efficiency and effectiveness in a business unit that suggests that using the system and performing one's work is synonymous. Measuring simple duration or times logged in would not capture how well employees are using the functionalities provided by the system. Deep structure use is a post-acceptance behavior that involves the integration of the system with the user's tasks (Wang and Butler 2006). Although there are various definitions of deep structure use, they all have centered on the extent to which users employ the features of the target system to support their tasks (Burton-Jones and Straub 2006; Wang and Butler 2006). Deep structure use is expected to be a key driver of performance given that employees' jobs require using the ES to complete a majority of their job tasks.

Social Networks

A social network is defined as a specific type of relation, such as friendship, linking a defined set of persons, objects, or events (see Mitchell 1969; Scott 2000). Social network research draws on patterns of interactions within social units in which an actor is embedded and explains outcomes experienced by the focal actor. An employee's position in a social network 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), or can lead to disadvantages, such as organizational exit (Krackhardt and Porter 1986). The structure of social interactions enhances or constrains access to valued resources (Brass 1984; Ibarra 1993a, 1993b). Work-related resources, such as task advice and strategic information, are accessible through social networks that may also transmit social identity, norms, and social support (Podolny and Baron 1997).

There are many types of networks (e.g., advice, awareness, communication, friendship, impeding). In the workplace, one of the most studied types of social network is the advice network (McDonald and Westphal 2003; Sparrowe et al. 2001). Advice networks comprise employees who seek and provide information, assistance, and expertise from and to one another in order to perform their jobs. Impeding networks, often termed hindrance networks, comprise employees who make it difficult for a focal employee to complete his or her job (Sparrowe et al. 2001). Appendix A summarizes the key studies from 2006–2010 in premier IS journals (i.e., *MIS Quarterly* and *Information Systems Research*) and organizational behavior journals (i.e., *Academy of Management Journal* and *Journal of Applied Psychology*) to highlight the

type of social networks previously studied. A close examination of Appendix A shows that there have been few studies that seek to expound on social networks in terms of both content and source. The majority of social network studies deal with only one type of network. Of those dealing with more than one type of network, the networks themselves are not compared in terms of mechanisms that influence outcomes of interest. This paper seeks to do just that by disaggregating positive and negative social ties (content) from both friends and acquaintances (source) in order to examine their effects on deep structure use and job performance in the context of an ES implementation.

Distinguishing Across Ties: Content and Source of Ties

We now discuss the content of social networks, both positive and negative, as well as the mechanisms by which we expect these social ties to influence deep structure use and job performance.

Obtaining advice from coworkers has been studied in several contexts (e.g., Sparrowe et al. 2001). Prior research on employee *advice networks* has generally based the networks on those to whom an employee goes for work-related advice (e.g., Goodwin et al. 2009; Ho et al. 2006). Such advice is generally believed and shown to have positive effects on behavior and performance (Ibarra and Andrews 1993; Sparrowe et al. 2001). Recent IS research has also confirmed such a relationship (e.g., Sykes et al. 2014).

There are also negative ties, often termed hindering network ties, in the workplace that have adverse effects on employee outcomes, such as job satisfaction and job performance (Duffy et al. 2006; Sparrowe et al. 2001). Hindering has many specific labels and can describe several behaviors in the social psychology and management literatures, such as interference, threats, sabotage, and rejection (Sahlins 1972; Sparrowe et al. 2001), as well as affective responses to such behaviors, such as annoyance and anger (Pagel et al. 1987). Here, we are interested in the impacts of hindering actions/information related specifically to doing one's job in the context of an ES implementation. We are interested in the general/broad hindering behavior of both friends and acquaintances and can include various actions taken to hinder, such as gossiping and undermining. Due to our need for a broader and more inclusive hindering network, we adapt and extend Sparrowe et al.'s (2001) concept of a hindrance network to a network we label as an *impeding network*. An impeding network maps the ties to employees who make it difficult for an individual to do his or her job.

Understanding the influence of such impeding social forces is important in light of negative asymmetry theory (Labianca and Brass 2006) which explains that it is often the negative relationships that are most powerful in terms of motivating or preventing others' behaviors when compared to more positive or neutral relationships. Impeding can come from conscious action, such as by willfully providing wrong information to another or by refusing to lend resources to aid task execution or completion. Impeding can also occur unconsciously by providing information that one believes is correct but is not, or from pursuing social contact that can impede another from doing their job, for example, a friend stopping by one's office to talk about a recent sporting event.

Beyond the content of ties in terms of positive and negative, in the workplace, the source of the relationship between two nodes is important. Employees can play multiple roles in terms of relationships with others. In this work, employees are classified as either being a friend or a non-friend (hereafter termed an *acquaintance*; Umphress et al. 2003). Expressive ties are those that are affective (i.e., based on the existence of friendship; Ibarra 1993b). Instrumental ties are those that involve employees among whom there is no affective relationship (Umphress et al. 2003), that is, they are instrumental in that ties with coworkers who are not friends exist due to the job itself.

It is likely that employees obtain advice both from expressive and instrumental ties. However, advice from a friend is likely to have different characteristics than that from an acquaintance due to the source characteristics' differences across the two types of ties (Constant et al. 1996). For example, prior work on trust has shown that friends have a higher degree of trust in one another when compared to their trust in those who are not friends (Krackhardt 1992). Greater trust in the source of advice will likely lend greater weight to the advice. Therefore, this work examines these two key sources of advice.

Similarly, impeding can be from friends (i.e., expressive impeding) or from acquaintances (i.e., instrumental impeding). Negative relationships are of particular importance when the concept of negative asymmetry—the idea that negative stimuli may have greater explanatory power than positive stimuli in a diverse range of situations, including person perception and social judgment (see Labianca and Brass 2006; Taylor 1991)—is considered.

Table 1 presents a summary of the core mechanisms that underlie the effects that we have proposed in our hypotheses. We first discuss the core mechanisms underlying the effects of each of the four types of networks on our key dependent variables. Next, we discuss the mechanisms that underlie the effects of each of the four cells.

Table 1. Underlying Mechanisms of Effects of Network Ties

		Source		
		Friends ***Expressive ties***	**Acquaintances** ***Instrumental ties***	
Content	**Advice**	*Information/resource access* • Emotional support (Ruderman et al. 2002) • Increased trust (Lincoln and Miller 1979)	• Unique knowledge access (Burt 1992)	No social pressure
	Impeding	• Pressure to conform (Granovetter 1973) • Social demands on time	• Withholding resources	
		Time wasting		

Easy access
Homophily/redundant knowledge

Model Development

Figure 1 presents our research model. Our model shows that it is the interaction between content and source of social network ties that influences deep structure use of an ES in the shakedown phase and that such use in turn influences job performance. We note that the antecedents to deep structure use are indeed general (not IT-specific) constructs. This is, in part, due to the fact that when an ES is implemented, the system becomes inextricably woven throughout most work tasks. Consequently, any interaction about work often relates to the system either directly or indirectly. For example, if an employee goes to a coworker seeking work-related advice, it is likely that some facet of the advice that is received will relate to how to use the ES to accomplish the work task. It would, therefore, be artificial to focus purely on "IT" variables as that would reduce our ability to explain job performance in the new ES-mediated environment that involves changes to the business processes, software used, and work roles.

Effect of Deep Structure Use on Job Performance

We expect that deep structure use of the ES will impact job performance given that the ES was created and implemented to increase effectiveness and efficiency. Deep structure use has its roots in task–technology fit. Task–technology fit focuses on the extent the technology features fit the tasks to be performed with the technology (Goodhue and Thompson 1995). Goodhue and Thompson (1995) go on to note that the greater the fit between the technology features and the tasks, the greater the performance benefits. Deep structure use goes beyond task–technology fit in that it represents the degree to which an employee is using the appropriate features for various tasks. Deep structure use reflects the breadth of functionalities a user is applying against the number of functionalities there are for a particular task. It is an indicator of how well one knows the functionalities of the ES as it relates to tasks at hand. The more functionalities within the ES an employee can access to perform his or her job will lead to the employee being more effective and efficient in the completion of tasks using the system. On the flip side, an employee who does not use the core features of the ES will find that he or she may not be able to perform his or her work tasks, especially in an efficient and effective manner. Taken together, this would suggest that the greater the deep structure use, the greater the performance will be.[2] Thus, we hypothesize:

H1: Deep structure use will positively influence job performance.

Effects of Social Networks

We next discuss what each of the two content types and two source types provide in the context of an ES implementation. We then present the arguments, drawing on Table 1, for the effects of each of the source–content interactions on deep structure use and job performance.

Advice: An advice network in the workplace is a map of relationships between nodes (often, employees) exchanging

[2]Other theoretical perspectives can also be used to support this relationship. Being able to achieve deep structure use will foster feelings of expertise in using the system (see Tenkasi and Boland 1996). Increased expertise with the system has been associated with increased self-efficacy (i.e., an individual's belief that they are capable of using the system; Blair et al, 1999). Increased self-efficacy with a task has been shown to positively influence performance of the task (Bandura 1993). Therefore, feelings of expertise in turn could push an employee to even higher levels of performance (see Sparrowe et al. 2001).

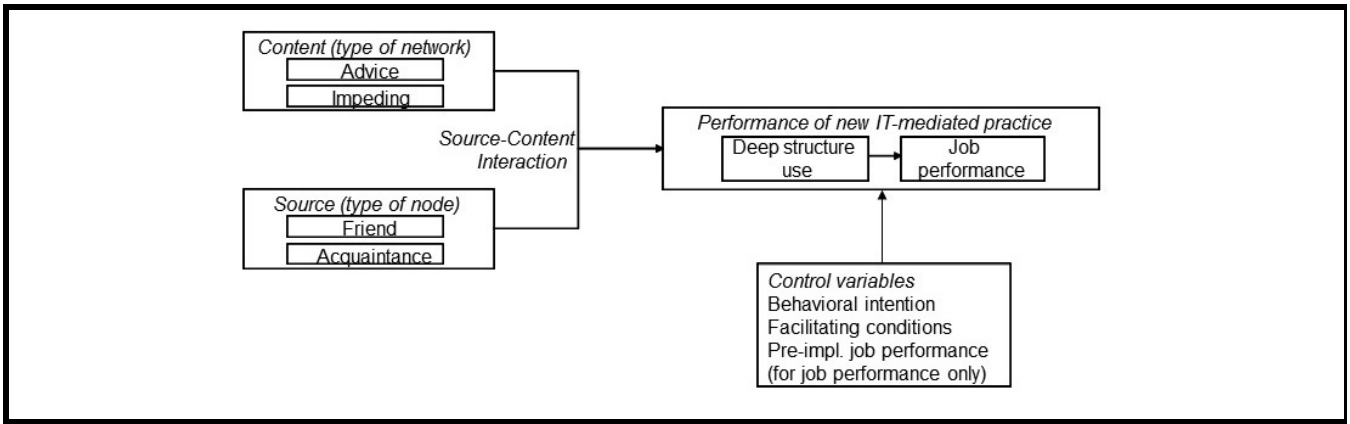

Figure 1. Research Model

informational resources to help one another accomplish work tasks (Borgatti and Foster 2003). The benefits accrued from advice networks are derived from the improved access to information and knowledge. Cross et al. (2001) identified five dimensions of advice network participation in the creation and dissemination of knowledge: solutions, meta-knowledge, problem reformulation, validation, and legitimization. Of these, the last two have a social support component such that, although actual information regarding the task at hand is not exchanged, affirmation of the advice-seeker being on the right track is given (validation), and quality of a proposed solution is ascertained (legitimization). In the context of an ES implementation, especially in the shakedown phase, advice from peers will be critical to successfully using the system to accomplish work tasks.

Impeding: Impeding, often termed hindrance, networks are those in which focal employees are impeded from easily accomplishing their work tasks by those to whom they are connected (Sparrowe et al. 2001). It is important to examine this dark side of the social ledger as in times of a major organizational change (e.g., during an ES implementation) negative influences can often be more detrimental than at other times (see Mehra et al. 2001). A major type of harm caused by impeding ties can be attributed to some form of time wasting. Time wasting can occur for several reasons—focusing on conversing with another instead of working on one's job tasks (Dunbar 2004), being denied access to information from an employee so that one has to take time to find another source (Sparrowe et al. 2001), or getting incorrect information from someone that leads to having to re-do tasks, fix errors, and track down the correct information. When a new ES has been implemented, both active and passive impeding can be detrimental to an employee being able to successfully complete work tasks using the new ES.

Friendship: In the workplace, a friendship network represents affective ties among employees (Umphress et al. 2003). Two characteristics of friendship ties that have been studied extensively are homophily and easy access to resources (Ibarra 1993b; Podolny and Baron 1997). Homophily is the tendency of individuals to associate and bond with similar others (McPherson et al. 2001). Access to resources is granted more easily to friends, rather than to acquaintances, due to increased trust and shared norms and goals between friends (Krackhardt 1992). It would thus stand to reason that when an ES is implemented, especially in the early stages of the implementation (e.g., shakedown), an employee is likely to turn to his or her friends in the workplace, be it for sympathy, empathy or with questions. Consequently, friends are likely to be the first line of support for employees after an ES has been implemented.

Acquaintances: Acquaintances in the workplace are employees who one knows for purposes of work but are not those with whom employees share an affective bond (Umphress et al. 2003). In terms of the workplace, acquaintances afford one the benefits of unbiased opinions and information that are sometimes not even shared with the circle of one's friends. The benefits an acquaintance tie brings is such objective informational access, usually without the social pressure to take the given advice that can sometimes come in case of advice from friends. Acquaintance ties are also not based on homophily so they are likely to provide information based on different experiences, expertise, and backgrounds when compared to the focal employee's experiences, expertise, and backgrounds. Such objective and pressure-free sources of potential advice will likely be important during an ES implementation.

Source–Content Interactions: Drawing on the above arguments, we now discuss how the source and content will interact, grounded in the mechanisms shown in Table 1, to influence deep structure use and job performance. Specifically, we note that the source–content interaction will have a direct effect on deep structure use and will also have an effect on job performance (partially mediated by deep structure use given that deep structure use is expected to influence performance). The arguments in this section are structured such that the effect on use is argued first and then the case is made for the effect on job performance.

ES implementations are often confusing, frustrating events for employees, especially during the volatile shakedown period (Hustad and Olsen 2011; Morris and Venkatesh 2010). During this time, it is likely that advice and impeding from fellow employees will relate heavily to the new ES as it is likely to cause new information needs and be a source of workplace disturbance. Further, given the embeddedness of an ES in employee work tasks, higher levels of ES use (such as increased deep structure use) can be expected to lead to improvements in job performance. Finally, although much of an employee's job tasks can be expected to involve the new ES, there are likely some elements of performance that are unaffected by employee software use, but rather involve using the business processes, documents, and workflow, as prescribed by the ES. These non-system use components are expected to be affected by both advice and impeding ties to peers.

Expressive Advice: Advice ties with friends, termed expressive advice ties, are likely to influence how well an employee copes with organizational change activities in the workplace as expressive advice ties offer emotional support that can lessen job-related stress (Wellman and Wortley 1990) and provide easy access to information (Krackhardt 1992). As mentioned earlier, when a new ES is implemented, business processes and workflow changes occur accompanied by the introduction of new software that result in entirely new jobs for employees (Morris and Venkatesh 2010) such that ties that aid employees in coping will be critical because of the stress caused by the change (see Beaudry and Pinnsoneault 2005). The role of expressive advice will be also critical because of the underlying trust among friends that will often result in an honest exchange of problems and conveyance of support.

People in the workplace most often make friends with those they work with on a daily basis, rather than with those who work in disparate areas of an organization because they are more likely to spend time with those closer by (Sias and Cahill 1998). It is, therefore, natural that their friends at work will have relevant and similar knowledge. In the context of a new ES, this means an employee is more likely to use features and use them in ways that his or her friends are using them. Overall, the greater the expressive advice ties, the more a person will likely be to use a greater number of functionalities provided by the system. Given the homophily that underlies friendship ties, advice can be provided in a way that empathizes with an employee's job situation and thus is likely to be well-received and translate into the use of the new ES.

The effects of expressive advice will also be direct on job performance (i.e., partially mediated by use). As discussed earlier, both advice and friendship have components of social support and the same is particularly pertinent in the context of expressive advice, both from the perspective of the advice-giver and the advice-seeker. Increased social support has been shown to enhance employee job satisfaction, organizational commitment, and general job-related affect (Oh et al. 2004), all of which have all been shown to increase employee job performance (Judge et al. 2001; Riketta 2002). Further, expressive advice ties can help with information and resources not directly related to the use of the ES and, thus, contribute positively to better job performance. Specifically, such advice could relate to using the new business processes that do not necessarily require using any specific ES features (see Sykes et al. 2014). Thus, we hypothesize:

H2a: Expressive advice ties will positively influence deep structure use of the ES.

H2b: Expressive advice ties will positively influence job performance.

Instrumental Advice: Instrumental advice ties are formed for the sole purpose of obtaining information and/or resources that will enable one to better perform one's work (Umphress et al. 2003). As such, instrumental advice ties have the potential to be more matter-of-fact and unbiased when compared to expressive advice ties (Umphress et al. 2003). Instrumental advice ties increase the likelihood that a focal employee will be exposed to many different ways of using the ES to accomplish various tasks. The more instrumental advisors an employee has, the more likely he or she is to have access to information that is necessary to solve problems that occur when he or she is using the new ES, especially during early interactions with the system—such as in the shakedown phase—when the challenges will be the greatest (Burkhardt and Brass 1990; Sykes et al. 2009). Given that instrumental advice ties are not rooted in homophily, the more instrumental advice ties an employee has, the more the unique knowledge to which an employee will have access. This allows for the discovery of more or even the most effective and efficient ways to use the ES to accomplish various tasks, thus resulting in a positive impact on deep structure use.

Beyond the effects that instrumental advice ties will have on deep structure use, these ties will influence job performance as advice related to business process or other non-system aspects of work tasks is sought and received (see Sykes et al. 2014). The point of distinction between instrumental advice ties and expressive advice ties is that instrumental advice comes without the social pressure that often accompanies expressive advice (see Granovetter 1973), which allows employees to judge the offered advice on its merit alone, increasing the possible usefulness of the advice (as pieces of advice that are judged to be not relevant or useful can be easily ignored). Thus, we hypothesize:

H3a: Instrumental advice ties will positively influence deep structure use of the ES.

H3b: Instrumental advice ties will positively influence job performance.

Expressive Impeding: Expressive impeding ties are ties to employees who are considered friends who make it difficult to do one's job. Impeding among friends can take many forms such as social pressure to comply with established norms or prevailing opinions (Wellman and Wortley 1990). Given the need for social acceptance within one's peer group, there is likely to be conformance to friends' viewpoints. Because the level of trust among friends is high, the more expressive impeding ties one has, the more the negative reinforcing social pressure that will also be broader and more general than impeding based on technical knowledge. In a highly stressful situation, such as an organizational change event in the form of an ES implementation, the need to conform to group norms will be even greater (Beaudry and Pinsonneault 2005). Negative asymmetry theory suggests that impeding in any context, here focused on or about a new ES, is likely to profoundly influence employees' feelings toward the object or behavior (here, the ES and its associated use) in a negative manner. It is thus likely that employees with more expressive impeding ties are more likely to avoid the system, rather than engaging with and exploring it. Whereas any impeding ties, by definition, make it difficult to accomplish one's work, expressive impeding ties represent ties to people one trusts and from whom one obtains emotional support (Sarason and Sarason 1985), thus making them particularly potent. Unlike with instrumental impeding, where an employee might be able to ignore the impeding behavior as the tie lacks the personal emotive component, an employee is less likely to be able to ignore or even want to ignore a friend who is making it difficult to work. Beyond the pressure to conform, expressive impeding comes with social demands placed on an employee's time.

We argue that impeding from friends related to use of the new ES will have a negative effect on job performance beyond that which is engendered from the negative effects on deep structure use of the ES. Time wasting, lack of necessary information, and other impeding behaviors that are accompanied by social pressure to comply with such behaviors due to their source, can negatively influence an employee's performance even if these impeding behaviors are unrelated to the new ES. Further, along the lines suggested by Sykes et al. (2014), it is possible that there is impeding related to the business processes, wherein employees may hinder the performance of the new processes by a focal employee by not fulfilling other/earlier aspects of the process and/or documentation. Thus, we hypothesize:

H4a: Expressive impeding will negatively influence deep structure use of the ES.

H4b: Expressive impeding will negatively influence job performance.

Instrumental Impeding: Instrumental impeding ties are those ties to acquaintances who make it difficult for one to accomplish his or her work. We argue that in the case of the shakedown phase of an ES implementation that affects employees' work processes, job stress will be heightened and workers will thus be more anxious (Piderit 2000). Both of these effects are expected to negatively influence job performance. Although instrumental impeding by definition has no expressive aspect, acquaintances can withhold valuable, unique information and/or resources. Instrumental impeding ties can also waste an employee's time, making it more difficult to do one's job. With less time available to do one's work due to instrumental impeding, the quality of work can suffer (Macan 1996). Thus, we hypothesize:

H5a: Instrumental impeding ties will negatively influence deep structure use of the ES.

H5b: Instrumental impeding ties will negatively influence job performance.

Comparing Effects: The theoretical perspective that we leverage to compare the different effects is negative asymmetry theory. The crux of this theory, as discussed earlier, is the stronger effect of negative stimuli compared to the effect of positive stimuli, especially in times of change and turmoil. Here, the effect of the stimuli can be categorized as positive or negative in two ways: in terms of source, where bonds to friends have an affective component but ties to acquaintances have no affective component,[3] and in terms of content, where

[3]We do not imply a positive or negative value judgment related to expressive versus instrumental ties. Rather, we note that the source can have positive or negative effects depending on the nature of the content.

impeding is negative compared to advice which is positive. Taking both source and content into account, we argue that impeding will be stronger when it comes from friends, as the impeding behavior is catalyzed by the affective nature of the relationship (positive source) and the social pressure exerted. Conversely, when advice (positive content) comes from acquaintances (non-affective source), it is likely to have a greater influence than when it comes from friends due to instrumental advice ties typically being maintained due to the perceived expertise and/or objectivity of the acquaintance. Thus, we hypothesize:

H6a: *The negative effects of expressive impeding ties on deep structure use and job performance will be stronger than the effects of instrumental impeding ties.*

H6b: *The positive effects of instrumental advice ties will be stronger on deep structure use and job performance than the effects of expressive advice ties.*

Method

This section describes the setting, new ES, data collection procedure, participants, and measurement.

Setting, New ES Module, and Data Collection Procedure

Our study was conducted in a large multinational corporation that was in the process of implementing an enterprise resource planning (ERP) system, one of the most common types of ES, in the entire organization. Data were collected from employees in a product design and development unit both 6 months before and 6 months after the implementation of a new ERP system module in the business unit. The data collection points were chosen so as to coincide with annual employee performance evaluations—the first for pre-implementation job performance and the second for the shakedown phase of the implementation. As is typical for ERP modules implemented in organizations, this module provided well-defined new business processes and new software to support the new business processes. In the particular business unit, the business processes deployed were the vendor-standard business processes, resulting in extensive changes to the business processes and work flows in the business unit. Although jobs in the business unit were designed to be mostly autonomous, there were collective goals for each product line as well as the business unit.

Once the ERP system module was implemented, the business unit and organization considered the first 6 months following the implementation to be an evaluation period during which employees could do things the "old way." At the end of the evaluation period, based on employee feedback and independent assessments, the management was going to determine whether to make course corrections or take other action (e.g., mandate system use or abandon the system). It should be noted that there was a high level of managerial support and push for employees to use the ERP system over the "old way" although there were no overt mechanisms in place to enforce this managerial preference. In interviews we conducted, nearly 90% of the employees in the business unit noted that the ERP system was "here to stay" regardless of the rhetoric related to doing "what employees felt was best in six months." Related to this, most employees noted that it was in their best interest to transition to the "new way of doing things ASAP."[4] As is the case with most ERP system implementations, in the focal business unit, the implementation significantly changed employees' jobs wherein they had to use the ERP system as much as possible. In post-implementation interviews with the management team, including line managers who dealt most closely with employees, it was revealed that the ERP system module could be used for about 70 to 80% of an employee's job duties, with 95% of the employees using the system for at least some of their tasks within the first 2 months after implementation. Likewise, managers noted that the new business processes would in the long-run be highly critical in the completion of employees' job tasks. However, part of the challenge related to the new business processes and new software in general is employees engaging in avoidance and workaround behaviors (Beaudry and Pinsonneault 2005). Consequently, despite the potential floor effects due to the need to use the ERP system module, we would, of course, expect avoidance and workarounds to be reflected via lower levels of system use. Thus, the setting lent itself very well to pursuing our research objective and underscored the ramifications of positive employee performance in the shakedown phase.

Participants

The sampling frame for this study was the list of 165 product design and development specialists in the business unit. Each of these employees had similar job duties. This study focused on each employee (i.e., ego) within the business unit. Membership in the business unit formed an appropriate boundary for our study as employees in the business unit interacted in

[4] Text in quotes in this paragraph is from often repeated quotes by managers or employees.

the context of the system that bound them with interdependent processes and a shared symbol system (Lauman et al. 1983). Each employee was a potential user of the new ERP module implemented in the business unit. Of the 165 employees in the sampling frame, 145 provided usable responses for a response rate of 88%, which was above the 80% response rate cutoff suggested for social network studies (Kilduff and Tsai 2003). Non-responses were due to incomplete responses and/or a lack of desire to participate. On average, the respondents were about 40 years old and had just over 5 years of tenure with the organization. About a fourth of the respondents were women. This demographic profile of the respondents matched the overall business unit's demographic profile that included non-respondents.

Measurement

We detail the measures used for our social network variables, the dependent variables of interest, and the control variables. All scales used in this study are shown in the Appendix B.

Social Networks

Social network data were collected using widely accepted sociometric techniques (Knoke and Yang 2008). Each potential participant was provided with a fixed contact roster that contained the names of the other 164 employees in the business unit (see Cummings and Worley 2004; Garton et al. 1997). Data about the content (i.e., advice and impeding) and the source of network ties (i.e., friends and acquaintances) were gathered by measuring (1) perceptions of the extent to which each employee received advice or was impeded, and (2) how each focal ego in the network categorized their ties (i.e., extent of friendship). This resulted in four sociomatrices: advice from friends, advice from acquaintances, impeding from friends, and impeding from acquaintances.

Source: Friends and Acquaintances: We adapted the technique of obtaining a fine-grained (nonbinary) measure of advice ties to the elicitation of friendship ties. In order to examine the source of the social network ties, we asked employees to rate, on a scale of 1 to 5, their social relationship with all others in the network from a named roster listing all other knowledge workers in the business unit (164 names). They were instructed to leave the line blank if they did not know the person socially. Scores of 4 and 5 were considered to be friendship ties because the item was worded so that friends were equated with "friend" or "good friend." Scores of 1, 2, or 3 were coded to be instrumental ties. In many friendship tie studies, whether someone is a friend or not is obtained from the binary choice of identifying an individual as a friend (i.e., yes/no) (e.g., Christakis and Fowler 2008). Thus, our dichotomization was consistent with previous work.

Content: Advice and Impeding Ties: The get-advice score for each ego was calculated as the degree centrality from the ego-reported advice matrix. This was measured as the number of advice ties an ego had with others in the network. Degree centrality for an ego in a network was calculated as the number of ties an ego reported getting advice from within the network. Likewise, the impeding score for each ego was calculated as the degree centrality for an ego in the impeding adjacency matrix.

Overlaying the Networks: In order to take into account the nuances between tie types, we took the responses to the friendship network question and overlaid those with both the impeding and advice networks. If an advice tie was with an alter who was also identified as a friend, then they were part of the expressive advice ties network. If an advisor was not identified as a friend, then that tie would be part of the instrumental advice network for the focal employee. Impeding ties were handled in a similar manner. For example, if Sam indicated that Carl, Michael, and Sally all were friends and Sam rated each of them as giving him advice at a frequency level of 3 (once a week) or greater, Sam's expressive advice degree centrality would be 3 (i.e., Carl, Michael, and Sally). Likewise, if Sam did not indicate John and Jane were friends, but reported they gave him advice at a frequency of 3 or greater, Sam's instrumental advice degree centrality would be 2 (i.e., John and Jane). As in the case of advice ties, impeding ties were separated into expressive and instrumental categories by overlaying the friendship network on the impeding network. Figure 2 illustrates how each focal ego within the network was tied to others in a small network, and the attendant interactions between source and content in that ego's case.[5]

Deep Structure Use

Deep structure use was measured using items developed based on the principles outlined in Burton-Jones and Straub (2006). We extend Burton-Jones and Straub's measurement approach in one important way. Specifically, they focused on just one task context (financial analysis) and the features of that task context. Because we were conducting our study in a naturally occurring work setting over a longer time frame, it was impossible to control the specific task contexts. Rather, we focused on the job context that comprised several key

[5]The two triangles that are not attached to the focal ego represent acquaintances the focal ego has at work who neither provide advice nor impede the focal ego.

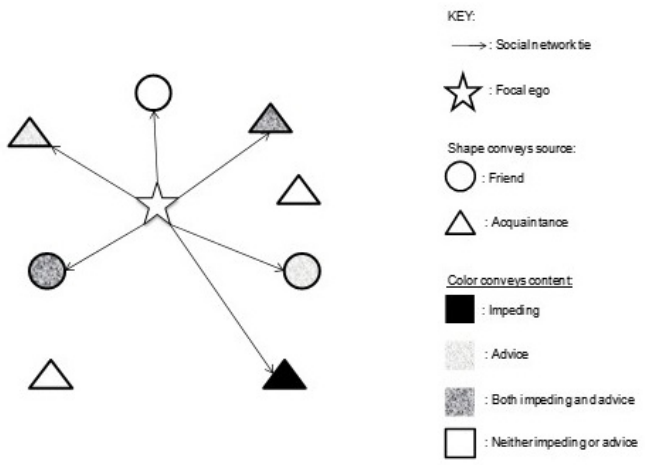

Figure 2. Example of Source and Content of Social Network Ties

tasks. Given that all participants in our study had similar job duties, we expected that the tasks they needed to perform were also similar. Consequently, it became important to identify the collection of key tasks that these employees performed and the features that best supported these tasks.

Deep structure use was measured using 14 items that related specific features of the ERP module to work tasks that employees had to do as part of their jobs. Deep structure use items were developed from interviews with the design and development team customizing the ERP module to the business unit and members of the business unit's management who were familiar with the job tasks of the participants as well as with the capabilities of the system. We started with close to 50 tasks and narrowed the list of tasks based on interviews. The items reflect the most important features of the new system. Table 2 shows the list of tasks that were identified and the corresponding ERP module features that support these tasks.

Job Performance

Our ultimate dependent variable was post-implementation employee job performance. There were many measures of employee job performance available in the literature, each with their own benefits and shortcomings, with the best measures typically being those provided by supervisors as they are free of some of the biases inherent in self-ratings (e.g., Bommer et al. 1995; Siders et al. 2001). Given our field study setting, we were constrained by the job performance measures that were used in the organization; this measure is reasonable because employees will in turn optimize their work to the metrics used in the organization. We used archival annual supervisor ratings of an employee's overall job performance. Because the human resources unit's staff included employees with doctorates in human resources, the performance measurement reflected research in the area of employee performance assessment. Specifically, the four items that were used to assess employee performance were adapted from the overall effectiveness dimension of Welbourne et al. (1998).[6]

Control Variables

Pre-implementation job performance was included as a control variable in predicting post-implementation job performance because prior performance is generally considered to be one of the strongest predictors of future performance. Behavioral intention and facilitating conditions were used as control variables in the prediction of deep structure use given that these two constructs have been shown in prior research to predict system use (Venkatesh et al. 2003).

Results

We used UCINET, version 6.29 (Borgatti et al. 2002), to analyze the social network data and generate the various social network latent variable scores. We used partial least squares (PLS) to test our model. The specific tool used was

[6]The scale of job performance includes eight other items that measure more specific dimensions related to performance and, as such, although we have the data available, we did not use them in this paper given our focus.

Table 2. List of Key Tasks and Features and Indicator Weights

Core Work Tasks	Core System Features	Indicator Weight
Understanding and benchmarking progress	#1 Summary report	.20**
	#2 Compare performance	.21***
Helping others	#3 Feedback	.23***
	#5 Collaborate	.26***
Learning	#6 History	.20**
	#7 Product specs and customer interests	.10
Tailor work for customers	#8 Customize	.38***
Produce good designs	#4 Comments	.48***
	#9 Protection/freeze	.37***
	#10 Development	.21***
	#11 Integrate/test	.40***
	#14 Costing	.22***
Share and store information	#12 Summarize	.44***
	#13 Versioning	.12

Smart-PLS 2.0 (Ringle et al. 2005). PLS is considered to be better suited than factor-based covariance fitting approaches, such as LISREL, when the primary goal is to explain variance and when latent variables are modeled using formative indicators. Although PLS does not attempt to minimize residual item covariance and does not produce a summary statistic of overall model fit, like traditional regression analysis, the variance explained and the sign and significance of path coefficients can be used to assess nomological validity (Hulland 1999).

The measurement model estimation provides information about internal consistency (reliability) and discriminant validity. We assessed the reliability and validity for scales with multiple, reflective items: behavioral intention, facilitating conditions, and job performance. In the case of each of these three scales, we modeled them as reflective because the responses to these items were expected to covary (see Petter et al. 2007). Deep structure use was modeled as a formative construct, based on the guidelines of Petter et al. (2007). Specifically, it is indeed possible for employees to use some, but not all, of the features that constitute deep structure use, thus resulting in the responses to these items not having to covary. The different social network variables were each assessed using the measures presented earlier, resulting in one score (indicator) per construct per employee. All multi-item scales were reliable, with internal consistency reliability (ICR) scores being well above the recommended level of 0.70 (Nunnally and Bernstein 1994), as shown in Table 3. We tested the measurement models in conjunction with each of the structural models that were tested. However, given the consistency in results and the clean factor structure obtained, we report the factor loadings, descriptive statistics, and correlations in conjunction with the full model. Internal consistency is also established when scales have an average variance extracted (AVE) of at least 0.50 and for satisfactory discriminant validity, the AVE for the construct should be greater than the variance shared between the construct and other constructs in the model (Chin 1998)—this was found to be the case as also shown in Table 3. The loadings for all items in all multi-item reflective scales were greater than .70 and the cross-loadings were all .30 or less, further supporting internal consistency and discriminant validity. The loadings and cross-loadings are not shown here due to the clean structure and the use of validated scales from prior research. The assumed loadings of the single-indicator constructs, which includes all social networks constructs, were 1.[7] For the formative indicators of deep structure use, 12 of the 14 indicators were significant with the weights of the significant indicators being between .20 and .48, as shown in Table 2; the weights show the average importance of the different functions/tasks in driving deep structure use. Specifically, it appears that comments, summarize, and integrate/test are the most important features driving deep structure use.

A few observations can be made about Table 3. The means of most of the Likert-scale variables were about 4, with a standard deviation greater than 1. The mean and standard deviations of the different tie centralities varied. Both of the

[7]Even when the assumed loadings were set at lower values (i.e., .90 and .80), we found the pattern of results to be identical to what is reported here.

Table 3. Reliability, Average Variance Extracted, Descriptive Statistics and Correlations

		ICR	Mean	SD	1	2	3	4	5	6	7	8	9
1	Behavioral intention	.85	4.43	1.12	.82								
2	Facilitating conditions	.73	4.01	1.08	.42***	.73							
3	Expressive advice ties	NA	14.22	5.89	.14*	.19**	NA						
4	Instrumental advice ties	NA	8.40	4.90	.19**	.28***	-.28***	NA					
5	Expressive impeding ties	NA	10.20	7.77	-.19**	-.08	.35***	-.20***	NA				
6	Instrumental impeding ties	NA	3.50	2.90	-.15*	-.07	.09	-.21***	.20***	NA			
7	Deep structure use	.73	3.90	1.41	.30***	.30***	.13*	.34***	-.43***	-.13*	NA		
8	Pre-impl. job performance	.77	5.32	1.10	.13*	.17**	.20***	.29***	-.28***	-.13*	.30***	.73	
9	Post-impl. job performance	.79	4.78	1.30	.15*	.18**	.21***	.34***	-.30***	-.15*	.44***	.41***	.75

Notes: 1. Diagonal elements are square root of average variance extracted and off-diagonal elements are correlations.
2. *p < .05; **p < .01; ***p < .001; NA = Not applicable.

expressive tie centralities were the highest, suggesting that people sought advice and were impeded more by their friends. Instrumental advice tie centrality was high but instrumental impeding was fairly minimal. Compared to pre-implementation levels, job performance after the implementation declined, which is a pattern often noted in the literature, especially in the trade press (see Sykes et al. 2014). Overall, the pattern of correlations was as expected. Both types of advice ties were positively correlated with deep structure use and post-implementation job performance, whereas both types of impeding ties were negatively correlated with deep structure use and post-implementation job performance. The strongest correlates of post-implementation job performance were pre-implementation job performance and deep structure use.

Table 4 shows the results of the structural models. Specifically, it includes two models predicting deep structure use. Model 1 examined the influence of two powerful predictors of use from the literature—behavioral intention (BI) and facilitating conditions (FC)—on deep structure use. Model 1 served as a baseline to compare the proposed model's prediction of deep structure use and explained 10% of the variance of deep structure use. Model 2 included expressive and instrumental advice and impeding ties to predict deep structure use, and explained 31% of the variance of deep structure use.

Table 4 also shows four models predicting post-implementation job performance. In model 1, pre-implementation job performance, along with BI and FC, were included as predictors. BI and FC were included in model 1 as they are important control variables predicting deep structure use and their pattern of effects on performance in terms of the extent of mediation is important and explained 17% of the variance in post-implementation job performance. Model 2 added deep structure use to model 1 and predicted 27% of the variance in post-implementation job performance. Models 3 and 4 (along with model 2 in the prediction of deep structure use) examine the mediation of deep structure use using the guidelines of Baron and Kenny (1986). Model 3 included the expressive and instrumental advice and impeding ties' influence on post-implementation job performance, but does not include deep structure use as a predictor, thus allowing us to examine the direct effects of the antecedents in the absence of the mediator. All types of social network ties, except for instrumental impeding, were significant and the model explained 26% of the variance in post-implementation job performance. Model 4 added deep structure use as a predictor to model 3's predictors. Deep structure use was significant and both types of network ties that were significant in the previous model remained significant (although the magnitude of the effect was lower), with 35% of the variance of post-implementation job performance being explained. The collection of these results suggests that the effects of the social network constructs on post-implementation job performance is partially mediated, that is, they have an effect on deep structure use, they have an effect on job performance in the absence of deep structure use, deep structure use has an effect on post-implementation job performance, and the effect

Table 4. Structural Model Results

	Deep structure use		Post-implementation job performance			
	1	2	1	2	3	4
R^2	.11	.34	.19	.29	.29	.39
Adjusted R^2	.10	.31	.17	.27	.26	.35
Behavioral intention	.21***	.13*	.13*	.03	.02	.02
Facilitating conditions	.22***	.15*	.12*	.04	.02	.02
Pre-impl. job performance			.37***	.37***	.34***	.31***
Expressive advice ties		.05			.15*	.08
Instrumental advice ties		.20**			.24***	.17**
Expressive impeding ties		-.33***			-.17**	-.15*
Instrumental impeding ties		.05			-.06	-.01
Deep structure use				.39***		.34***

Note: *p < .05; **p < .01; ***p < .001.

of some of the social network constructs on job performance persists (although there is a drop in the magnitude of the effects) even with the inclusion of deep structure use.

Regarding our specific hypotheses, post-implementation job performance was predicted by deep structure use of the ES, thus supporting H1. We hypothesized that the social network constructs would significantly influence employees' deep structure use of the new ES. These hypotheses were partially supported by the results. Expressive advice did not significantly influence deep structure use, but instrumental advice did, thus supporting H3a, but not H2a. Expressive impeding negatively influenced deep structure use but instrumental impeding did not influence deep structure use, thus supporting H4a but not H5a.

Consistent with our expectations, social network constructs predicted job performance. However, in our context of ES-driven organizational change, both sources of advice ties (i.e., friends and acquaintances) had a significant effect, thus supporting H2b and H3b, but only one type of impeding tie (i.e., from friends) had a significant effect, thus supporting H4b but not H5b. This is interesting because we expected that in the context of a new ES implementation both forms of impeding would be significant due to the tenets of negative asymmetry theory that holds that negative stimuli are especially powerful in times of stress. However, instrumental impeding was not a significant predictor of job performance.

Based on negative asymmetry theory, we posited that effects of negative stimuli (impeding) will be stronger compared to the effects of positive stimuli (advice). In examining the predictors of deep structure use, we found that, of the significant predictors, based on a Chow's (1960) test of beta differences, expressive impeding ties, compared to expressive advice ties, was a stronger predictor. Furthermore, we found that expressive impeding was stronger than instrumental impeding on both deep structure use and job performance, thus supporting H6a; whereas instrumental advice was stronger than expressive advice on both deep structure use and job performance, thus supporting H6b.

In order to show that separating out the source and content of social network ties is a better conceptual treatment than the more traditional aggregated conceptualization, we provide a benchmarking analysis in Table 5. The results show that more variance in deep structure use (compare the results for model 2 of deep structure use in Tables 4 and 5) and job performance (compare the results for models 3 and 4 for post-implementation job performance in Tables 4 and 5) was explained when the advice and impeding ties were separated by the source of the tie (expressive or instrumental) than when they are left as unitary measures (advice and impeding). The comparison of the effects of the different types of advice ties show an interesting pattern. In Table 5, the overall effect of advice ties on deep structure use did maintain the magnitude of instrumental advice ties from Table 4, suggesting that the overall advice tie effect likely originates from the effect of instrumental advice ties. In the prediction of post-implementation job performance, both types of advice ties had an effect in the absence of deep structure as a predictor in Table 4 and advice ties had an effect in Table 5 (model 3 of both tables), In a comparison of model 4 across the two tables, the instrumental advice ties effect in Table 4 appeared to be reflected in the effect of overall advice ties in Table 5. The role of impeding showed a slightly different pattern. In

Table 5. Benchmarking Structural Model Results

	Deep structure use		Post-implementation job performance			
	1	2	1	2	3	4
R^2	.11	.20	.19	.29	.20	.31
Adjusted R^2	.10	.17	.17	.27	.17	.27
Behavioral intention	.21***	.15*	.13*	.03	.03	.03
Facilitating conditions	.22***	.17**	.12*	.04	.03	.03
Pre-impl. job performance			.37***	.37***	.34***	.31***
Advice ties		.21***			.20**	.13*
Impeding ties		-.15*			-.10	-.08
Deep structure use				.39***		.37***

Note: *p < .05; **p < .01; ***p < .001.

the explanation of deep structure use, Table 4 showed a strong effect for expressive impeding, whereas the effect of overall impeding was much more modest in Table 5. Likewise, impeding had no direct effect in the prediction of post-implementation job performance in examining Table 5, whereas expressive impeding did have an effect in Table 4.

Discussion

Our objective was to leverage the distinction across content and source of social network ties to explain deep structure use and employee job performance. We drew on social network theory and argued that the source (i.e., friends or acquaintances) and the content (i.e., advice or impeding) and their interactions will predict post-implementation job performance. Further, we argued that these effects would be partially mediated by deep structure use of the new ES. Our results confirmed most of our predictions, and underscored the importance of both source and content of social network ties in driving deep structure use and job performance. The social network constructs explained significant unique variance beyond the traditional drivers from technology adoption research (i.e., behavioral intention and facilitating conditions) in deep structure use. Likewise, the social network constructs and deep structure use explained significant unique variance in post-implementation job performance beyond what was explained by pre-implementation job performance.

Theoretical Implications

Our work makes several contributions to both IS and social networks research. This work expands the nomological network related to job performance, particularly post-ES implementation job performance, by incorporating different social network constructs with deep structure use as a key mediator. Such an approach complements and extends traditional views related both to the prediction of deep structure use and job performance, and advances our understanding of the role of social networks in this context. The model presented here complements and extends prior technology adoption research in two ways: (1) it explicitly examines the phenomenon of ES implementations in the volatile shakedown phase, and (2) it goes beyond traditional conceptualizations of system use as the ultimate dependent variable, and examines deep structure use and job performance. By focusing on job performance in the context of an ES implementation, our work complements research that has focused on other job outcomes, such as job satisfaction, in a similar context (e.g., Morris and Venkatesh 2010) and extends work on the IS success model that calls for a focus on a variety of IS impacts (see DeLone and McLean 2003).

The interesting and varied pattern of results in terms of the source and content of social network ties has contributions and implications for IS research. Although instrumental advice ties provide benefits, expressive impeding ties are a significant obstruction to employees' job performance in the context of ES implementations. Further, expressive advice ties and instrumental impeding ties do not appear to play a significant role in driving deep structure use. This suggests that in terms of source, friends are more likely to negatively influence deep structure use, whereas acquaintances are more positive contributors. This work also offers possible new boundaries for negative asymmetry theory, highlighting that not all impeding ties are influential, as might be expected from the theory. Specifically, although we might expect that any impeding tie would be a significant negative influence on deep structure use, we found that impeding ties that are not

from a source with a strong affective component (i.e., friendship) do not strongly influence behavior (here, deep structure use). Also, such instrumental impeding ties do not influence job performance. It is only the interaction between source and content, that is, when friends impede one's work, that performance is negatively affected.

Building on the encouraging pattern of findings in explaining deep structure use, a critical future research direction is to incorporate different types of use into the nomological network presented here. Burton-Jones and Straub (2006) argued that lean conceptualizations and measures, which have been used widely in IS research, are less useful. In order to validate their ideas in a field setting, future work should examine other rich conceptualizations of use, such as cognitive absorption, and lean conceptualizations, such as duration and frequency of use (see Burton-Jones and Straub 2006; Venkatesh et al. 2008). Several interrelated questions are worthy of investigation in such a context. Do other conceptualizations of use predict job performance? If so, are the relationships positive or negative? What are the drivers of these other conceptualizations of system use? Further, depending on the direction of the relationships between these conceptualizations of use and job performance, interventions to promote or prevent such use should be examined.

Although the basic idea of social network constructs having an effect on job performance partially mediated by behavior has been demonstrated in prior social networks research (e.g., Sparrowe et al. 2001), the nuanced explanation that emerged here, both from the perspective of the different social network constructs and from the perspective of a specific behavior, provides a valuable explanation in the context of the shakedown phase of an ERP system implementation. Future work should examine if the pattern of findings that emerged here generalize to other phases of implementation (see Morris and Venkatesh 2010) and to other organizational change contexts (see Herold et al. 2007). One particular null finding deserves careful reassessment: is advice from friends unhelpful? The underlying mechanisms for this null finding should be tested—for instance, is advice from friends unhelpful because of homophily and related overlap in knowledge?

There are several other interesting and important future research directions. First, the observed opposing patterns of effects of network ties suggest that two sets of interventions warrant investigation: (1) ones that can foster the right kind of ties and/or limit the wrong kind of ties, or (2) ones that amplify the positive effects of instrumental advice and/or mitigate the negative effects of expressive impeding. Second, the encouraging findings from this work related to the effects of different types of networks suggest that other possible network types (e.g., communication networks) could be studied. Our ultimate dependent variable was job performance and future work can investigate affective outcomes, such as job stress and job satisfaction, as ultimate dependent variables, given that they are frequently associated with turnover and other important consequences. Such work using social networks as a theoretical lens could provide a complementary or even an integrative explanation of job satisfaction relative to recent work using the job characteristics model (Morris and Venkatesh 2010). Third, we studied an ERP system module and such systems are known to create greater interdependence among employees that in turn is an important contextual reason for the role of different types of social networks. Future research should study systems in other contexts that have a great deal of interdependence, such as those implemented in healthcare (e.g., Venkatesh et al. 2011), law enforcement (Hu et al. 2005), and technologies targeted specifically for group work (Valacich et al. 2006), to understand the generalizability of our findings—such research will allow us to understand the important distinctions in theory that result from specific contexts (see Alvesson and Karreman 2007; Johns 2006). Fourth, with the growth of social media, both within and outside organizations, and online communities, the roles of such entities should be examined for what implications they may have for our findings. Fifth, we focused on the shakedown phase and future work should study the phenomenon over a longer time horizon. Not only would such work provide an understanding over the course of the entire implementation life cycle, but also it would help understand network changes over time (e.g., Snijders 2005). Finally, this work complements our related work on social networks, organizational interventions, and various outcomes (see Sykes 2015; Sykes et al. 2014). We believe a more holistic examination that overlays different types of networks (Sykes et al. 2014) in addition to what is studied here and various interventions will be valuable.

Practical Implications

Managers need to be sensitive to and proactively manage the opposing forces of instrumental advice and expressive impeding. Knowing that the "easiest" sources of advice (i.e., friends) are not the best sources, social engineering techniques should be used to make it easier for advice to be obtained from acquaintances. It has been known for a while now that friendships in the workplace often develop with the help of proximity (e.g., Johnson 1989). One way to manage advice from more acquaintances might be to have mentoring partnerships created across proximal areas so that employees who are farther from one another have an easier time of connecting for the exchange of information/knowledge. Another technique might be to assign mentors based on differences in

demographic characteristics, as the homophily principle suggests that individuals choose friends from similar others (Kandel 1978; McPherson et al. 2001). By making advice more easily available from diverse acquaintances, managers increase the likelihood of employees making instrumental advice ties, while limiting expressive impeding, that will lead to increased deep structure use of a new ES and increased job performance.

From the results related to the deep structure use to performance relationships, other practical implementations emerge. The good news is that deep structure use can indeed contribute favorably toward employee job performance. To this end, fostering situations where instrumental advice will be available to employees will be critical. The term "super-user" is frequently used but seldom do organizations provide release time for such super-users to help others as part of their own job. Although we do not particularly study super-users, the creation of such formal advisor/help roles for super-users has the potential to increase the amount of instrumental advice available and even possibly decrease the negative effects of expressive ties. Based on our findings, in times of IT-driven organizational change, especially due to ERP system implementations, having the right types of network ties are crucial to getting the type of use that will make a difference. Managers need to approach the issue of informal networks quite systematically in order to achieve implementation success. Two ways this might be accomplished are (1) creating an environment wherein employees have a better chance of networking with potential instrumental advisors through activities such as brown-bag lunches or workshops related to using the new system better, and (2) redesigning training sessions related to the new system in such a way that power users/productive workers are showcased so that other employees know to network with those individuals (see Sykes 2015).

Conclusions

We theorized and found strong evidence in support of the differential roles the source and content of social network ties can play in influencing deep structure use and employee job performance during the shakedown phase of an ES implementation. Social network constructs played a strong role affecting job performance, both directly and indirectly via (i.e., mediated by) deep structure use. Based on the models tested, it is clear that fostering deep structure use is critical and this can be accomplished best by providing instrumental advice while avoiding the pitfalls of expressive impeding. We hope that this work thus serves as a platform for investigating different types of networks and their impacts.

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MIS Quarterly

RESEARCH ARTICLE

EXPLAINING POST-IMPLEMENTATION EMPLOYEE SYSTEM USE AND JOB PERFORMANCE: IMPACTS OF THE CONTENT AND SOURCE OF SOCIAL NETWORK TIES

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Appendix A

Key Social Networks Research, 2006–2010

Authors	Year	Journal	Type of Network Studied	DVs
Hsieh et al.	2008	MISQ	Personal network (based on Valente 1995; measured by asking "what percent of the people you know has adopted internet TV)	Continued use intention
Sykes et al.	2009	MISQ	Give-help and get-help (advice network)	System use
Devaraj et al.	2008	ISR	Collaboration network	Ease of Use; Usefulness; Intention to use
Bampo et al.	2008	ISR	Communication networks (based on word-of-mouth); Digital networks are examined in terms of random networks, scale-free networks and small world networks	Campaign's performance
Forman et al.	2008	ISR	Network of reviewers with shared geographical location	Online product sales; Helpfulness rating; Subsequent reviewer disclosure of identity descriptive information
Hahn et al.	2008	ISR	Collaborative network	New project team formation (Developer joining of a project within the first two months of its initiation; Number of developers joining a project; Joining a particular project)
Hinz and Spann	2008	ISR	Friendship and information networks (information network between friends, family and colleagues)	Bidding behavior
Kane and Alavi	2008	ISR	Multi-modal information network	Organizational performance
Robert et al.	2008	ISR	Workflow, communication and advice network (asked team members how much they worked with, communicated with and depended on other employees)	Knowledge integration; Team decision quality

Authors	Year	Journal	Type of Network Studied	DVs
Trier	2008	ISR	Communication network	Network formation
Zhu and Watts	2010	ISR	Communication networks (based on email communication). As a robustness check, measured network among criminals belonging to same gang	Task performance
Chi et al.	2010	ISR	Interfirm alliance networks (joint-ventures and strategic alliances)	Competitive action (volume, complexity and heterogeneity of action)
Chellappa and Saraf	2010	ISR	Interfirm alliance network	Choice of alliance partner; firm performance
Balkundi and Harrison	2006	AMJ	Advice, friendship networks	Team effectiveness (viability and performance)
Perry-Smith	2006	AMJ	Communication network	Creativity
Joshi et al.	2006	AMJ	Network conceptualized as members belonging to minority groups	Individual pay
Shipilov	2006	AMJ	Interfirm network	Firm performance
Beckman	2006	AMJ	Network conceptualized in terms of founding members with common prior company affiliations	Exploitative behaviors; Explorative behaviors; Firm performance
Perretti and Negro	2006	AMJ	Coordination network	Presence of new comers; Presence of new combinations of team members
Conlon et al.	2006	AMJ	Network of authors who have already published in a prominent journals	Scientific impact
Chen et al.	2007	AMJ	Network of competitors	Perceived competitive tension; Volume of a focal firm's attack
Hillman et al.	2007	AMJ	Interorganizational networks (number of links to other firms with women directors)	Female representation on board of directors
Carson et al.	2007	AMJ	Leadership network measured based on the response to "to what extent do you depend on the team member for leadership"	Level of shared leadership in a team; Team performance
Stam and Elfring	2008	AMJ	Advice network measured in terms of the information shared with other firms	Firm performance
Chua et al.	2008	AMJ	Friendship network, advice network, network based on economic exchanges among managers	Affect-based trust; Cognition-based trust
Kang	2008	AMJ	Director interlocks	Market value of firms with director-interlocks to other firms accused of financial reporting fraud; Reputational penalties
McDonald et al.	2008	AMJ	Advice network	Advice-seeking behavior; Firm performance
Ozcan and Eisenhardt	2009	AMJ	Network ties assessed on the dimensions of trust, communication, conflict and achievement	Likelihood of forming portfolios with high performing attributes; Firm performance
Jokisaari and Nurmi	2009	AMJ	Informal networks	Perceived supervisor support; Work mastery; Growth in salary; Job satisfaction

Authors	Year	Journal	Type of Network Studied	DVs
Mitsuhashi and Grece	2009	AMJ	Interorganizational alliances	Likelihood of forming alliances; Organizational growth; Organizational failure rate; Organizational performance
McDermott et al.	2009	AMJ	Interfirm network	Level of product upgrading
Tortoriello and Krackhardt	2010	AMJ	Advice network (knowledge sharing network)	Generation of innovations
Westphal and Graebner	2010	AMJ	Friendship network between CEOs	Formal board independence; CEO verbal impression management; Analyst appraisals of firm
Wong and Boh	2010	AMJ	Advocate's social network	Managers' reputations for trustworthiness among their peers; Self-efficacy
Greve et al.	2010	AMJ	Interfirm alliance	Firm's withdrawal from interfirm alliances
Guler and Guillén	2010	AMJ	Firm's home country network	Rate of firm's foreign market entry
Martin and Eisenhardt	2010	AMJ	Communication network at the business unit	Business unit collaboration
McDonald and Westphal	2010	AMJ	Friendship network	CEO social identification with corporate elite; Strategic help provided by CEOs to other CEOs
Tsai and Wu	2010	AMJ	Co-citation network	
Lechner et al.	2010	AMJ	Intergroup communication network (measured in terms of frequency of interaction)	Performance of strategic unit
Phelps	2010	AMJ	Firm's alliance network	Firm's degree of exploratory innovation
Shipilov et al.	2010	AMJ	Board interlocks	Organization's adoption of a practice (and second-wave of adoption)
Flynn and Wiltermuth	2010	AMJ	Advice network	Consensus (perception of the degree to which others share individual's views on ethical matters)
Semadeni and Anderson	2010	AMJ	SNA used only in the operationalization. Imitation was calculated based on the correlation between the use of key terms used in the description of services (using Bonacich normalization routine)	Imitation
Dacin et al.	2010	AMJ	General concept of "social network"; conceptualized in terms of students belonging to Oxbridge college	Identity; shift in social position
Bowler and Brass	2006	JAP	Help/advice network, friendship network	Performance and receipt of Interpersonal commitment behavior
Ferrin et al.	2006	JAP	Trust network measured by asking "to what extent do you trust X"; OCB was measured based on help/advice network	Trust in coworker; Coworker OCB

Authors	Year	Journal	Type of Network Studied	DVs
Levin et al.	2006	JAP	Egocentric network measuring the length of the relationship between individuals; advice network	Level of trust
Simons et al.	2007	JAP	Based on homophily but does not apply SNA	Behavioral integrity; Trust in management; Interpersonal justice perceptions; Global satisfaction; Affective commitment; Intent to stay
Colquitt et al.	2007	JAP	Task interdependence network	Perceived helpfulness ; Perceived trust
Venkataramani and Dalal	2007	JAP	Positive and negative affective networks	Helping behavior; harming behavior
Avery et al.	2007	JAP	Based on social identity theory but does not apply SNA	Employee engagement
de Jong et al.	2007	JAP	Workflow network ("how dependent are you on X for materials, means, information, etc.")	Perceived receipt of help from coworker; trust in coworker
Anderson et al.	2008	JAP	Network of employees in an organization	Influence (measured based on coworker rating)
Zohar and Tenne-Gazit	2008	JAP	Communication and friendship networks	Climate strength
Lau and Liden	2008	JAP	Trust network measured by asking "do you	Extent to which employees are trusted talk to X about confidential work-related matters"
Chiaburu and Harrison	2008	JAP	Advice network measured in terms of the information provided by coworkers	Role perceptions (role ambiguity, role conflict, role overload); Work attitudes (job satisfaction, job involvement, organizational commitment); Withdrawal (effort reduction, absenteeism, intent to quit, turnover); Interpersonal effectiveness; Organizational effectiveness
Scott and Judge	2009	JAP	Work communication network	Agreement among coworkers about the popularity of a given employee; Organizational citizenship behavior; Counter-productive work behavior
Lai et al.	2009	JAP	Friendship network	Willingness to accept i-deal
Zhou et al.	2009	JAP	Advice networks	Creativity
Baer	2010	JAP	Communication network (measured in terms of frequency, closeness and duration of interaction)	Creativity
Venkataramani and Tangirala	2010	JAP	Workflow networks (measured in terms of interactions with fellow employees)	Personal influence; Voice behavior
Venkataramani et al.	2010	JAP	Advice network	Job satisfaction; Turnover intention

Appendix B

Instrument

Social Network Survey Questions

	I contact this person for advice related to my work:				
	Many times a day	Once a day	Once a week	Once a month	Less than once a month
Name 1	1	2	3	4	5
Name 2	1	2	3	4	5
….					
Name n-1	1	2	3	4	5

	How would you rate your social relationship with…				
	Casual acquaintance	Acquaintance	Casual friend	A friend	A good friend
Name 1	1	2	3	4	5
Name 2	1	2	3	4	5
….					
Name n-1	1	2	3	4	5

	This person makes it difficult to do my work:				
	Many times a day	Once a day	Once a week	Once a month	Less than once a month
Name 1	1	2	3	4	5
Name 2	1	2	3	4	5
….					
Name n-1	1	2	3	4	5

Deep Structure Use (7-point Likert agreement scale)

1. I use the “weekly summary report” feature to understand my progress.
2. I use the “compare performance” feature to benchmark my performance against the work of my peers.
3. I use the “feedback” feature to provide input to others on their work.
4. I read the comments provided on my design.
5. I use the “collaborate” feature to share and store information among team members.
6. I use the “history” feature to learn about other similar work done in the past.
7. I use the system to get product specifications and customer interests from the marketing unit.
8. I customize the features and menu structure for each project.
9. Whenever necessary, I use the “protection” or “freeze” features to commit design aspects or design changes.
10. I use the “development” feature for our interactions with the “product development” unit.
11. I use the “integrate” and “test” features as the design moves into the development phase.
12. After the completion of a design, I use the “summarize” feature to leave notes for future users.
13. I use the “versioning” feature to provide the detailed history and evolution of the design.
14. I use the “costing” feature to interact with manufacturing to get price data related to my design.

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.

Behavioral Intention (7-point Likert agreement scale)

1. I intend to use the system in the next <n> months.
2. I predict I would use the system in the next <n> months.
3. I plan to use the system in the next <n> months.

Facilitating Conditions (7-point Likert agreement scale)

1. I have the resources necessary to use the system.
2. I have the knowledge necessary to use the system.
3. The system is not compatible with other systems I use.
4. A specific person (or group) is available for assistance with system difficulties.

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