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# ENTERPRISE SYSTEM IMPLEMENTATION AND EMPLOYEE JOB PERFORMANCE: UNDERSTANDING THE ROLE OF ADVICE NETWORKS

Tracy Ann Sykes
University of Arkansas

Viswanath Venkatesh
University of Arkansas
vvenkatesh@vvenkatesh.us

Jonathan L. Johnson
University of Arkansas

# ENTERPRISE SYSTEM IMPLEMENTATION AND EMPLOYEE JOB PERFORMANCE: UNDERSTANDING THE ROLE OF ADVICE NETWORKS

## ABSTRACT

The implementation of enterprise systems, such as modules of enterprise resource planning (ERP) systems, alters business processes and associated workflows, and introduces new software applications that employees must use. Employees frequently find such technology-enabled organizational change to be a major challenge. Although many challenges related to such changes have been discussed in prior work, little research has focused on post-implementation job outcomes of employees affected by such change. We draw from social network theory—specifically, advice networks—to understand a key post-implementation job outcome—i.e., job performance. We conducted a social network study among 87 employees, with data gathered before and after the implementation of an ERP system module in a business unit of a large organization. We found support for our hypotheses that workflow advice and software advice are associated with job performance. Further, as predicted, we found that the interactions of workflow and software get-advice, workflow and software give-advice, and software giving and getting advice were associated with job performance. This nuanced treatment of advice networks advances our understanding of post-implementation success of enterprise systems.

**Keywords:** Social networks, get-advice, give-advice, enterprise system implementation, job performance

## INTRODUCTION

A very common change event that occurs in organizations is the implementation of new information systems (IS), especially enterprise systems (ESs; Cummings and Worley 2008; Sharma et al. 2008). Of the many types of ESs, enterprise resource planning (ERP) systems has been a $60+ billion industry for some time now and is expected to grow (AMR Research 2009; Deloitte 2011, 2012; Global Industry Analysts 2010). Although ESs offer the possibility of seamlessly integrating an organization's information flows, it is common for such implementations to be accompanied by non-adoption of the system (Plaza and Rohlf 2008), lower job performance, lower job satisfaction and high turnover rates. Failure rates have been noted to be up to 80% (Devadoss et al. 2008; Panorama Consulting 2010). With billions of dollars spent annually on implementing a variety of new ESs (AMR Research 2009; Gartner 2011; Panorama Consulting 2012), it behooves us to examine possible factors that affect employee's job performance, a critical indicator of implementation success. Against this backdrop, this work seeks to examine post-implementation employee job performance.

Today's business world is very faster moving and more complex than ever before (Cascio 1995; Wilson 2008), thus resulting in a great deal of interdependence among employees and firms (see Rai et al. 2009; Venkatesh et al. 2011). It is thus important to investigate factors relating to co-workers as an employee's work relies not only on the employee's own work, but also on the work of co-workers within the business unit. This is reinforced by information internal to the organization being vital to employees' work (Davis et al. 2009; Singh et al. 2002; see also Alavi and Leidner 2001). One way to examine factors pertaining to co-workers is to examine employee social networks. For employees with information laden jobs, software advice networks—i.e., social network ties that provide advice related to a system's software—constitute

an especially valuable form of social capital, providing information and access to specialized knowledge necessary to carry out one's job. We expect this to be especially important in the context of an enterprise system (ES) implementation because of the choreography of workflows and work tasks that increase interdependence among employees. ES implementations comprise two main parts—an extensive redesign of business processes and the deployment of new software to support the new business processes (Morris and Venkatesh 2010; Robey et al. 2002). ES implementations fundamentally change the nature of tasks, workflows and therefore, by extension, employees' jobs (Davenport et al. 1996; Morris and Venkatesh 2010). Barley (1986) found that technology changed organizational structures, which in the case of ES implementations could be, in large part, due to the new business processes enabled by the new software systems. Even an ultimately successful ES will frequently depress productivity in periods of transition due to disruptions in business processes, jobs, and patterns of flow of information and work (Davenport 2005; Edmondson et al. 2001). A new ES introduces uncertainty in the work environment in the transition period (Kolodny et al. 1996) and often results in realignments of business processes and work unit interdependencies (Robey et al. 2002). We argue that the uncertainty and structural realignments accompanying a new ES will create pressures for sources of information, particularly related to the new workflows and software.

A myriad of factors have been shown to affect job performance, such as job stress (Hunter and Thatcher 2007), employees' justice perceptions (Janssen et al. 2010) and job characteristics (Gilboa et al. 2008). Traditional explanations for the effects on job performance have relied on constructs derived from the attributes of individuals, groups, technologies and organizational contexts (e.g., Carson et al. 2007; Davidson and Chismar 2007; Quigley et al.

2007; Tesluk and Mathieu 1999). This is unsurprising, of course, insofar as the bulk of social science explanations are grounded in attributes (Wellman 1988), and these theories often include variables intended to tap social influence and other processes that are generally associated with the concept of social structure. In many cases, such variables (e.g., cohesiveness) are better considered proxies of structure—predicates of groups or cultures rather than structure, qua structure (Mayhew 1981). Social network researchers argue for a deeper treatment of the concept of structure by directly considering the ties within networks of formal and informal relationships found in all work settings. The network perspective sees social actors as embedded in complex networks of relationships that may both constrain behavior and enhance productive capacity. More recently, IS researchers have leveraged social networks to understand technology-related phenomena (e.g., Kane and Alavi 2008; Sykes et al. 2009). This perspective is particularly relevant to IS contexts given that it parallels views on IS, which can both constrain behavior and have the ability to enhance productive capacity. In a network perspective, maximum information is obtained by employing constructs that directly tap into the structure of the embedding networks. This is especially pertinent when studying the context of an ES implementation—i.e., a large-scale organizational change event—that is expected to alter business processes and the way in which work is accomplished.

The aforementioned changes and consequent processes will result in the need for employees to exchange information about the new workflows and new software applications, and employees' success will hinge on this exchange. Specifically, we theorize that employees' embeddedness in the workflow and software advice networks, each of which is separated into perceptions of give- and get-advice, will have an effect on job performance. This line of reasoning is consistent with the core of socio-technical systems theory (Bostrom and Heinen

1977), which has had a rich tradition of being applied in the study of IS implementations (e.g., Carrillo and Gaimon 2002; Kling 1980; Lapointe and Rivard 2005; Markus 1983), that identifies different components of technical and social sub systems. This is also consistent with other prior research (e.g., Boland and Tenkasi 1996) that notes that knowledge workers in organizations have unique and differentiated expertise and perspectives on work practices and technical artifacts. We further theorize about the interaction effects across the embeddedness in these four types of advice ties on job performance. Against this backdrop, the objectives of this paper are to:

(i) Develop a model of post ES-implementation job performance that incorporates advice networks by disentangling the effects of workflow and software get- and give-advice networks; and

(ii) empirically test the model in a year-long study in the context of an ERP system module implementation in a business unit.

## THEORY DEVELOPMENT

We first discuss advice networks, their disaggregation, and their importance in the context of an ES implementation. We then develop hypotheses relating employees' embeddedness—i.e., how each employee is connected within a given social network—in the different types of advice networks to post-implementation job performance.

### Advice Networks and Their Disaggregation

Workplace advice networks comprise employees in a defined workplace setting (e.g., business unit) who seek and provide information, assistance and expert knowledge to and from one another in order to perform their jobs (Sparrowe et al. 2001). A dominant concept in the study of social networks, including advice networks, is a node's positional embeddedness

(Ansell 2003). Network embeddedness is the extent to which a node is connected to other nodes and how interconnected those nodes are to each other (Granovetter 1992; Nahapiet and Ghoshal 1998). Although prior social network research has typically treated advice as a unitary concept, we make the case that a more nuanced treatment of advice is necessary to better understand processes that influence job performance in the context of an ES implementation. The issue of unitary vs. nuanced treatment of constructs also relates to the bandwidth-fidelity paradox (see Cronbach and Gleser 1965). The paradox reflects tradeoffs associated with either narrowly defining and measuring variables or having a single construct that broadly captures many different characteristics.[1]

We disaggregate advice for two important reasons: (1) the disaggregation is theoretically justified, each of the components can be clearly defined and each of the components can be distinctly measured; and (2) each of the components can account for useful non-error variance in the dependent variable of interest. Although the first reason is somewhat subjective and subject to debate, we feel there is substantial theoretical justification and explanatory value in disaggregating advice in the context of an ES implementation. The rich treatment of contextual variables is important (Davidson 2006; Johns 2006), has been shown to be useful in many IT-related contexts (e.g., Davidson and Chiasson 2005) and is key to better understand organizational change (Herold et al. 2007). The second reason for disaggregating the advice process is that it becomes more amenable to empirical assessment.

[1] More focused and narrow conceptualizations of constructs are assumed to be better or more true measures of the constructs they represent (high fidelity) and have greater predictive ability over their narrow scope, although broader conceptualizations have less predictive validity over greater scope. An example of the bandwidth-fidelity paradox can be found in personality research. On the one hand, there are broader conceptualizations of personality that treat personality as a single construct (with many contributing attributes) versus fine-grained conceptualizations, such as the five constructs that are represented in the Big-5 that treat personality more narrowly and specifically (Ones and Visweswaran 1996).

Cross et al. (2001) point out that the traditional treatment of advice networks only illustrates who people go to for work-related solutions. Although this stance on advice networks is over a decade old and there has been much recent research utilizing advice networks, there has been little in the way of opening up the black box of advice networks themselves[2] (Zagenczyk and Murrell 2009), particularly in ES-enabled organizational change contexts. We argue that it is difficult to track types of information or information needs through a unitary conceptualization of advice networks, especially in the case of an ES implementation that requires two distinct types of information—i.e., information related to the new software and information related to the new business processes/workflows—whereas a general advice network conceptualization will not explain the nuances of the information exchange and its effects on post-implementation job performance. Thus, by disaggregating different types of advice, we will further our understanding of the role of advice networks in the context of an ES implementation. Also, social network ties are perforce, limited. This is because creating and maintaining social ties takes resources, such as time and cognitive load (Kilduff and Tsai 2003). Employees must, therefore choose the ties to create, the ties to maintain, and the ties to dissolve. By disaggregating our conceptualization of advice networks, we can gain a deeper understanding of specific benefits that different types of advice ties provide.

Pre-implementation general work-related advice networks will serve as a basis for the formation of post-implementation networks. However, with the introduction of a new ES, we expect the new advice networks not only to be a function of the old networks, but also to be reshaped as each employee identifies others who understand the new environment—i.e., new workflows and new software systems. For instance, Burkhardt and Brass (1990) found that early

[2] We acknowledge that different types of networks, such as advice, communication, friendship and undermining, have been studied in prior research (see for examples, Borgatti and Foster 2003; Cross et al. 2001).

adopters of a new information system became more central in advice networks that in turn gave them increased access to valuable work-related information. Just as each employee's workflow advice network evolves as a result of a new ES implementation, give- and get-advice ties will form around software use as well. Employees' software advice networks can be expected to be related, to some extent, to the previous general work-related (unitary) and new workflow-related advice ties. However, given that the ES involves new software applications, those who are particularly technically competent and/or those who are knowledgeable in the new software applications (e.g., "power users") are more likely to become important in software advice networks as such employees will likely be able to provide useful advice to others. Thus, the ES implementation context gives rise to workflow and software advice networks and each of these two networks can be further broken down into get- and give-advice networks.

These arguments are generally consistent with socio-technical systems theory (STST; Salembier and Benchekroun 2002). In STST, organizations comprise two separate subsystems: social and technical—see Bostrom and Heinen (1977). The technical subsystem comprises the devices, tools and techniques needed to transform inputs into outputs in a way that enhances the economic performance of the organization. The social system comprises the employees, and the attitudes, knowledge, needs, skills and values they bring to the work environment as well as the reward system and authority structures that exist in the organization. STST has been used to help explain a wide variety of phenomena, particularly IS change (Lyytinen and Newman 2008) and IS innovation (Avgerou and McGrath 2007).

One of the core tenets of STST is that there are two distinct sides to the technical subsystem: the technology and the tasks, each with its own unique qualities, characteristics, information needs and relationships with the other sub-system components that in turn point to

the need for two different types of advice to help employees cope and adapt. These two components (technology and tasks) interact with components of the social subsystem (structure and people), as well as with each other. This informs our context as well as in that the case of an ES implementation, we believe it is vital to examine the effects of both *types* of advice related to the technological subsystem—i.e., workflow and software.

The first dimension, along which we disaggregate the advice networks, is content. We examine workflow advice separate from software advice. This is relevant given the types of change that occurs during an ES implementation. As noted earlier, an ES implementation comes with changes to business processes and the introduction of new software applications (Davenport 2000; Robey et al. 2002; Ross and Vitale 2000). Not only do employees need to learn how to use the new software applications, but they are also required to use new business processes. The second dimension along which we make a distinction in disaggregating advice networks is the difference between giving and getting advice. Although the two networks are really asymmetric treatments of the same network, as advice is what moves between nodes in each network (see Ko et al. 2005), we believe that examining the networks in terms of not only the message being transmitted, but also the direction of transmission, is vital to our understanding of ES implementations, thus gaining maximal information from using nuanced advice networks (Cross et al. 2001). Such a disaggregation of advice networks into get- and give-advice networks is consistent with prior research (Chan and Liebowitz 2006; Zagenczyk and Murrell 2009). Specifically, giving advice represents power and influence (Carpenter and Westphal 2001; Sparrowe and Liden 2005), whereas getting advice represents knowledge acquisition (Hansen, Nohria, and Tierney 2005; Isaac et al. 2009). Table 1 summarizes the 2x2 that emerges from our disaggregation of advice networks.

**Table 1. 2x2 of Advice Networks**

| | **Get-advice** | **Give-advice** |
|---|---|---|
| **Workflow advice** | Knowledge acquisition related to new workflows (business processes, norms, rules, practices and procedures). | Power and influence gained from giving advice related to workflow (business processes, norms, rules, practices and procedures). |
| **Software advice** | Knowledge acquisition related specifically to the technical knowledge about the software systems. | Power and influence gained from giving advice related to the use of the software systems. |

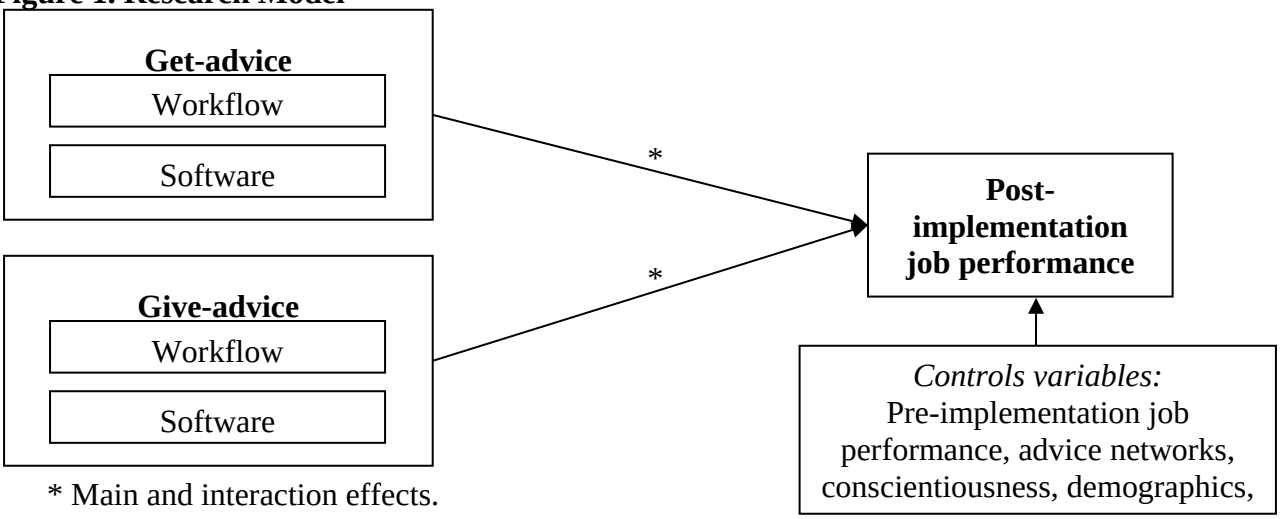
## Hypothesis Development

In this section, we first present the rationale for the independent (direct) effects of embeddedness in each of the types of advice networks. Next, we present our rationale for six interaction effects. Figure 1 presents our research model.

### Get-advice Networks

Getting advice is one mechanism through which employees acquire knowledge. The more embedded an employee is in the get-advice network, the greater the opportunity to obtain information exists. The nature of human cognition is such that no one employee can know everything (Brandon and Hollingshead 2004). However, employees can create links to other employees in order to access diverse information that they do not possess (Hollingshead 1998; Moreland et al. 1996; Rulke and Galaskiewicz 2000). An employee with more expansive get-advice ties can leverage those ties to get access to the right information in a timely manner (see Burt 1992). We will next discuss the rationale for the roles of workflow get-advice and software get-advice as they relate to job performance.

**Figure 1. Research Model**




* Main and interaction effects.
Interactions are:
(1) Get-advice (workflow) X Give-advice (workflow);
(2) Get-advice (software) X Give-advice (software);
(3) Get-advice (workflow) X Get-advice (software);
(4) Give-advice (workflow) X Give-advice (software);
(5) Give-advice (workflow) X Get-advice (software); and
(6) Get-advice (workflow) X Give-advice (software).

Workflow advice can help an employee understand the new business processes (Burkhardt and Brass 1990; Burt 2005). The more embedded in the workflow get-advice network an employee is, the greater the amount and more complete the information about the workflows is available. Getting advice specifically related to workflows will lead to greater breadth and depth of knowledge about the new environment within which the employee performs his/her job. Further, advice from employees who are familiar with the same job tasks to one's own can help one learn the new business processes faster as advisors are more likely to provide information that fits well with an employee's particular needs. Workflow advice networks also serve as coping mechanisms during the organizational change event (see Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984) by helping employees acclimatize to the new norms brought about by the ES implementation (Coleman 1988). Socio-technical systems theory suggests that factors concerning the tasks influence the behavior of people who perform those tasks (Steers and

Mowday 1977). Similarly, knowledge of the tasks influences how people perform those tasks. Therefore, knowing how to perform the tasks translates into knowing how to perform one's job.

Workflow advice plays a key role in helping an employee to learn and cope with new workflows and in keeping the employee knowledgeable about where his/her tasks and job fit within the grand scheme of organizational activities. Whereas an employee's software advice network will help them deal with technical problems associated with the new software applications that are part of the ES. Knowledge acquired through the software get-advice network serves as a source of information on technical matters, such as system functionalities, system-generated errors and system constraints or rules. Being embedded in the software get-advice network will help an employee learn improved ways of accomplishing tasks using the new software, thereby helping achieve high levels of performance and/or performance gains. Beaudry and Pinsonneault (2005) suggest that users wishing to take maximum advantage of opportunities provided by an IS implementation will use the system more extensively in order to obtain renown as an "expert user." Socio-technical systems theory recognizes the distinct nature of the technology from the tasks (Appelbaum 1997). Here, software advice relates directly to the technology component of the technical sub-system. Thus, we hypothesize:

H1(a): An employee's embeddedness in the workflow get-advice network will be positively associated with job performance.

H1(b): An employee's embeddedness in the software get-advice network will be positively associated with job performance.

**Give-advice Networks**

From a resource dependence or exchange theory perspective, power results from access to, and control over, important organizational resources, such as information. People who have

access to resources decrease their dependence on others and people who control relevant resources increase others' dependence on them, thereby acquiring expert and/or referent power and influence (Pfeffer 1981, 1982; see also French and Raven 1959). Giving advice is one expression of referent power and influence. When an organization implements an ES, the organizational environment changes (Ross and Vitale 2000). Employees able to assimilate the change more rapidly will gain power and influence as they become a source of information on which their peers become dependent (Burkhardt and Brass 1990). Such advice-giving enhances their embeddedness that in turn positively influences their relative power (see Brass and Burkhardt 1992). Thus, employees providing information would acquire power over others and such power can be leveraged in times of need where aid can be obtained for their own jobs (Brass 1984). Advice giving also contributes favorably to an employee's job performance as it provides an employee with opportunities to see problems from different perspectives (i.e., perspective taking; e.g., Stiller and Dunbar 2007).

As an ES is introduced, power and influence can stem not only from knowledge about the new workflows, but also from knowledge about the new software. Giving advice signals that providers are experts in their specific content areas (workflow or software) and their superiors and peers are likely to attend to such signals (Herling and Provo 2000). Employees who are heavily embedded in the give-advice networks will be seen by their supervisors as performing a valuable service, as such employees not only improve coworker and organizational performance, but also engage in extra-role behaviors and gain in prestige (Völker and Flap 2004)—all of which tends to be rewarded in job performance evaluations (Podsakoff et al. 2000; Van Dyne and LePine 1998) and can be expected to be particularly recognized or even exaggerated in major organizational change situations. Thus, we hypothesize:

H2(a): An employee's embeddedness in the workflow give-advice network will be positively associated with job performance.

H2(b): An employee's embeddedness in the software give-advice network will be positively associated with job performance.

**Interactions**

The interaction hypotheses are organized around the complementarities across the mechanisms specified in the rows and columns in Table 1. We expect the interaction between embeddedness in getting and giving each type of advice to be associated with job performance over and above the main effects of these constructs. These interactions are important as they will help us better understand which ties are most valuable to an employee in the context of an ES implementation.

*Getting and Giving Advice Embeddedness*

In socio-technical systems theory, the components of the sub-systems are interactive with all other components (Mumford 2003). This interaction between components indicates dynamic relationships that create synergies. Employees who both get and give advice in a content area (workflow or software) gain knowledge as well as power/influence in the given content area. Such employees display an organic or developing expertise that they share with others in the advice network. This evolving expertise allows participants of these networks to both learn by asking for advice (getting advice) as well as to improve their learning process by passing on what they know to others (giving advice)—similar to learning through teaching, reinforcing acquired by passing it on (Cortese 2005). Employees who are active in both getting advice related to problems with which they are dealing and giving advice to those who come to them in the same area are in a better position to see patterns of information gaps or problem areas than those who

are less engaged in these advice networks. Employees who are less engaged, or engaged only in either the giving or getting of advice, are more likely to only see part of the overall workflow picture when compared to those who are more actively engaged in both giving and getting advice.

Employees who are engaged in both the give- and get-advice networks in a particular content area (workflow or software) will be more involved in the overall flow of valuable (in terms of doing one's job) information. Employees who act as "transmitters"—i.e., who are high in both input and output within the network (Marsden 1990)—will not only be exposed to more information (knowledge acquisition), but also be seen as a source of valuable information, thus gaining power and influence. They will also be able to test assumptions they may hold regarding the specific type of advice in which they are acting as transmitters for (workflow or software) and enrich their knowledge by being able to gain information from the perspectives of others (Boland and Tenkasi 1996). This will allow them to retain their power/influence in their area of expertise. Together, the acquisition and provision of information are mutually reinforcing activities. Actors who are more embedded in both give- and get-advice networks will have access to information that will enable them to perform better than those who are not embedded in both giving and getting information in a particular advice network. Thus, we hypothesize:

H3(a): The interaction of an employee's embeddedness in the workflow get- and give-advice networks will have a positive effect on job performance.

H3(b): The interaction of an employee's embeddedness in the software get- and give-advice networks will have a positive effect on job performance.

*Workflow and Software Advice Embeddedness*

The success of an ES implementation hinges both on the new business processes being faithfully appropriated and executed, as well as the software applications being used to complement the processes (Soh et al. 2000). We expect employees who are embedded in both workflow and software advice networks will likely achieve the highest job performance because of the tight coupling of business processes and software applications in an ES implementation (Klaus et al. 2000). This tight coupling requires an employee to not only fully understand the various workflow issues related to the activities that she or he must perform, but also effectively use the software applications in the context of different business processes. Thus, those who are embedded in both types of advice networks will experience the smoothest transition to the new organizational environment due to the availability of the support to construct the "complete picture" related to job tasks. In sum, high embeddedness in both networks will reinforce each other in helping employees to achieve the highest performance and/or maximal performance gains.

In terms of getting advice, employees who are embedded in both the workflow and software networks will gain a more holistic understanding of the new ES as they will have the ability to acquire knowledge related to all aspects of the system, compared to employees who are less embedded in either or both networks. We expect this interaction to have a significant effect on job performance because employees who are able to acquire knowledge related to all parts of the new ES are less likely to become "stuck" or to remain frustrated with the ES (Umphress et al. 2003).

In terms of being embedded in the workflow give- and software give-advice networks, employees thus positioned signal to others within the network that they have a more holistic

mastery over the ES. Such signaling reinforces an employee's position as a giver of advice, which will encourage advice seekers to continue to go to the employee for advice. The advice-giver will thus continue to receive information that will allow him/her to better his/her own performance using the system. Further, such advice-givers gain the opportunity to remain powerful/influential as the more advice they give to others, the more likely they are to continue to learn about the ES. From a supervisor's perspective, an employee who can provide advice with regard to both aspects of an ES, which are tightly interwoven, will see the most benefits, frequently through high performance ratings, for contributing to improved co-worker and organizational performance. Thus, we hypothesize:

H3(c): The interaction of an employee's embeddedness in the workflow get-advice and software get-advice will have a positive effect on job performance.

H3(d): The interaction of an employee's embeddedness in the workflow give-advice and software give-advice networks will have a positive effect on job performance.

*Content Area and Direction*

We expect that the interactions between advice content area (workflow or software) and advice direction (giving or getting) will influence job performance. Employees in these scenarios are those who are more expert in one content area related to the system and active seekers of knowledge in the other content area. Such employees will gain both types of benefits from their advice ties: knowledge acquisition from getting one type of advice and power/influence from giving the other type of advice. Such employees signal to others within the networks that they are active and contributing members. This is likely to reinforce the active state as others will continue to come to them for advice (Ibarra and Andrews 1993). For example, an employee who is an expert in the workflow aspects of the ES is likely to be asked for advice on this topic. If that

employee provides advice, they will obtain power/influence within the network for being a recognized expert in the workflows related to the ES. If this employee also gets advice from others who are expert in the software aspects of the ES to bolster their knowledge, they will also gain benefit in the form of knowledge acquisition that will help them gain a holistic understanding of the ES and derive performance benefits. Thus, we hypothesize:

H3(e): The interaction of an employee's embeddedness in the workflow give-advice and software get-advice networks will have a positive effect on job performance.

H3(f): The interaction of an employee's embeddedness in the workflow get-advice and software give-advice networks will have a positive effect on job performance.

## METHOD

In this section, we describe the setting, new ES, participants, measurement and data collection.

### Setting

We collected data in a business unit of a large multinational telecommunications company, headquartered in Europe. The focal system, which we discuss next, was specifically designed and implemented for the business unit. The business unit managed activities related to suppliers of components and materials for various product lines. Our sample was made up of supplier liaisons whose duties included selecting suppliers, ordering products, finding new suppliers, sending out calls for bids, receiving and processing bids, and placing orders. Supplier liaisons also interfaced with other business units (e.g., inventory management, accounts payable). Each supplier liaison reported to one of eleven product line supervisors. Each product line supervisor supervised about 8 supplier liaisons. There were 3 product group managers, who each supervised 3 or 4 product line supervisors. The product group managers reported to a vice

president. The business unit formed a logical boundary for the advice networks in our study given that the ES module was implemented in the unit, and other business units implemented different ES modules, thus having a different set of business processes and software applications from the focal business unit.

## New Enterprise System

The new ES was an ERP module targeted to the specific business unit. The IT department of the organization customized a commercial ERP module and completed the development over a period of 8 months. The ES implementation included the introduction of new business processes (i.e., workflows) and software applications. The ES thus significantly automated and transformed activities in the business unit. Although employees could choose not to use the ES or use it in a perfunctory manner, management publicly pushed for employees to use it. Significant resources were devoted to championing the new software applications, training employees and rolling out process changes with change management consultants. Thus, the ES implementation was an organizationally driven IT-based change that created a context for new advice networks related to the new workflows and software applications.

The management of documents and contacts was a key part of the supplier liaison job function. Historically, the business unit expected each supplier liaison to manage documents and contacts as they wished, with most employees using different off-the-shelf tools with no integration across employees. The new ERP module was an integrated solution that allowed employees to manage communication with suppliers, share information with others in the business unit and share relevant information with other business units (e.g., inventory management after an order was placed). The organization's objective for the ERP module was to replace the old, employee-chosen and fragmented systems with the integrated solution of new

business processes and software applications. The old business processes were replaced by the new business processes that were defined by the vendor. The new ERP module aimed at organizing and allowing better access to information across employees. It also provided sophisticated workflow functionality and helped manage all types of content and documents (e.g., emails, requests for quotes) using templates. Also, other relevant ERP modules were integrated with the focal ERP module—e.g., inventory control, accounting. As the business unit had designed the supplier liaison positions to be autonomous, each product line and the business unit as a whole had collective goals. The new ERP module was designed to assist in managing these shared goals, to streamline business processes and have a unified set of software applications across all employees.

## Participants

The participants were employees in the business unit who were the target users of the new ERP module. The sampling frame was a list of the 108 knowledge workers (not including the secretarial staff or the leadership team—i.e., product line supervisors, product group managers, the vice-president) in the business unit. Although this sample size is small compared to more traditional survey-based studies, in the case of a full-roster network study, it is considered moderate to large (Thaden and Rotolo 2009). One reason that we chose to use a full-roster instrument to obtain responses is that this method allows for better capturing of all advice ties (Constant et al. 1996; Cooper 2008).

The participants were supplier liaisons, i.e., employees who are in charge of interacting with the various suppliers of materials and parts necessary for the organization to produce its various product lines. Members of the business unit interacted in the context of the new ERP module that bound them with a shared symbol system and interdependent processes. For this

reason, membership in the business unit was deemed an appropriate boundary for this study. We interacted extensively with the leadership team regarding the study and they were the primary stakeholders with whom we shared our results at the aggregate level. As noted earlier, they were, therefore, not included in the study. Eighty-seven of the 108 potential employees provided usable responses in all phases of the data collection. Of the 87 participants, 22 were women (25.3%). The participants' average age was 38.9 with a standard deviation of 8.8, and the average organizational tenure was about 5 years. Although we had no control over non-response, the high response rate of (>80%) and the similarity in the demographic profile of non-respondents and respondents alleviated the concerns of non-response bias to some extent while also meeting the requirements of social network studies (Scott 2000).

## Measurement

The survey items are shown in Appendix 1.

### Social Network Constructs

Social network data were collected using widely accepted sociometric techniques (Wasserman and Faust 1994). Respondents were provided with a fixed contact roster that contained the names of all 108 employees of the business unit. They were asked to describe the frequency of contact for giving advice to or getting advice from every employee on the roster. Each respondent indicated the frequency of interaction with other employees in terms of their perceptions of giving and getting advice related to the: (1) new workflows; and (2) new software applications. For example, the elicitation (see Cross and Cummings 2004; Garton et al. 1997) was based on the following question (for software advice): "In general, how often do you contact or are contacted by the persons listed below for advice related to <<module name>>. Please leave the row blank if you do not interact with that person at all." The end points for the five-

point scale were “less than once a month” and “many times a day.” In addition to asking who they sought out for advice, respondents were asked who sought them out for advice.

Distinguishing between workflow and software advice, and measuring employee perceptions of both get- and give-advice resulted in four different sociomatrices: workflow get-advice, workflow give-advice, software get-advice and software give-advice. Each sociomatrix comprised employees and the ties among them, where the ties represent interaction directed towards getting advice from or giving advice to peers. Each of the matrices was converted into directional binary adjacency matrices by dichotomizing ties. Consistent with prior research (e.g., Hanneman 2001), a relationship with frequency of interaction of 3 (getting or giving advice a minimum of once per week on average) or above is treated as a tie being present whereas 2 or below indicates the absence of a tie. We chose to dichotomize at the weekly level of advice as employees had weekly product line meetings, which would allow them to meet and ask questions of others more easily. Because we are examining advice network ties, we felt that we needed to capture the most likely advisors within the network, while weeding out incidental contact between employees.

We operationalize an employee’s embeddedness within an advice network as their eigenvector centrality in the advice network. Eigenvector centrality measures the importance of a node in a network by assigning relative scores to all nodes in the network based on the principle that connections to high-scoring nodes contribute more to the score of the node in question than equal connections to low-scoring nodes (Bonacich 2007). Eigenvector centrality is ideally suited as an indicator of power and influence (Borgatti 2005) in a social network (here, advice network). It is also an excellent indicator of access to information (Mehra et al. 2006).

The software get-advice score for each focal employee (ego) was calculated as the eigenvector centrality for each ego in the software give-advice adjacency matrix. Eigenvector centrality (Bonacich 1972) is defined as the principal eigenvector of the adjacency matrix defining the network. The defining equation of an eigenvector is: $\lambda v = Av$, where A is the adjacency matrix of the graph, $\lambda$ is a constant (the eigenvalue), and v is the eigenvector. The equation lends itself to the interpretation that a node that has a high eigenvector score is one that is adjacent to nodes that are themselves high scorers. UCINET, v6.29 (Borgatti et al. 2002), a widely used software tool for the analysis of social network data, calculates eigenvector centralities in a range of 0 to 1. We multiply this score by 100 to get a score in the range from 0 to 100. Similarly, workflow get-advice ties were operationalized as the eigenvector centrality for the ego in the workflow get-advice adjacency-matrix. The calculations for give-advice eigenvector centrality were similar to those in the case of get-advice but using the give-advice matrices. All centrality scores were calculated as individual attribute data, which were then mean centered. Interaction terms were created by multiplying the appropriate centrality scores (that had been mean centered; e.g., software get-advice centrality X workflow give-advice centrality).

**Dependent Variable: Job Performance**

Our dependent variable is post-implementation employee job performance. There are many measures of employee job performance, each with their own benefits and shortcomings, but the most common approaches to job performance measurement are supervisor- and self-ratings (e.g., Bommer et al. 1995; Cleveland and Shore 1992; Siders et al. 2001). We used archival annual supervisor ratings, aggregated from 4 items each on a 7-point scale from very poor to excellent, of an employee's overall job performance. The organization's human resources (HR) department had developed these items based on much prior research on job performance as

the HR department, which based on our informants, included several employees with PhD degrees in various fields related to organizational behavior, industrial and organizational psychology and human resources. In particular, the core set of items that we use here were adapted from Welbourne, Johnson, and Erez (1998)—specifically, the items pertaining to doing things related to one's job description. Also, the organization had found the scale to be reliable across several years and thousands of employees. We were given access to the item-level data for our analysis. The supervisor in charge of assigning the ratings was the product line supervisor to whom each liaison reported. Although we collected data from the employees about ties to the various supervisors, as noted earlier, these supervisors were not part of our advice networks. In order to rule out various biases, we compared the results across the various product lines and product groups, and used dummy variables to code supervisor id. None of these analyses showed any differences; the mean job performance ratings across supervisors were not significantly different. Likewise, the supervisor id dummy variables produced no significant interactions.

**Control Variables**

The individual characteristics that we included as control variables were organizational tenure, gender, computer experience, computer self-efficacy and conscientiousness. Age and organizational tenure have been associated with job performance (e.g., Brenner et al. 1988; Gould and Werbel 1983; Sauser and York 1978; Tesluk and Jacobs 1998; Yammarino and Dubinsky 1988) but as both are typically correlated, we included only the latter. Likewise, gender has been associated with job performance (e.g., Igbaria and Baroudi 1995; Semadar et al. 2006). Given the context of a technology implementation, we controlled for computer experience (measured as number of years) and computer self-efficacy, which was measured using the scale adapted from Venkatesh (2000). Various studies have shown conscientiousness to be associated

with job performance (Hogan and Holland 2003; see also Barrick and Mount 1991; Ones et al. 1994; Tett et al. 1991 for meta-analyses) and, therefore, we included it as a control variable. We also included job satisfaction and pre-implementation job performance as control variables. Job satisfaction, measured as overall job satisfaction, has been associated with job performance (e.g., Judge et al. 2001).

## Data Collection Procedure

Our data were collected via online surveys and from archival sources. The data collection began with pre-implementation data about job performance from supervisors' ratings and an employee survey of personality, job attitudes and demographic characteristics approximately five months prior to the ES implementation ($T_0$) which was concurrent with the annual employee performance review in the business unit. The evaluation of all employees in the business unit was conducted over the course of a month. The ES was rolled out in the business unit with a formal training program of three days. Immediately before the training, the employees filled out a survey that collected social network data related to general workplace advice ($T_1$). Workflow and software advice network and job attitudes data were collected six months post-implementation ($T_2$) over a one-month period as it was done concurrent with the timing of the next organizational performance evaluation process (thus, approximately 1 year after $T_0$). The $T_2$ annual reviews were the source of the post-implementation job performance data.

## RESULTS

Table 2 shows the descriptive statistics and correlations. The descriptive statistics suggest that employees engage with several peers in terms of giving and getting advice. Interestingly, relative to pre-implementation ratings, supervisor ratings of post-implementation job performance were lower. The control variables were correlated with pre-implementation job

performance, as expected. Of all the variables, conscientiousness and job satisfaction were most highly correlated with job performance. The various pre-implementation advice constructs were correlated with pre-implementation job performance. The pre-implementation advice constructs were correlated with post-implementation job performance but not as strongly as the post-implementation advice constructs were. Also, as expected, the pre-implementation advice constructs were correlated with post-implementation advice constructs but the correlations were below .30, thus suggesting that the ES implementation did, in fact, lead to a reshaping of the advice networks. The advice networks did not simply carryover from pre- to post-implementation. Further, the correlations between various workflow and software advice network constructs were about .20. Appendix 2 shows a subset of the workflow get-advice network and the corresponding software get-advice network that demonstrates the minimal overlap across these networks.

We examined the psychometric properties of the various multi-item scales. Table 2 also reports the reliabilities of the multi-item scales, with all scales being reliable with Cronbach alpha scores being greater than .70. We also conducted a factor analysis with direct oblimin rotation of all multi-item independent variable data and found the loadings in all cases to be greater than .70 and cross-loadings to be .30 or lower, thus supporting convergent and discriminant validity. We tested for the presence of influential outliers using both the Cook's Distance measure (Belsley et al. 1980) and graphical methods and found no outliers. In order to reduce multicollinearity, we mean-centered the data associated with variables that were going to be used to create interaction terms (Aiken and West 1991). We also adhered to recommendations in other work with regard to testing interaction effects (see Carte and Russell 2003). The variance inflation factors of all variables in the various model tests were all under 4, thus

alleviating concerns related to multicollinearity. In order to establish a baseline understanding of the prediction of job performance by the various individual characteristics and advice networks, baseline models using pre-implementation data were run and are shown in Appendix 3.

**Table 2. Descriptive Statistics and Correlations**

| | | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Gender (1 = male) | .76 | .43 | - | | | | | | | | | | | | | |
| **2** | Organizational tenure | 5.1 | 2.6 | .17** | - | | | | | | | | | | | | |
| **3** | Computer experience | 9.55 | 4.52 | .25*** | .23*** | - | | | | | | | | | | | |
| **4** | Computer self-efficacy | 4.40 | 1.51 | .29*** | .17** | .50*** | .78 | | | | | | | | | | |
| **5** | Conscientiousness | 5.15 | 1.23 | -.20** | .16* | .20** | .21** | .71 | | | | | | | | | |
| **6** | Job satisfaction—post | 4.10 | 1.19 | -.17** | -.23*** | .13* | .13* | .14* | .76 | | | | | | | | |
| **7** | Job performance—pre | 5.01 | 0.88 | .14* | .20** | .02 | .03 | .40*** | .20** | .82 | | | | | | | |
| **8** | Get-advice (general)—pre | 14.48 | 3.50 | -.21** | .18** | .08 | .04 | .18** | .15* | .26*** | - | | | | | | |
| **9** | Give-advice (general)—pre | 15.54 | 3.80 | .10 | .04 | .08 | .06 | -.15* | .06 | .28*** | .24*** | - | | | | | |
| **10** | Get-advice (workflow)—post | 20.30 | 4.01 | -.24*** | .23*** | .04 | .04 | .19** | .19** | .21** | .24*** | .15* | - | | | | |
| **11** | Get-advice (software)—post | 14.95 | 4.04 | -.17** | .19** | .19** | .18** | .15* | .24*** | .08 | .18** | .17** | .28*** | - | | | |
| **12** | Give-advice (workflow)—post | 22.88 | 4.13 | .04 | -.18** | .09 | .10 | -.17** | .19** | .20** | .16* | .29*** | .20** | -.10 | - | | |
| **13** | Give-advice (software)—post | 16.66 | 3.89 | .04 | .16* | .20** | .19** | -.16* | .24*** | .13* | .16* | .22*** | .14* | .05 | .22*** | - | |
| **14** | Job performance—post | 4.66 | 1.05 | .17** | .20** | .01 | .02 | .41*** | .29*** | .28*** | .24*** | .18** | .32*** | .34*** | .37*** | .31*** | .79 |

*Notes:*

1. Diagonal elements are Cronbach alphas; blank diagonal elements indicate variables for which alpha is not calculated. Off-diagonal elements are correlations.
2. *p<.05; **p<.01; ***p<.001.

## Structural Model Testing

We analyzed the data with post-implementation job performance as the dependent variable. The results of the hierarchical regression analysis examining the effects of the control variables, and both pre- and post-implementation advice networks in predicting post-implementation job performance are shown in Table 3. In block 1, the control variables were included and the pattern and amount of variance explained (17%) was quite similar to our pre-implementation analysis (Table A in Appendix 3). In block 2, pre-implementation advice constructs were significant, accounting for 27% of the variance in job performance, also consistent with what we observed in the pre-implementation data. In block 3, we added the main effects of the post-implementation get- and give-advice, both for workflow and software advice (H1 and H2). We found that both the pre-implementation advice constructs became non-significant and all post-implementation main effects were significant, thus supporting H1 and H2, and accounting for 40% of the variance in job performance. Overall, the model in block 3 explained more variance than unitary conceptualizations of advice (these conceptualizations are drawn from prior literature and represent non-disaggregated advice ties; Table B in Appendix 3) that had explained a more modest variance of approximately 20%.

In order to examine the effects of the interactions between types of advice and their effects on job performance (H3), we included them in block 4. Including the interactions increased the variance explained to 52%, which was much higher than the model with only direct effects. Of the six interactions hypothesized, three were found to be significant—H3(b) (software get- and give-advice), H3(c) (workflow get- and software get-advice) and H3(d) (workflow give- and software get-advice). H3(a) (workflow get- and give-advice), H3(e) (workflow get- and software give-advice) and H3(f) (software get- and workflow give-advice) were not supported.

To better understand the interaction effects, we plotted the three significant interactions, as suggested by Aiken and West (1991), shown in figures 2a-c. Specifically, we used one standard deviation below and one standard deviation above the mean as the end points. Slope tests were conducted and the slope of each line in each plot was found to be significantly different from zero and from the other line (see Dawson and Richter 2006).

H3(b) was supported in that the interaction between getting and giving software advice had a positive effect on post-implementation job performance. Specifically, the interaction between software get- and give-advice was associated with job performance, such that employees highly embedded in both the software get- and give-advice networks had the highest performance, followed by the high-give/low-get scenario, with low-low being third and the low-give/high-get scenario being the lowest performers. The interaction between workflow-get advice and software-get advice had a positive effect on post-implementation job performance, thus supporting H3(c). Specifically, the highest performers were highly embedded in both workflow and software get-advice; next were those who were low in workflow get-advice network embeddedness but highly embedded in the software get-advice network; third were the employees who had low embeddedness in both get-advice networks; and, finally, the lowest performers were those who had low software get-advice network embeddedness and high embeddedness in the workflow get-advice network. The interaction between workflow-give and software-give advice had a positive effect on job performance, thus supporting H3(d). Specifically, the highest performers were those highly embedded in both workflow and software give-advice networks, followed by those high in the software give-advice network and low in the workflow give-advice network, followed by the next highest performers being in the low

software give-advice network and high workflow give-advice network, and the lowest performers had low embeddedness in both types of give-advice networks.

By controlling for pre-implementation advice and job performance, we retain the component measures (Edwards and Parry 1993) and, in essence, understand how changes in advice ties relate to job performance change (Cohen et al. 2002). As our theorizing deals primarily with post-implementation job performance, we dropped the pre-implementation advice and job performance, and re-estimated the model to understand the effects of post-implementation advice networks on post-implementation job performance (i.e., without a statistical focus on change). We found the pattern of results to be quite similar. These results thus provide support for the key role of different types of advice networks in understanding post-implementation job performance and job performance change in ES implementations.

**Table 3. Final Model: Predicting Post-implementation Job Performance**

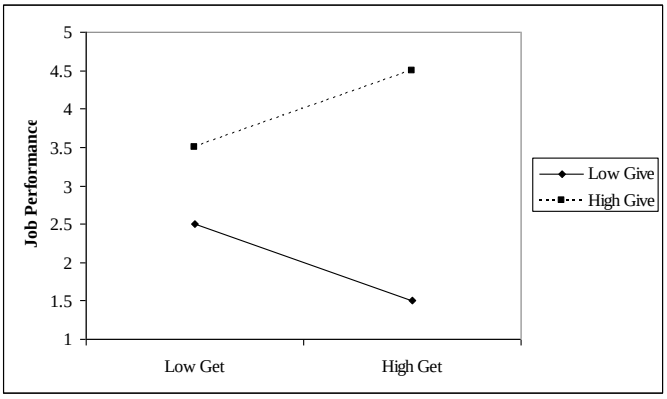
| | **Block 1** | **Block 2** | **Block 3** | **Block 4** |
|---|---|---|---|---|
| $R^2$ | .17 | .27 | .40 | .52 |
| $\Delta R^2$ | .17** | .10* | .13** | .12* |
| Adjusted-$R^2$ | .13 | .18 | .31 | .38 |
| ***Control variables:*** | | | | |
| Gender | .03 | .02 | .02 | .01 |
| Organizational tenure | .12* | .03 | .02 | .01 |
| Conscientiousness | .20** | .17** | .12* | .03 |
| Post-implementation job satisfaction | .19** | .17** | .16* | .03 |
| Pre-implementation job performance | .24*** | .20*** | .17** | .13* |
| ***Pre-implementation effects:*** | | | | |
| Get-advice (general work-related) | | .20** | .01 | .01 |
| Give-advice (general work-related) | | .18** | .02 | .03 |
| ***Post-implementation main effects:*** | | | | |
| Get-advice (workflow) | | | .18** | .02 |
| Get-advice (software) | | | .15* | .04 |
| Give-advice (workflow) | | | .35*** | .15* |
| Give-advice (software) | | | .19** | .03 |
| ***Post-implementation interactions:*** | | | | |
| Get-advice (workflow) X Give-advice (workflow) | | | | .04 |
| Get-advice (software) X Give-advice (software) | | | | .16* |
| Get-advice (workflow) X Get-advice (software) | | | | .25*** |
| Give-advice (workflow) X Give-advice (software) | | | | .15* |
| Get-advice (workflow) X Give-advice (software) | | | | .02 |
| Get-advice (software) X Give-advice (workflow) | | | | .02 |

*Notes:*

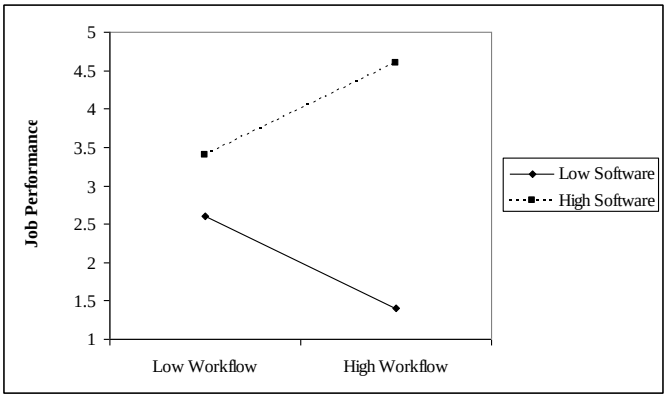
1. Shaded areas are not applicable and the significance of the $\Delta R^2$ is based on an F-test.
2. * p<.05; ** p<.01; *** p<.001.

**Figure 2. Interaction Plots**

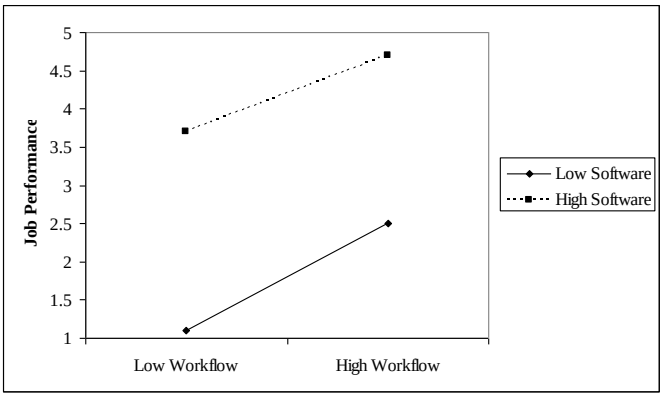
(A) Software Advice: Get and Give




(B) Get-advice: Workflow and Software




(C) Give-advice: Workflow and Software




## DISCUSSION

This objective of this work was to better understand the role of employee advice networks in the context of one of today's most common organizational change events—i.e., an ES implementation—and their relationships to post-implementation job performance. We conceptualized advice networks in terms of workflow and software advice, and further broke down advice ties in terms of give- and get-advice to gain a richer understanding of what types of advice are obtained and given, and how they relate to post-implementation job performance. The results lent support to the idea that different types of advice affect post-implementation job performance in the context of an ES implementation. Our proposed model explained 52% of the

variance and outperformed other models—i.e., main effects only and general work-related advice conceptualizations (the interested reader can see these other models in Appendix 3).

## Theoretical Implications

In terms of the IS literature, this work advances our knowledge by illustrating how employee advice networks contribute to job performance soon after an ES implementation. This is particularly important because ESs that are successful in the long run will frequently depress productivity in periods of transition due to changes in business processes, jobs, and patterns of flow of information and work (Davenport 2005; Edmondson et al. 2001). Understanding the factors that can improve job performance in the early stages of an ES implementation, when productivity is typically depressed (Markus and Tanis 2000; Ward et al. 2005), enhances our knowledge in this area. The results of this work highlight how embeddedness in different types of advice networks relates to job performance. Further, they point to differences in the underlying mechanisms of how advice networks relate to job performance after a major organizational change event. This paper advances our knowledge by highlighting the importance of two distinct types of ES knowledge, workflow and software, given that they were minimally correlated and contributed to explaining post-implementation job performance, thus complementing broader work—i.e., that conceptualizes technology broadly (e.g., Barley 1986), develops a general framework (e.g., DeLone and McLean 2003), and examines macro-level dependent variables, such as firm performance (e.g., Rai et al. 1997; Rai et al. 2006). By highlighting the particular types of advice networks that play a role tied to an ES implementation, this work calls attention to the important role of context in theory development (see Davidson 2006; Davidson and Chiasson 2005; Johns 2006) in general, and organizational change in particular (Herold et al. 2007).

This work explicates the complexities of advice related to an ES implementation. The interactions amongst the content and direction are especially interesting in that not all relationships were found to follow an "intuitive" pattern of more advice of two types interacting so that they create equally good performance. The first two interaction hypotheses (H3a-b) were concerned with the interaction among the direction of advice (i.e., getting and giving either workflow or software advice). Although the hypothesis that software get-advice X software give-advice would have a positive effect on post-implementation job performance was supported, H3a, the similar hypothesis related to workflow was not supported. One reason for this finding can be drawn from STST: there are two facets to the technical side—the technology and the tasks. However, the technology (in this case, software) subsumes some of the task-related knowledge necessary, as the software defines how many tasks are accomplished, thus potentially making the software, rather than workflow, more vital to job performance. Also, it is possible that the software portion of the new ES requires more technical knowledge than the workflow portion, which would suggest the software advice gives more status (in the giving of advice) and more valuable knowledge (in the getting of advice). The interaction plot in Figure 2(a) shows that the highest performers were those highly embedded in both getting and giving software-advice; however, the worst performers were not those who were low in both getting and giving of software-advice, but those who were low in giving and high in getting that seems, on the surface, counterintuitive because although low in giving (i.e., low in power/influence), employees who are high in getting were expected to benefit by having greater access to required information. However, role typologies that incorporate information on the ratio of actors' incoming and outgoing ties often focus on the status implications of imbalances, and employees who actively seek out others, but who are unsought out themselves, are generally regarded as

low status, and often are labeled “sycophants” (e.g., Burt 1978; Marsden 1990). In a more functional sense, employees who frequently seek advice, but who are not sought by others for advice, are unlikely to be seen as high performers, and may, in fact, be seen as a drain on others’ time and resources. Thus, compared with those less embedded in give- and get-advice networks who could be perceived as self-sufficient (even if not helpful to others), we found that employees with high embeddedness in software-get advice but with little embeddedness in software-give advice networks were the lowest performers. For H3(a), we speculate that in terms of the workflow get- and give- advice interaction, that when we examine the benefits obtained due to knowledge acquisition (get) and through power/influence (give) both related to workflow, little synergy is created in terms of an impact on job performance. This could be due to the software advice network being more important to aiding in accomplishing one’s job, especially in the early stages after an ES implementation.

For interactions between different content areas (workflow and software) but same direction (giving or getting) of advice, we found support for both hypotheses. The plots for each of these are given in Figure 2(b) and 2(c) respectively. For H3(c), we found a pattern of results similar to that found for H3(b). Specifically, the highest performers were employees who were highly embedded in both the workflow and software get-advice networks. However, the lowest performers were those who were highly embedded in workflow get-advice but were low in software get-advice. It is likely that in the context of a new ES implementation, the exigencies associated with the software applications are more overwhelming and novel than the related changes in the workflows. Access to software advice is, therefore, imperative for employees to adapt to the new environment, whereas reliance on existing workflow advice networks, or perhaps even shifting attention away from such networks in the transition will not be as

damaging to performance as lacking in software advice networks would be. At the other extreme, employees who seek to adapt to the new environment by getting advice *only* from their workflow advice networks are unlikely to successfully adapt as those sources of advice will be unequipped to deal with the demands of the new software applications. In such cases, where employees fail to obtain software advice and attempt to compensate by expanding their workflow advice network embeddedness, performance is likely to be low and/or even erode (relative to pre-implementation levels).

We interpret the interaction plots such that those who are less embedded in both software and workflow advice networks may recognize the difficulties with the new situation and engage in a variety of coping and adaptation behaviors (Beaudry and Pinsonneault 2005). However, those who are centrally situated in *either* the workflow get- *or* software get-advice network probably invest a substantial amount of time in trying to learn the new processes *or* software applications, respectively, by leveraging their advice networks and also, due to the lack of access to one type of network, try to learn some aspects (i.e., workflow or software) on their own. Given their limitations in knowledge access, they may not be able to complete the tasks using the new processes and/or software applications and thus, have to resort to pre-implementation approaches. Together, this results in more time being spent in the combination of old and new approaches to work activities, resulting in low employee job performance due to possible interference from various task activities (Hecht and Allen 2005). In fact, given the interference, such employees were shown to perform more poorly than the low-low employees who may be more cautious and slow in their use of the new approaches to work and consequently, use old approaches to perform tasks and bypass failed attempts to complete tasks using the new approach before switching back to the old approach. Also, low-low employees, by virtue of their relative

isolation, may have developed coping mechanisms in the form of individual problem-solving skills that will enable them to adapt to the ES more readily than others who rely on only one of the workflow or software advice networks. There is evidence in prior research that some employees will resort to workarounds (see Boudreau and Robey 2005)—we believe that to be the approach of the low-low employees but unlike those with incomplete information, the low-low employees get their job tasks done, albeit less effectively than the high-high employees. We found the two types of advice to interact such that the highest performance was at the highest ends of both scales, and the lowest performance was among employees with high embeddedness in the workflow get- and low embeddedness in the software get-advice networks.

Both H3(e) and (f) deal with cases where an employee is "expert" in one area of the system—either workflow or software—and is an active seeker of information in the other area of the system (workflow get-advice X software give-advice; workflow give-advice X software get-advice). Neither of these proposed interactions was significant. One possible reason for this is that the benefits gained from being an expert in a single area, while seeking to acquire knowledge in the other area provides little opportunity for *complementarities* to be created and leveraged in terms of job performance, although the main benefits of acquiring knowledge and gaining in power/influence would still be present. In other words, although understanding any part of the system can prove helpful to a user, it is only when both parts of the system are understood that maximal benefits can be achieved.

This work builds on that literature and is one of the relatively few individual-level investigations of the impacts of an ES implementation on employee job outcomes. Further, this study sheds light on an important aspect of the challenge associated with ES implementations—i.e., existing bases of knowledge in the organization may be inadequate in helping cope with an

ES implementation. This is corroborated by pre-implementation advice characteristics being minimally associated with post-implementation performance. ES implementations require the interpretation and enactment of best practices, as well as configuration of technology, that are subject to improvisations and change at the enterprise level as well as local adaptations (Feldman and Pentland 2003). Our findings suggest that social structures that are reconstituted after an ES implementation are strongly associated with job performance. Our findings underscore that to achieve the expected benefits of ESs (i.e., maximum performance) and to recover quickly from the shock of such ES-related change, different types of advice networks are independently and interdependently critical to employees.

This work advances knowledge in the social networks literature by explicating the differences found in the types of advice employees give and get. In some part, this paper answers the call for further understanding of advice networks given by Cross et al. (2001). Our work provides a richer, more nuanced understanding of advice networks, not only from a social networks perspective, but also from the perspective of the ES context (see Johns 2006). As we acknowledged earlier, the types of distinctions we draw complement the distinctions drawn in social networks research—e.g., advice, communication, friendship and hindering (Burkhardt and Brass 1990; Kilduff 1992; Sparrowe et al. 2001). Further, this work utilizes advice networks in order to better understand organizational change (Herold et al. 2007). Similarly, understanding that employees benefit from both get- and give-advice network embeddedness is significant because treating advice networks as a unitary concept, as it has been in the past, gives us only a broad appreciation of the benefits of participating in advice networks. Clearly, at least in this particular organizational change context—i.e., ES implementation—the different types of advice have complementary positive effects whereas having access to only one type of advice is, in

some cases (e.g., only workflow get-advice), harmful. By disaggregating types of advice, we gain a more in-depth understanding of the phenomenon of interest here and such disaggregation could be useful in future network studies as long as the disaggregation is theoretically motivated. Whereas we focused only on the "job" dimension of job performance, future research should examine the differential effects of this rich conceptualization of advice on different performance dimensions (see Welbourne et al. 1998) and in other contexts (Johns 2006). The strengths of field research notwithstanding, field settings do come with idiosyncrasies. Our study was conducted in one business unit of one organization in Europe. Beyond the typical need to examine the generalizability of findings to different organizational contexts, the role of culture and its effects on some of our predictor variables and possibly even as a moderator is important to understand given the globalization of firms today. There is evidence that culture at the national (e.g., Hofstede 2001), organizational (e.g., Hofstede et al. 1990) and the individual (e.g., Rai et al. 2009) levels plays a role in influencing employee behavior in organizational settings in general and technology settings in particular. Examining the interplay of cultural characteristics and social networks will help us understand the extent of generalizability of our findings and will deepen our understanding of employee interactions in the workplace and the consequent impacts on employee outcomes.

## Limitations and Additional Future Research Directions

Social network studies focused on collecting primary network data are often difficult to conduct. We, therefore, limited our social network data collection to a focal business unit. Data about ties to the IT department/unit and those outside the business unit, including across organizational boundaries (e.g., Tiegland and Wasko 2003) and communities of practice (e.g., Wasko and Faraj 2005; Wasko et al. 2004), would help deepen our understanding of the role of

advice networks and its contribution to performance because these are known avenues people use for advice/information. To address the practical constraints of such a study, researchers could examine such ties and strength of ties by examining email or bulletin board archives (e.g., Wasko and Faraj 2005). Further, as we did not examine leader-member exchange (see Liden et al. 1997) or perceived organizational support (see Rhoades and Eisenberger 2002), the model presented here should be refined to include these constructs as they represent important aspects of an employee's social structure. Other sources of support for problems and difficulties, especially for IT-related problems, are bulletin boards and email groups. We did not study the availability of such support due to such data not being available to us. However, future studies that incorporate such would be valuable as these sources of support (computer-mediated communications) enable the tracking of exchanges between employees, as well as the identification of resident experts (Wisker et al. 2007). These areas of future study also represent ways of making advice networks more visible in these contexts.

We did not investigate the use of specific media for getting and giving advice. Past research suggests that employees' use of media (e.g., electronic mail) is linked to their level of being informed about their company and commitment to its management's goals (Kraut and Attewell 1997). Future research should examine how the use of different media underlying advice networks may relate to job performance (see Zhang and Venkatesh forthcoming). Further, we only focused on one type of network—i.e., advice. Integrating other types of networks (e.g., friendship, hindering) with the disaggregation presented in this paper could help garner further insights into ES implementation success (see Sykes and Venkatesh forthcoming). Exploring the longitudinal trajectories of social networks and linking them to behavior (e.g., software use) and

job performance would be valuable. This is especially true as prior work has shown that ES implementations can take several years to move through all stages (Volkoff et al. 2007).

Another set of future research directions relate to the role of technology use and the associated stream of research on technology adoption, which is one of the most mature streams in IS research (Venkatesh et al. 2007). Besides integrating the role of the various conceptualizations of technology use in the prediction of job performance (Burton-Jones and Straub 2006; Venkatesh et al. 2008) with what we have proposed here, it will be useful to integrate the rich perspective of social influences that we have developed here into existing models of technology adoption, such as the unified theory of acceptance and use of technology (UTAUT; Venkatesh et al. 2003). Extending this idea of a rich conceptualization of social influences and integrating it into technology adoption models in contexts outside the workplace, such as UTAUT 2 (Venkatesh et al. 2012), will be theoretical and practical significance.

## Practical Implications

Understanding the underpinnings of advice in the context of an ES implementation is important for several reasons. First, employees develop and maintain work-related advice networks, especially in knowledge-intensive job settings (Cross et al. 2001). These networks represent a natural resource that organizations can leverage in order to ease their employees through the transition period of new ES implementations (Bruque et al. 2008). Better understanding of how these virtually untapped resources operate in the context of ES implementations will better arm managers with tools that can be leveraged to improve the uptake of the new system and, hopefully, minimize the period of job performance decline that so often follows an ES implementation. Second, employees coping with a new ES face both the need to understand a new hardware and software configuration (technical knowledge), and the need to

understand new business processes. ES implementations as organizational change events are both common and stressful. One method of coping with the new information needs from an ES implementation is through the auspices of different types of employee advice networks. Our paper highlights the need for organizations and management to develop interventions that handle both types of information that have been identified in this work. Our work illustrates that, at least in the short-term, it is the software side of the ES that is most important on which an employee should seek to gain advice. It is possible that for maximal benefit, organizations could design training interventions and support services so that the early focus is on the software side, with later stages focusing on workflows. Finally, by disaggregating advice networks into get- and give-advice, we draw attention to the different benefits an employee gains from both actions—knowledge acquisition and garnering power and influence within employee social structures. By identifying employees who seek out more advice than others do, managers can determine if one or more employees are in need of supplemental training. In terms of power and influence, managers can identify those employees to whom other employees go for advice related to the new workflows and software. Knowing who has the power and influence within employee advice networks can facilitate faster information diffusion. Further, by making giving advice an important part of the job duties of some employees (see Davis et al. 2009), managers can facilitate the success of an ES, especially in terms of employees' job performance that can collectively result in organizational-level ES implementation success.

In terms of the interdependencies, managers need to recognize that not all advice is equal. From a context perspective, software advice was key, and in the absence of software advice, workflow advice was detrimental. Priority should be given to interventions that address software information needs over workflow needs, if one must choose one over the other. Prioritizing

across support interventions is an essential step for organizations. In fact, one of the best ways to provide support, based on this study, may be to provide release time for super users of the software-side of the ES.

## CONCLUSIONS

Our research studied the role of advice networks during an ES implementation. We found strong evidence to suggest that a nuanced conceptualization of advice that distinguishes across get- and give-advice and workflow and software advice, and the interactions therein provide a richer explanation of employees' job performance, compared to the understanding gained from a unitary conceptualization of advice that has been used in much prior research. Our work advances the ES implementation literature by providing a pivotal explanatory role for social structures, a concept that has been under-investigated in the context of such implementations. Further, complementary effects of different types of advice networks on post-implementation job performance highlights the need for managers to incentivize getting and giving advice both on the new workflows and the software applications in order to facilitate ES implementation success.

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## APPENDIX 1. SURVEY INSTRUMENT

Age (in years):
Gender: Male □ Female □
Amount of time worked for <<company>> in years:_____
Amount of computer experience you have in years: _____

**Conscientiousness (1=not at all, 7=to a very large extent)**
I do things according to a plan.
I make plans and stick to them.
I waste my time (R).
I pay attention to details.
I do things in a half-way manner (R).
I find it difficult to get down to work (R).
I get chores done right away.
I am always prepared.
I shirk my duties (R).

**Computer self-efficacy (1=strongly disagree, 7=strongly agree)**
I could complete a job or task using a computer…
…If there was no one around to tell me what to do as I go.
…If I could call someone for help if I got stuck.
…If I had a lot of time to complete the job for which the software was provided.

**Job satisfaction (1=completely dissatisfied, 7=completely satisfied)**
All in all, how satisfied are you with the persons in your work group?
All in all, how satisfied are you with your supervisor?
All in all, how satisfied are you with your job?
All in all, how satisfied are you with this organization, compared to most?
Considering your skills and the effort you put into your work, how satisfied are you with your pay?
How satisfied do you feel with the progress you have made in this organization up to now?
How satisfied do you feel with your chance for getting ahead in this organization in the future?

**Advice networks (in each case, the lead-in text was followed by a roster)**
*Unitary advice lead-in text:* In general, how often do you contact or are contacted by the persons listed below for work-related advice. Please leave the row blank if you do not interact with that person at all.

*Workflow advice lead-in text:* In general, how often do you contact or are contacted by the persons listed below for advice related to your workflow and business processes. Please leave the row blank if you do not interact with that person at all.

*Software advice lead-in text:* In general, how often do you contact or are contacted by the persons listed below for advice related <<ES module name>>. Please leave the row blank if you do not interact with that person at all.

| | I contact this person… | | | | | This person contacts me… | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Many times a day** | **Once a day** | **Once a week** | **Once a month** | **Less than once a month** | **Many times a day** | **Once a day** | **Once a week** | **Once a month** | **Less than once a month** |
| **Name 1*** | 5 | 4 | 3 | 2 | 1 | 5 | 4 | 3 | 2 | 1 |
| **Name 2** | 5 | 4 | 3 | 2 | 1 | 5 | 4 | 3 | 2 | 1 |
| **….** | … | | | | | … | | | | |
| **Name N** | 5 | 4 | 3 | 2 | 1 | 5 | 4 | 3 | 2 | 1 |

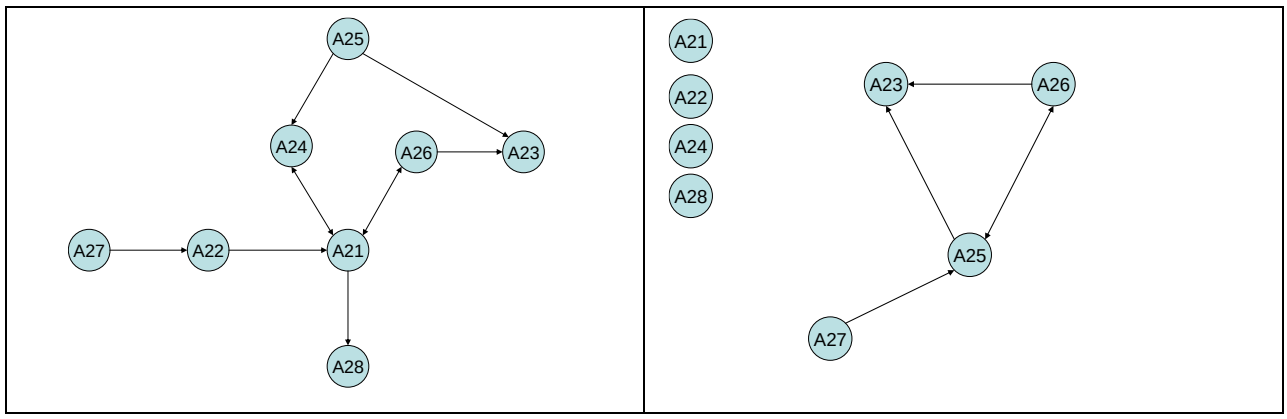
*Note*: The following items were not present on the survey instruments, instead they were filled out by a supervisor for each employee at the time of the employee's annual evaluation.

**Job performance (1=needs much improvement, 7=excellent)**

*Job (doing things specifically related to one's job description)*

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

## APPENDIX 2. EXAMPLE OF WORKFLOW GET-ADVICE VS. SOFTWARE GET-ADVICE SUB-NETWORKS




*Note:* The sub-network shown is from a single product line. It was chosen at random. Similar patterns of differences among getting- and giving-advice networks were found across all product lines.

## APPENDIX 3. ADDITIONAL DATA ANALYSIS

### Baseline Models

In order to establish a baseline understanding of the prediction of job performance by the various individual characteristics and advice networks, we used the pre-implementation data including control variables, and general get- and give-advice eigenvector centralities. The results of the hierarchical regression analysis examining the effects of the control variables and advice networks on pre-implementation job performance are shown in Table A. The control variables accounted for 17% of the variance in job performance. When the advice constructs were added, only conscientiousness and job satisfaction were significant among the control variables, and both advice constructs were significant, accounting for 25% of the variance in job performance.

**Table A. Predicting Pre-implementation Job Performance**

| | **Block 1** | **Block 2** |
|---|---|---|
| $R^2$ | .17 | .25 |
| $\Delta R^2$ | .17*** | .08** |
| Adjusted-$R^2$ | .12 | .19 |
| ***Control variables:*** | | |
| Gender | .02 | .01 |
| Organizational tenure | .13* | .07 |
| Conscientiousness | .29*** | .23*** |
| Extraversion | .17** | .05 |
| Job satisfaction | .30*** | .23*** |
| ***Advice:*** | | |
| Get-advice (general work-related) | | .19** |
| Give-advice (general work-related) | | .15* |

*Notes:*
1. * p<.05; ** p<.01; *** p<.001.
2. Shaded areas are not applicable.
3. Significance of is based on an F-test.

In order to provide a related yet distinct empirical baseline for the comparison of the nuanced treatment of advice, we tested models using three different unitary eigenvector centrality measures of post-implementation advice. These unitary (not disaggregated) measures

of advice are based on traditional views of advice. Together, these unitary metrics provide baseline benchmarks against which models using the nuanced conceptualizations of advice and their interactions can be compared. Table B presents the pre-implementation baseline results. Model 1 is based on total contact with others; model 2 is based on a linear combination of workflow get- and give-advice; and model 3 is based on a linear combination of workflow and software get- and give-advice. The results showed that the unitary conceptualizations of post-implementation advice had modest effects on post-implementation job performance, with each of the different models explaining about 20% of the variance.

**Table B. Baseline Models: Predicting Post-implementation Job Performance**

| | **Model 1** | **Model 2** | **Model 3** |
|---|---|---|---|
| $R^2$ | .19 | .20 | .21 |
| Adjusted-$R^2$ | .12 | .13 | .14 |
| ***Control variables:*** | | | |
| Gender | .02 | .02 | .01 |
| Organizational tenure | .02 | .01 | .00 |
| Conscientiousness | .16* | .18** | .17** |
| Pre-implementation job performance | .19** | .20*** | .17** |
| Post-implementation job satisfaction | .17** | .17** | .16** |
| ***Pre-implementation effect:*** | | | |
| Unitary advice | .05 | .04 | .03 |
| ***Post-implementation effect:*** | | | |
| Unitary advice[1] | .16* | .17** | .20** |

*Notes:*

1. This construct was operationalized based on overall work-related advice. The pattern was identical when a linear combination of get- and give-advice was used.
2. * p<.05; ** p<.01; *** p<.001.