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Towards a Theory of IS Support-Related Activity

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Abstract
Information systems (IS) support department has become one major source of knowledge for organizational end-users (employees) as organizations increasingly adopt complex and integrated information technologies. Despite its significance to IS post-adoptive use, IS support-related activity remains under-studied. This study aims at developing an integrative conceptualization of IS support-related activity by drawing on IS use and adaptation theory. We conducted an in-depth qualitative study in the organizational support of a new procurement system and analyzed 591 service interactions between IS support personnel and end-users. Our data analysis suggests that IS support-related activity is a multifaceted phenomenon that comprises a set of increasingly complex behaviors, including technology-oriented behaviors, user-oriented behaviors, and activities that IS personnel undertake to adapt to the technology-user-business context. In particular, IS support personnel were found performing three major types of IS support activity -- informating, diagnosing, and boundary-spanning â which were associated with IS use behavior and required different types of knowledge in IS support context. This study contributes to IS literature by developing a comprehensive view of IS support-related activity, extending existing conceptualizations that exclusively focuses on technology or on human agency. The findings highlight the complexity and dynamics in IS post-implementation era, and present an urgent need to evaluate the challenges in and competence required for IS support work.

Keywords: service adaptability, information system support, procurement, theory development

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Towards a Theory of IS Support-Related Activity

(Revised Submission to 2012 Pre-ICIS JAIS Theory Development Workshop)

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11/27/2012, Tuesday

Abstract

Information systems (IS) support department has become one major source of knowledge for organizational end-users (employees) as organizations increasingly adopt complex and integrated information technologies. Despite its significance to IS post-adoptive use, IS support-related activity remains under-studied. This study aims at developing an integrative conceptualization of IS support-related activity by drawing on IS use and adaptation theory. We conducted an in-depth qualitative study in the organizational support of a new procurement system and analyzed 591 service interactions between IS support personnel and end-users. Our data analysis suggests that IS support-related activity is a multifaceted phenomenon that comprises a set of increasingly complex behaviors, including technology-oriented behaviors, user-oriented behaviors, and activities that IS personnel undertake to adapt to the technology-user-business context. In particular, IS support personnel were found performing three major types of IS support activity -- *informating*, *diagnosing*, and *boundary-spanning* – which were associated with IS use behavior and required different types of knowledge in IS support context. This study contributes to IS literature by developing a comprehensive view of IS support-related activity, extending existing conceptualizations that exclusively focuses on technology or on human agency. The findings highlight the complexity and dynamics in IS post-implementation era, and present an urgent need to evaluate the challenges in and competence required for IS support work.

Key words: IS support, IS use, adaptation, IS professional, procurement system, theory development.

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Towards a Theory of IS Support-Related Activity

1. Introduction

The support operation of information systems (IS) in organizations is challenged by increasing demands of end-users but constrained by insufficient financial and human resources. The challenge becomes more problematic when organizations increasingly adopt complex and enterprise-wide technologies. Information technology (IT) has been integrated in the business processes of an organization, becoming an essential part of a larger system consisting of employees, procedures, tasks, and technical functions, referred to as "IT-enabled work systems" (Jasperson et al., 2005). In an IT-enabled work system, such as customer relationship management (CRM), successful completion of employees' work relies not only on employees' proficiency in their business domains but also their proficiency in using information technology to facilitate their business tasks (Hsieh et al., 2011). IS support department becomes one major source of knowledge for organizational end-users (employees), engaging in frequent knowledge transfer with end-users (Santhanam et al., 2007) and bridging user groups by passing good IT use practices from one unit to the others (Pawlowski and Robey, 2004).

Despite its significance to IS post-adoptive use in organizations, IS support-related activity remains under-studied. IS researchers have adopted different views in their investigations of IS post-implementation phase, including IS use and maintenance. One view focuses on technology, emphasizing the role of technical functions in determining organizational effect of IT. In this regard, detecting and resolving technical malfunctions become important responsibilities of IS support operation (Das, 2003). Another view is human-oriented, highlighting the importance of user training and user competence in promoting organizational use of IT. According to this

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human agency view, users' lack of competence with a new IT constitutes a major hurdle, negatively affecting their learning and appropriating the technology for their work tasks (Boudreau and Robey, 2005). To this end, IS support department should focus on training end-users and improving their knowledge of a new technology. Effective use of integrated technologies is influenced by multiple inter-related factors (Jasperson et al., 2005). Consequently, in the support work of such IT-enabled system, a comprehensive view of IS support is warranted. Thus, in this study, we define information system (IS) support broadly as the set of behavior that individual IS workers undertake to resolve IS use problems and to enhance IS users' employment of technical systems.

To develop a theoretical framework on IS support-related activity, we drew on IS use and adaptation theory, and conducted an in-depth qualitative study of organizational support of a new procurement management system. The analysis of 591 service interactions between IS support personnel and end-users suggests that IS support-related activity is a multifaceted phenomenon that comprises a set of increasingly complex behaviors, including technology-oriented behaviors, user-oriented behaviors, and activities that IS personnel undertake to adapt to the technology-user-business context. In particular, IS support personnel were found performing three major types of IS support activity -- informating, diagnosing, and boundary-spanning – which were associated with IS use behavior and required different types of knowledge.

This study contributes to IS literature by developing a comprehensive view of IS support-related activity, extending existing conceptualizations that exclusively focuses on technology or on human agency. In this article of theory development, we define theory as statements that provide a lens for viewing the organizational use and support of information technology artifacts, which is consistent to the objective of type II theory, theory for explaining (Gregor, 2006). This

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theoretical framework is applied to information systems adopted and used across business units in an organizational setting.

The remainder of the paper is organized as follows. Section 2 reviews prior studies on IS use and support, and on adaptive job performance. Section 3 and 4 present the research methods and analysis results respectively. Then, section 5 presents the discussion of the paper, followed by contributions and implications in section 6. The paper concludes in section 7 with limitations and directions for future research.

2. Literature Review

In the following sections, we outline research on IS support, IS use and adaptation behavior that informed our study.

2.1 Information Systems Support

Existing studies on IS support offer insights from two different perspectives. One view, the technology-focused, concerns the malfunctions in technical systems. Das (2003) studies technology support by software vendors and highlights the role of diagnostic skills and technical expertise of support personnel in resolving user-reported problems (Das, 2003). According to this technology focus, the main objective of IS support is to solve technical problems; matching problem resolution strategies with the nature of tasks resulted in timely resolutions of system use problems, improving the productivity of support personnel. With a focus on the technical competence of IS professionals, Nelson and colleagues (2000) compare post-implementation phase of IS to the development stage and suggest that skill set required of IS professionals differs under the two different IS project stages, i.e., knowledge of system integration will be needed for system maintenance.

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In contrast, the human-oriented view considers IS support as activities designed to improve users' knowledge of those installed information technologies, thus promoting their system use. According to this view, IS support personnel should pay attention to the information and knowledge requests by end-users. For example, Santhanam et al. (2007) identify different types of knowledge flows between IS support personnel and end-users; technical knowledge flows from support personnel to business users while business domain knowledge flows in the opposite direction. Pawlowski and Robey (2004) find that, in addition to technical knowledge, IS support professionals were able to pass good practices of technology use from one user group to another, playing an important knowledge brokering role. Carr (2006) views the provision of IS support as customer service, thus highlighting a requisite skill set (including communication skill) required of IS professionals. These studies suggest that activities in IS support may be associated with knowledge exchange, knowledge brokering or relationship building.

Information systems use involves three key aspects (user, technology, and task) and entails a process of adaptation among the different aspects over time. Consequently, when the IS support workers are requested to assist individual users with their technology use, their support-related activities may be related to any aspects of IS use. Therefore, we draw upon IS use literature for further insights on understanding IS support-related activity.

2.2 Individual-level System Use and Adaptation

System use is one of the most studied topics in the IS field, and is often measured by frequency, duration, or variety of system functions used. Burton-Jones and Straub (2006) review studies on system use and propose a conceptualization of IS use that consists of user, system, and task. In particular, they define individual-level system use as "an individual user's employment of one or

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more features of a system to perform a task" (Burton-Jones and Straub, 2006; p. 231). Similarly, Barki and colleagues (2007) view individual-level IS use activities as encompassing a person's interaction with IT to accomplish tasks, thus leading to user-technology-task adaptation.

Users' characteristics and behaviors are an important dimension of post-adoptive IS use for two reasons. First, characteristics of individual users, such as their IT knowledge and skills, influence their experience with information systems. Prior research concludes that users' lack of skills and expertise were major causes of problems with new computer technologies (Boudreau and Robey, 2005; Robey et al, 2002) and inhibited users' application of domain knowledge (Mackay and Elam, 1992). More importantly, users with different levels of expertise (experienced vs. inexperienced) had different perceptions about their system use and thus adopted different coping strategies in their interaction with information technologies (Beaudry and Pinsonneault, 2005). Second, individual technology use is critical to understanding post-adoptive use of IS and to maximizing organizational use of those installed technologies. For example, Rice and Cooper (2010) suggest that user-enacted workarounds and undesired work routines resulted in delays in work schedules and negatively impacted organizational performance. Hsieh and colleagues (Hsieh et al., 2011) observe that organizations were able to extract more business value from IS when users' problems with technical systems were understood and resolved in a timely manner and users employed more system features.

Moreover, IS use is viewed as adaptation behaviors in response to technology and task. Individuals make adaptations in their employment of technology in performing business tasks. First, individuals have demonstrated different adaptation patterns in their technology use. For example, during the early phases of post-adoptive system use, employees engage in their initial learning of both new technologies and new work practices. Later, they engage in more

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exploration of system features and accomplish different kinds of tasks (Novick et al., 2007). As users learn to overcome knowledge barriers in using installed technologies (Robey et al., 2002; Santhanam et al., 2007), they reflect on the results of their usage and adjust their actions over time (Goodhue and Thompson, 1995).The user-system interaction triggers a process of co-adaptation between users and technical systems, leading to changes in organizational work processes or in technology features (Orlikowski, 1996).

Adaptation is also associated with the task and technology in IS use. Barki and colleagues (2007) extend the conceptualization of IS use to include not only the three dimensions (user, task, technology) and interactions, but also the associated adaptations in relation to each dimension and interaction. The adaptation falls under three major categories: 1) *technology interaction* behaviors, i.e., individual users' appropriation of technical features to accomplish tasks; 2) *task-technology adaptation* behavior, including changing or modifying an IT and how it will be deployed in an organization (also referred to as "adapting the technology," and "adapting the work"); 3) *individual adaptation* behaviors (i.e., learning), also called self-modification or adapting self (Barki et al., p.176).

The above studies suggest that how individuals employ information technology to perform their business tasks is likely to trigger potential changes in their work routines in organizations. Similarly, individual-level system use behavior will likely lead to various requests for technology use assistance and help. The effective management of IS support can be enhanced by considering individual use behaviors, encompassing user characteristics, technical features and task requirements. We argue that viewing end-users as customers of IS support department and examining the adaptive behavior of IS support personnel will generate new

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insights on IS support operations. In this regard, we draw upon organizational studies on employee adaptive job performance to inform our study of the IS support phenomenon.

2.3 Adaptive Job Performance

Organizational behavior researchers have explored the notion of adaptive job performance, and examined how individual employees deal with new conditions or requirements in a work context. Employees' adaptive job performance is a multi-dimensional construct. According to Pulakos and colleagues (2000), adaptive performance of an employee is conceptualized as an eight-dimensional construct, including solving problem creatively, dealing with uncertain and unpredictable work situations, and demonstrating interpersonal adaptability. Based on an empirical validation of the eight dimensions in 24 different jobs (e.g., aircraft commander, soldier, engineer, attorney, manager), the study concluded that the relevance of each of the eight adaptive dimensions depends heavily on the type of jobs.

In marketing field, customer customization has been emphasized as important business strategy. To understand how to encourage those adaptive behaviors, marketing scholars have investigated the meaning of adaptive job performance by customer service workers. For example, Gwinner and colleagues (2005) studied the performance of customer contact employees selling phone service packages at a call center, and highlighted the adaptive strategies used by frontline employees to customize their behaviors to meet consumers' needs. The scholars identified two types of adaptive behaviors that are most relevant in the sales service context: interpersonal and service offering. The former focused on the interpersonal interactions and viewed the customer as the focus such that the sales representatives adjust their "approach" and "style" to create

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individualized interactions. The latter behavior, the service offering adaptive behavior, focused on the customization of the services being delivered.

Similarly, in the context of IS post-adoptive support, IS workers provide information, knowledge, and diagnosis to end-users who encounter difficulties with newly-installed technologies. Responding to customers' requests and resolving their technology use problems in a timely manner are critical to this support context (Czegel, 1998). Moreover, the quality of the service offerings, i.e., accuracy of information provided and timely problem resolutions, has a significant influence on the execution of IT-enabled work tasks across an organization (Hsieh et al., 2011). Hence, tailoring their activities to end-users' system use needs is likely to be associated with effective performance. Therefore, in this paper, we also seek to understand IS support from an adaptive perspective, and view IS support-related activity as the set of behaviors that individual IS workers undertake to adapt to varying user needs for assistance, taking into consideration the underlying key dimensions of IS use.

3. Method

We conducted an intensive field study to investigate the variety of activities performed by IS professionals in support of a newly-implemented SRM system. The case study (Yin, 1994) focused on the early stage of the SRM system post-implementation, the first month after the system roll-out. During the critical first month, organizational employees were attempting to perform their routine business basks under the new information system, and were frequently seeking assistance from IS support operation.

This project phase was well suited to our research goal because of the time pressure and knowledge demands manifested in the post-implementation support environment. First,

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providing quick and accurate information and solutions is critical to overcoming users' frustration and problems with the new information technology, allowing users to resume their work routines. Second, supporting the integrated technology required IS workers to be equipped with knowledge encompassing multiple domains, including technology application and business context. The site selected for this research provided us the opportunity to collect rich case study data in an organizational setting (Yin, 1994) and allowed us to examine the complexities and dynamics that characterize the knowledge-intensive activities of IS support in organizations.

3.1 Research Site and Data Collection

The research site is a large U.S. enterprise located in the eastern region of the United States. In January 2007, it successfully completed its multi-site implementation of supplier relationship management (SRM) system, as part of an enterprise resource planning (ERP) package. To provide a centralized support to the 11,000 users across different sites, the organization set up a Support Center staffed with experienced IS professionals who involved in the configuration and implementation of the project. During the first 3 months after the system roll-out, the organization offered training sessions to end-users, providing an overview of the new system and training on users' access roles. Employees started to formally use the new system to procure office supplies and materials in April 2007. The study reported here focuses on the support activities during the first 5 weeks (April - May 2007) of the new SRM system use.

Employees at the organization had two channels to report their system use problems and to request knowledge and assistance: phone calls or emails. Both emailed and phoned problems were logged in the tracking system with description of the problem and contact information of the reporting employees. There were three levels of support professionals at the support center:

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front-liner, specialist, and developer. Level 1 analyst received calls and logged them with a unique ticket number, then assigned the tickets to level 1 specialists. When level 2 specialists could not resolve a problem, they passed it to the development team at level 3 for system modification and enhancement. Among all three levels of support, specialists at level 2 were the main knowledge source to directly address to end-users' SRM use problems and information requests. Thus, they became the focal IS support professionals in this study. As the support center manager informed us, the first month of the formal use and support of the new system was very challenging, and a variety of problems were reported across the four institutions.

For our study, we extracted a total of 691 ticket records closed from the organization's ticket-tracking database for the period of five weeks: from week 1 (the 1st week of April 2007) to week 5 (the 1st week of May 2007). We chose this timeframe for our data samples, as the period was considered by our site informants (manager and specialists) as the critical learning period for the end-users, mostly departmental administrators in the organization. This secondary data set contains data on the sequence of activities in solving an enterprise system problem, from the problems' origin, to its categorization and assignment, and to the final resolution of the problem. Additionally, we also conducted three interviews with the support center manager and specialists in December 2007 for additional insights about the post-implementation support context. We conducted semi-structured interviews with the support center manager and two support specialists and asked them open-ended questions about their experience with post-implementation support, including the types of problems encountered by organizational end-users, support staff's resolution strategies, and knowledge transfer challenges with regard to the new enterprise system. Each interview lasted forty-five to seventy-five minutes. Insights from the interviews are used to supplement our data analysis.

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3.2 Data coding and analysis

Our objective was to identify the types of support activities performed and how an IS support-related activity is linked to the behaviors in IS use (including user, technology and task). We coded and analyzed data iteratively, initially using open coding as well as codes suggested by the literature, then revised codes as we refined and clarified our theoretical interpretation. We (the author and another faculty of MIS) manually coded the texts on problem description and resolution strategies to extract information on end-users' requests and support services provided. To code the tickets, both coders determined the coding schemes together, performed a trial coding on 100 records, and discussed the coding results. Based on the coding scheme, we coded independently the remaining 591 problem records for our data analysis. We first used 30 records to do the coder training and after the training, the inter-rater reliability measured by Cohen's Kappa index (Lombard et al., 2002) has increased to 0.88 and reached the agreement at 93% of the 100 records. This suggests an acceptable level of agreement between the two coders (Ryan and Bernard, 2000). When a coding discrepancy exists, the two coders discussed the coding and resolved the discrepancies together.

Table 1 summarizes the major analytic categories that resulted from this iterative analytic process. The categories were drawn generally from the literature reviewed in Section 2 and were derived from our data analysis process.

<INSERT TABLE 1 HERE>

The SRM system installed at the organization enabled the procurement process both internally and externally. One important function in SRM is the Shopping Cart functionality, which enables an employee to obtain goods and services from the eMarketplace, an Internet-

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enabled electronic portal embedded in the SRM system. The completion of the Shopping Cart function involves two main stages, to create a purchase order, and to approve and confirm a purchase order. The two stages of procurement impose different work tasks and knowledge requirements on end-users. Consequently, the extent to which each type of support activity provided differs between the two procurement stages. As shown in Table 2, informating activities slightly dominated the Create stage while diagnosing activities significantly dominated the Approve/Confirm stage. We organized and integrated findings around the three types of support-related activities by the two procurement stages. Next we report our findings with illustrative examples drawn from our sources of data.

<INSERT TABLE 2 HERE>

4. Results

In the following sections we examine in details how users of the new SRM system initiated request for assistance during their interactions with the new technology and how IS support professionals engaged in support-related activities that often enabled the frustrated users to overcome their problems with technology use. In the post-adoptive use and support arena, IS support professionals have become one major channel to facilitate technology learning and use of organizational end-users. To adapt to varying needs for system use support, IS professionals were found to engage in three types of IS support-related, including informational, diagnosing, and boundary-spanning.

4.1 Informating Activity – To Enhance User-Technology Adaptation

SRM system integrates the procurement process between a focal enterprise and its suppliers (vendors) such that a purchase order created in the system is automatically routed to the

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authorized vendors pre-configured in the system. Initiating a purchase order requires the role of requisitioner and knowledge about the vendor's product offering. Informational service was a common type of service provided by the support personnel. When accessing a SRM system, employees have different authorization roles (e.g., requisitioner and approver), determined by their respective positions in an organization. The knowledge requests were dominated by "What is" or "How to" questions, such as "What is the purchase order (PO) number?" or "how to change the shipping addresses on a shopping cart?" When the Support Center received those information requests, they usually sent users some guidelines or walked users through the steps on the phone.

As shown in the episode below, the user was requesting knowledge about system-generated information (e.g., PO number for a shopping cart). The IS support person not only located the correct PO number as requested, but also detailed the procedure (how to locate a PO number) for the user's future reference.

> *Request: "Customer needs the PO# for shopping cart. Shopping# 1xxxxx".*
>
> *Response: "Researched and responded by email: The PO number for shopping cart number 1xxxx is 2xxxx. You find this by: 1. Go to Check Status. 2. click on magnifying glass next to the item to open up the details. 3. ……"* [Episode Stage1_N01]

Once a shopping cart was generated, with an assigned SC (shopping cart) number, it was added to the shopping cart workflow to be approved and processed. Users' confusions with the Shopping Cart function arose as a shopping cart order progresses along the approval path to the final receipt of goods and payment at the "Approve/Confirm" stage. Hence, knowledge of workflow embedded in both the system and in the organization was in high demand during the Approve/Confirm stage. Sometimes, they spent long time on the phone to walk the frustrated

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users through the steps to complete a task on the system. When assisting a user with regard to performing the online payment request, a support worker recorded the resolution as the following:

> *{"Educated or trained the customer as to the correct procedure: this was more than an hour phone call. we went through each step of viewing docs, statuses, work flow, saving as complete, tree on and off, display documents, display check information."}* [Episode Stage2_N00]

Given the variety of ways a workflow proceeds from one process to another, IS support persons found themselves explaining different options associated with a workflow, i.e., the integration of data and processes across work units. For example, how to change vendor name on a PO was complicated because the "Undo" action was closely tied with data integration across multiple parties. The following interaction reflects the dynamics.

> *Request: "Customer wants to change the company name on the PO. Customer has already finished the transaction and she already has the product. PO# 2xxxxxx."*
>
> *Response: "Emailed response: Hello xxx, There is no way for you to directly change the vendor on a PO once it has been processed and delivered. Before it has been completed, an approver can change information, but not after. If the need to change the vendor is based on getting the payment to the right company, (then) contact AP to ask how to update information to have the payment paid to the right vendor. If what you need is for a vendor name or address to be updated, (then) go to (URL) http://xxx /forms.html, and click 'New Vendor' form, and check the Change box, and submit that for change. In the meantime, you will still want to contact AP to make sure that the payment goes to the right name and address. Please call us back if this does not give you what you need.* [Episode Stage2_N02]

In summary, during the initial stage of procurement, end-users' service requests focused on the new features offered in the implemented technology. In this regard, those IS support professionals were considered as the "Expert" of the SRM application, and their knowledge of the technical system, including know-what (e.g., what is the vendor ID?), know-how (e.g., how to modify a shopping cart?), and know-why (e.g., how to remove double orders?). Further, when a support person walked users step-by-step on the phone to complete a work task, such as to modify a shopping cart, the support person trained individual end-users "on-the-job" to enhance

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their technology usage. As a result of the informational activity, IS support personnel transferred their knowledge about the technical system to end-users.

4.2 Diagnosing Activity - To Enhance User-Technology-Task Adaptation

Different from informating activity, which focused on assisting users with getting familiar with the technical functions, diagnosing activities relied on the ability of IS support personnel to identify the causes of an unsuccessful user-technology-task interaction, and to develop solutions for solving the problem. This type of activity was dominant during the later stage of procurement (Table 2), the approve/confirm stage, which often involved multiple stakeholders, including the person(s) with "Approver" roles, the central purchasing department, and external vendors.

In the context of integrated technology of SRM, users usually got confused about the shopping cart approval path, and had no knowledge about the status of their actions in the system. A common problem users encountered during the Approve/Confirm stage was about returned shopping carts. This was due to an exceptional occurrence in the approval path of a purchase order when a submitted shopping cart was modified by the approver and returned to the requisitioner role (who initiates the purchasing order). When this occurred, frustrated users sought assistance to understand the work flow of his shopping cart, as reflected below,

> *Request: "Customer has a Shopping Cart Question about returned shopping cart."*
>
> *Response: "Walked customer through the process of going back onto the SRM shopping cart area and finding the cart. Changes had been made by the approver and were sent back to the customer to accept the changes. Customer was successful in accepting the changes, and cart processed through to creation of a Purchase Order."* [Episode Stage2_N01]

The PO approval path was complicated by the approver rules associated with multiple authorized approvers. In the SRM, one or many approvers may be assigned to approve for a particular cost center. If many approvers existed, then all of them would see the shopping cart

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awaiting approval in their SRM inbox, but only approval was needed to process a transaction. Without knowledge of the approval rules, the user questioned why her boss did not receive a shopping cart to approve. In that case, the support person diagnosed the problems and provided the resolution, as shown in the following:

> *Request: "Customer has a Question about Shopping Cart. Can't find internal order number on PO that is being brought up"*
>
> *Response: "Educated or trained the customer as to the correct procedure. [I] talked a long time with Andy about doc # 19xxxxxx. Why was it approved by Cathy and not her boss Nikky? Both ladies are approvers for the shopping cart, and are connected to the order #s used in this document, but only Cathy is getting the doc to approve."* [Episode Stage2_N03]

The approver "mystery" above can be explained by the approver rule of "First One Gets It"; when an approver goes in first and approves the shopping cart, the approval procedure is completed and the work item will disappear from the SRM inboxes of the other approvers. The work item will also be removed from other approvers' inboxes, as soon as the first approver opens the shopping cart item in their SAP inbox. That explained why one supervisor never received "the doc to approve" in the case above.

Sometimes, shopping cart problems occurred as a result of missing or outdated vendor code. Because of the urgency of a user request (e.g., system use problem), e.g., a specific shopping cart being held as a result of no-vendor assignment, the support personnel researched and resolved the problem within 2 hours of receiving the problem report.

> *Request: "# 1xxxxxx was just created, and it's being held because of no vendor assigned."*
>
> *Response: "Shopping Cart # 1xxxxxx has been submitted. Because you requested an item that is not associated with a specific vendor, it will be researched and purchased by a purchaser at the Supply Chain Shared Services. As the cart was entered yesterday, you might want to allow a few more days before following up with the purchaser. You can always check the status of this shopping cart in the Check Status link in Go Shopping.* [Episode Stage2_N04]

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When users provided the specific information (e.g., shopping cart #) and precise error (e.g., no vendor assigned) in their requests, the specific information enabled the support personnel to speed up his researching and problem-resolving process. However, when no detailed information was provided by users, IS support personnel had to make assumptions, negatively affecting their responsiveness to customer requests. Therefore, IS support workers suggested users to provide the following (specific) information, *shopping cart number, specific problem encountering*, with the frontline help desk persons who answered the phone so that the support workers could troubleshoot the problem more efficiently. This suggests that IS support can be viewed as collaborative process during which both IS support personnel and business users relied on each other's information and knowledge in order to speed up the problem resolution.

In summary, during this later stage of procurement, users' attentions shifted to the workflows and rules about transaction approval and confirmation. The Approve/Confirm stage involved multiple sources (information, goods, money) and multiple parties (user, purchasing, and vendor). As a result, the service interactions between IS professionals and end-users became complex and dynamic. IS professionals diagnosed user-reported problems with their shopping carts, and provided users with knowledge about both technical system and the business domains.

4.3 Boundary-spanning Activity -To Coordinate User-Technology-Task Interaction among Business Units

When using integrated technologies such as SRM, end-users faced increasing demands to coordinate across business units. As the technologies were designed to support the information needs of multiple business functions, different business units in an organization were closely related as they accessed to the same technical system and one central database to perform their

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work tasks. Effective use of enterprise technologies required individual employees (users of the technology) to understand not only how the technology enables and supports the work tasks at their units but also how their interactions with the technology (e.g., data inputs and outputs) influence other business units or are being influenced by others. In other words, users need to understand the consequence of their user-technology-task interactions on other business units. When users lacked such cross-unit knowledge, IS support personnel connected users across multiple business units, thus performing the third type of support-related activity, boundary spanning.

For example, one important business rule in managing Shopping Carts is the rule of 3-way match: a vendor's invoice will be automatically paid by the Accounts Payable (AP) unit only when the invoice matches the initiating PO and the confirmation receipts of the order delivery. Lack of such knowledge may lead to technology use problems across work units, impairing the successful completion of a work task, as reflected below in the procurement scenario described by the manager of the support center,

> *"Lisa from the Surgical Operation unit created a purchase order for medical equipment by using the Procurement module in an ERP system, SAP/R3. Upon the delivery of the order, John at the Accounts Payable unit logged in the SAP/R3 system, he found the discrepancy in price between the invoice from vendor and the original purchase order by Lisa. Then John rejected to pay the invoice in the system, which triggered an error message to Lisa's inbox in SAP/R3 system. Frustrated, Lisa called the SAP Support Center, and complained about why "clearing the incorrect price message" did not resolve the payment issue. With the help of an analyst at the Support Center, Lisa realized that only if she "completed the workflow item that she received and accepted the price difference from the vendor" in her R3 system inbox would allow John at the Accounts Payable to pay the invoice."* [Interview -- Support Center Manage]

As shown above, the successful completion of the account payment task was impeded not only by the price discrepancy, e.g., between original online procurement order by Lisa and the invoice price charged by vendor, but also by Lisa's lack of knowledge about the 3-way matching rule enforced by the enterprise technology. In this case, the support person acted a bridge

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between Lisa and John, helping Lisa (in this case) to understand the interdependence between their work tasks. In other words, the support person spanned the boundary between the work units of the two users.

Spanning activity was also evidenced when IS personnel responded to service requests on workflows. For workflow-related requests and problems, IS personnel not only provided detailed information about the procedures, but also provided a pointer of contact in other business units (e.g. Purchasing Unit). Under these circumstances, IS professionals played the role of a boundary spanner, in addition to problem-solving. For example, after diagnosing problems, IS support personnel not only provided users with problem solutions but also took extra step to coordinate with other parties involved in the SRM-enabled purchasing process. In this case, IS personnel spanned both departmental and organizational boundaries (e.g., AP and vendor) on the users' behalf, as shown in the following.

> *Request: "There is a PO that didn't make to the vendor."*
>
> *Response: "Researched, I couldn't find what would keep the PO from reaching vendor, contacted AP (Accounts Payable), PO had been sent to vendor. AP is sending copy of PO to customer so that customer can forward to vendor. Done."* [Episode Stage2_N06]

In the context of integrated technology of SRM, users may be lacking knowledge about the responsible units for correcting a data error and completing a workflow item. Under those circumstances, end-users' information requests cannot be satisfied by the explanations of data or functionality in the technical system. Support persons often connected the user who initiated the shopping cart with the Purchasing unit. This boundary- spanning service is evidenced below:

> *Request: "Customer has a Question about Store Room/Supplies."*
>
> *Response: "Educated or trained the customer as to the correct procedure, She needs to have the vendor added. Neither one of us can find the vendor in the (SRM) system. I asked her to complete a new vendor form and send to Shared Services (at Purchasing Unit)." [*Episode Stage1_N02]

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Sometimes both diagnosing and boundary-spanning activities were performed in response to one user request. In resolving one incident about a misplaced shopping cart, the support personnel not only diagnosed the problem, also offered additional information about whom/when to follow up next and where to check the status of the submitted shopping cart, as shown in the following:

> *Request: "Customer has a Question about Shopping Cart. Placed an order on 4/5"*
>
> *Response: "The solution was as follows for this incident: Provided customer with the telephone number to Shared Services Purchasing and advised her to have the buyer who is responsible for Office Supplies either provide her with the contact information for Office Depot or have the Buyer call Office Depot to see why several items on her order have not been shipped."* [Episode Stage2_N05]

In another episode, the IS personnel diagnosed the problem and directed the user to the external vendor. Hence, the boundary spanner guided the user to contact vendor, crossing the organizational boundary.

> *Request: "Customer is placed an order and is receiving double order."*
>
> *Response: "Advised her that for LVPOs, a PO is faxed in. She should contact vendor."* [Episode Stage1_N03]

In summary, the boundary-spanning activity connected users from one unit with those from another unit to complete an interdependent task in the procurement process. It was often performed in conjunction with those diagnosing activities which engaged multiple users from different business units. To perform this activity effectively, IS support personnel demonstrated their knowledge of data and process integration enforced by the technical system.

5. Discussion

The purpose of this paper has been to develop a comprehensive understanding of information system support work in organizations. In knowledge-intensive work such as SRM post-adoptive support work reported in this paper, understanding the demands for the support work and the

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knowledge required of support providers (the IS support personnel) is critical to effective IS support performance. Each service encounter between those end-users and IS professionals thus represented an episode of IS support service. Our analysis of 591 service interactions revealed three major types of IS support-related activities --- *informating*, *diagnosing*, and *boundary-spanning* --- which were associated with IS use behaviors and required an increasing scope of knowledge of IS support personnel. Figure 1 summarizes findings and provides a guide to our discussion of the patterns we observed among IS use component, IS support-related activity, and knowledge requirement.

<INSERT FIGURE 1 HERE>

5.1 Interplay between IS Use and IS Support-Related Activities

An *informating activity* was performed to respond to users' request for information and knowledge during the user-technology adaptation in IS use, during which individuals began to actively learn about and utilize installed technologies. Users may encounter problems which, if unresolved, prohibit their continued and extended use of the applications. Examples of the SRM use problems included failed shopping carts or unpaid vendor invoices. Each support request at any point in time reflected a knowledge barrier that the end-user encountered in their technology use, such as lacking knowledge about a designated approver or about the 3-way matching rule for paying an invoice. Knowledge barriers have been documented in the post-adoptive use of enterprise resource planning (ERP) technology, preventing end-users' effective use of the enterprise technology (Boudreau and Robey, 2005; Robey et al., 2002). To extend this line of research, our study provided a detailed account of users' learning via individual support request.

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Through information and step-by-step instructions, an informating activity enhances users' knowledge of the technology application and how it is applied to users' work context.

A *diagnosing activity* was performed when users' requests for assistance arose during users' actual employment of technical functions for work tasks, i.e., the user-technology-task adaptation. Under this circumstance, support personnel performed a diagnosis of a problematic system use incident and provided users with remedies. By tracing the causes of system use problems and developing resolutions for users, IS support personnel not only resolved users' problems with the technical system, but also enhanced users' knowledge about technology use via sharing problem diagnosis and resolution. The problem-specific knowledge is pragmatic and embedded in the context where knowledge is applied and transformed (Carlile, 2002).

In the post-adoptive use of organizational systems, such as SRM and ERP, user-technology-task adaptation may exert impact on data and processes across business units. Under this circumstance, a *boundary-spanning activity* might be needed to adequately address a system use problem and its organizational consequence. Such a boundary-activity connected user groups that accessed and relied on the same technical system for their work, such as in the scenario of PO processing. As demonstrated in the case of purchasing order processing tasks by Lisa and John, the support personnel was able to relate John's task and use of the procurement system to Lisa so that both of them were able to complete their tasks. This bridging role was made possible by the unique position of IS support personnel in serving the multiple users groups that accessed the same integrated technology. This bridging role is consistent with the conceptualization of a broker to "provide connections between communities of practice" (Wenger, 1998; p.109). Prior IS research has documented this bridging role of IS professionals in multi-party IS development (Levina and Vaast, 2005) and during IS post-implementation phase (Pawlowski and Robey,

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2004). Our study extended this line of research by revealing IS professionals' activities in connecting users across multiple units and sharing users' lessons learned (i.e., unsuccessful attempts in using the technology). As a result, the boundary-spanning activity not only serves the needs to coordinate individual user-technology-task instances across the boundary of business units but also enhances users' knowledge of business data and process integration.

As Figure 1 depicts, our case analysis did not suggest a simple one-to-one relationship between IS support-related activity and IS use component. Instead, we found that as IS use involves more complex adaptations, such as from user-technology adaptation to the adaptation of user-technology-task, IS support-related activity also became more challenging, requiring support personnel to perform diagnosing and boundary-spanning activity.

5.2 Interplay between IS Support-Related Activities and IS Workers' Knowledge

Our accounts of IS support activity may reflect simply a delivery of technical knowledge as a result of addressing users' requests. However, to facilitate end-users' technology use, IS support personnel adapted their activities to varying needs of users, applying their prior stock of knowledge about the technology and business domain to the detailed problematic circumstances emerging in the process of user-technology-task interactions. Performing those activities successfully required a wider scope of knowledge, ranging from knowledge of technical application and business domain (Lee et al., 1995), to knowledge of problem-specific details (Sabherwal and Becerra-Fernandez, 2005), and knowledge of business data and process integration (Davenport, 1998).

To facilitate users' initial interactions with technical system, IS support personnel transferred their knowledge of the technical application to end-users. Meanwhile, they acquired

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more knowledge about the business domain of users. The variety of knowledge flowing between IS support personnel and end-users can be categorized as conceptual ("know-what"), procedural ("know-how"), and abstract ("know-why") under the two domains of business and technology. The knowledge flows have been documented in a prior study of post-implementation knowledge transfer between users and IS professionals (Santhanam et al., 2007). Further, when responding to users' problems with the procurement system, IS support personnel needed to understand problem details (e.g., user role, order quantity, price, vendor code etc.) before they could successfully uncover problem causes and develop resolutions. This spanning activity required overlapped knowledge across the boundaries, and required the ability to trace the source for and to forecast the consequence of a correct (or incorrect) action on the entire technical system. Therefore, to perform the variety of support activity, IS workers need to develop comprehensive set of knowledge, including accumulated knowledge in both technical and business domain, and newly-developed capability crossing functional boundaries.

The completion of a SRM-enabled procurement task relied on the tight integration of data and process across business units within an organization and between the organization and external vendors, complicating the subsequent IS support activities. In this regard, the scope of knowledge requests may encompass multiple areas, including technology application, business domain, technology-business dependence, and business-business dependence. We referred to this set of knowledge as "knowledge portfolio" in the IS support environment. As the support-related activity shifted from informating to boundary-spanning, the change in support activities led to a wider scope of knowledge requirement.

6. Contributions and Implications

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Our study examined organizational support of an integrated technology, the supplier relationship management (SRM) system, and made two important contributions to IS research. Frist, our analysis reveals that IS support persons adapted their behaviors to the varying needs of end-users across multiple business units. This study develops an integrated framework of IS support-related activity, including the three increasingly challenging types of activities, the associated IS use behavior, and the portfolio of knowledge required in the support environment. This integrated framework thus extends research on IS support.

In addition, our study suggests the knowledge competency of IS professionals in the support context is multi-faceted, encompassing both business domain and technical applications, and their inter-dependence**.** This extends research on IS workers' knowledge and competency. To effectively meet changing requests for technology use support, IS support professionals were found to adapt their roles, from technical expert to boundary spanner. Prior studies have highlighted the multiple sets of knowledge and skills required from IS professionals, including technical and system integration competence (Nelson et al., 2000), problem-solving ability (Das, 2003), and communication and interpersonal skills (Gallagher et al., 2010). Our study extends this line of research by providing a detailed account of the activities when each type of knowledge would be desired, and by expanding the competence to include boundary-spanning capability.

Findings of this study offer useful implications for organizations and their managers in improving their information system use and support. By linking the IS support to IS use, this study suggests that strategic investment of IT does not end at the point of rolling out a new system. Rather, to achieve maximum and sustained benefits from IT investment, organizations should account the business value of IS support, and manage resources flowing in and out of IS support operations. Moreover, findings of the study highlight the importance of paying attention

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to competency development and professional development for IS professionals in the support environment which is characterized by changing user requests and increasingly complex technologies. Matching the types of user needs in technology use with the types of support activity required the IS workers not only to be equipped with the capacity of technical domain knowledge and business domain knowledge, but also having the ability to comprehend and respond to users' unexpected information needs and to cross business unit boundaries. .

7. Conclusion and Future Research

This study investigated IS support-related activities in one type of organizational information system, SRM system, in a U.S. enterprise. We drew on archival data and interview data in an in-depth case study that enhanced our understanding of IS support phenomenon, enabling us to develop an integrated framework encompassing the three types of activities, and their associations with IS use components and IS professionals' knowledge. Although the empirical findings of this case are not generalizable to other research sites or settings without further study, the analytic generalizations can help guide empirical research in other contexts (Lee and Baskerville, 2003). These analytically generic patterns can be applied to the post-adoptive use and support of other integrated information technologies such as CRM and ERP. Empirical studies of other technology and organizational setting may reveal additional support-related activities and refine our understanding of how IS support activities interrelate with IS use and their efficacy under different constraints.

Future research can be extended along two promising directions. First, our qualitative data extracted from the ticketing database mainly reflected the service records made by IS support personnel. Customers (end-users) may have different counts of the same service

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interactions and may perceive the service provision differently (Podsakoff et al., 2000). A further investigation of IS support personnel's customer-oriented activity should also adopt the assessment by customers. Second, as IS use behavior evolves over time, IS support-related activities are likely to evolve accordingly to adapt to the needs of end-users. To that end, a longitudinal study of IS support-related activity is likely to generate additional insights in managing and sustaining effective use and support of integrated information technologies.

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Table 1. Summary of Coding Categories		
Category	***Code***	***Definition***
IS Use Interaction	(1) User-Technology Adaptation	Individual users' learning of technical features
	(2)User-Technology-Task Adaptation	Individual users' appropriation of technical features to accomplish tasks
	(3)User-Technology-Business Adaptation	Changing or modifying an IT and how it will be deployed in an organization
Support Activities	(1)Informating	Activity focusing on providing users with information and knowledge about technology and business domain
	(2)Diagnosing	Activity solving system use problems, including the identification of problem causes and development of resolutions for solving the problem
	(3)Boundary-Spanning	Activity connecting user groups that accessed and relied on the same technical system for their work
Knowledge Required	(1)Technology application Knowledge	Knowledge about the technology application being utilized, including conceptual ("know-what"), procedural ("know-how"), and abstract ("know-why").
	(2)Business Domain Knowledge	Knowledge about the business domain being supported, including conceptual ("know-what"), procedural ("know-how"), and abstract ("know-why").
	(3)Context Knowledge	Knowledge about how a technical features is applied to a business task, i.e., problem-specific knowledge about a user-technology-task instance.
	(4)Integration Knowledge	Knowledge about the inter-dependence among business units.

Table 2: Frequency Distribution of Support-Related Activities by Procurement Stages			
Support Activity	***Freq. (%)***	***(1) Create Stage***	***(2) Approve/Confirm Stage (3)***
Informational	243 (41%)	167 (28%)	76 (13%)
Diagnosing	282 (48%)	125 (21%)	157 (27%)
Boundary-spanning	66 (11%)	25 (4%)	41 (7%)
Total	591 (100%)	317 (53%)	274 (47%)

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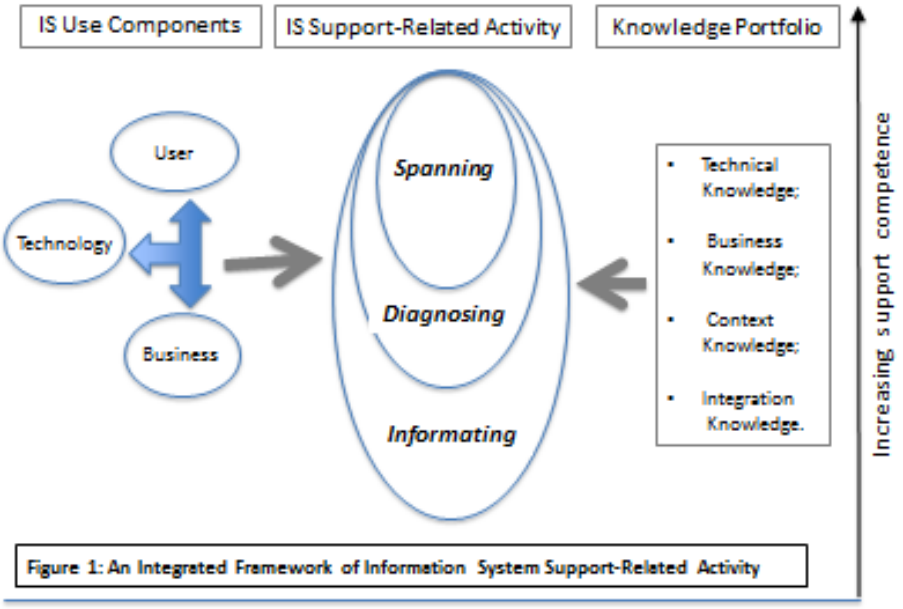

Figure 1: An Integrated Framework of Information System Support-Related Activity

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