Understanding Post-Implementation Support for Enterprise Systems: An Empirical Study of IT Personnel's Customer-Oriented Citizenship Behaviors

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ABSTRACT: Post-implementation support for information systems (ISs) remains an important but under-explored topic. In this study, we focus on the customer service aspect of post-implementation support for enterprise resource planning (ERP) systems and examine the antecedents and performance consequences of customer-oriented organizational citizenship behaviors (OCBs) performed by information technology (IT) personnel. We predict that characteristics of IT support tasks influence IT personnel's customer-oriented OCBs, which in turn exert both direct and moderating effects on their task efficiency. The analysis of 300 support tickets in relation to two ERP modules (Supplier Relationship Management and HR/Payroll Management) in a large enterprise provides mixed results. Task type was found to be associated significantly with the occurrence of OCBs, but the influence of task complexity was not significant. Moreover, OCBs were found to be negatively related to task efficiency, but the degree of the negative relation was contingent on task type and task complexity. The findings enhance our understanding of IT support services and extend the OCB literature on customer orientation. Practically, the results offer insights into managing IT support and IT workforce during the post-implementation stage of information systems.

Keywords: IT support; IT personnel; post-implementation; organizational citizenship behavior (OCB); customer orientation; enterprise resource planning (ERP).

I. INTRODUCTION

Organizations have increasingly implemented packaged systems, such as enterprise resource planning (ERP) systems, to streamline organizational business processes. Such organizational information systems (ISs) contain various software modules that integrate multiple business areas, such as accounting and finance, human resources, manufacturing, sales, and distribution (Davenport 1998; Robey, Ross, and Boudreau 2002). For employees to gain maximum benefits from installed information technologies (ITs) such as ERP systems, an organization must provide effective IT support to its employees during the post-implementation stage. However, post-implementation support for information systems remains an important but under-explored topic. The review of ERP literature by Grabski, Leech, and Schmidt (2011) concludes that studies of ERP post-implementation usage and support are limited and calls for more research on the ERP post-implementation stage, especially on individual learning and usage of ERP systems. In response to this call, this study examines the post-implementation support for ERP systems in an organizational setting.

Information technology support services engage in multi-faceted tasks, ranging from answering "*how-to*" questions and troubleshooting system usage problems to performing user training. To successfully complete such varied tasks, professionals in the IT support function (referred to as "IT personnel") have developed an in-depth understanding of users' information needs and users' problems with the installed technologies. IT personnel have thus become an important knowledge resource in assisting their business colleagues during the post-implementation stage of information systems. The following example illustrates the process through which an IT worker resolved a user's problem with vendor payment processing in a new supplier relationship management (SRM) system.

> User got the message that G/L [general ledger] account was not good. We [the support personnel and the user] checked G/L and it was good. Then we checked the vendor number, and it was a 4xxx number. We found a 2xxx number. That did it. I walked her through saving as complete. Her system lost the doc, so we did it a second time. Workflow didn't display properly. She didn't know her approvers. We located her approvers and fixed the workflow display. [It] was a one-hour phone call.

As shown in the example, the IT worker performed a sequence of activities and took the initiative to ensure that the business user fully understood the detailed procedure in locating and displaying payment requests in the SRM system. The observation shows that the IT worker provided the user with relevant knowledge and solutions, suggesting a customer orientation in the IT worker's task-related behavior. The customer service aspect of IT personnel has attracted increasing attention from IS scholars and practitioners. IS literature has implicitly examined IT personnel's customer-focused behavior in the IS development process, such as acquiring business domain knowledge to better serve users' information needs (Pawlowski and Robey 2004) and improving communication skills and developing a requisite knowledge set (Gallagher, Kaiser, Simon, Beath, and Goles 2010). Organizations have also started to adopt service agreements between their IT departments and other business units, establishing a service relation between providers and customers (Carr 2006). Although important, the customer service aspect of IT personnel has not been explicitly and empirically investigated in prior studies.

In this study, we view IT employees in the support function as customer service providers and focus on their service interactions with their customers, business users of IT in an organization. Our view is that, in assisting their business counterparts with their post-adoptive use of newly installed information technologies, IT personnel engage not only in role-prescribed behaviors toward their business counterparts, but also in behaviors that go beyond their job descriptions. In the

organizational studies literature, employees' extra-role, discretionary behaviors, such as helping a new colleague become familiar with everyday work routines, are called organizational citizenship behaviors (OCBs) (Organ, Podsakoff, and MacKenzie 2006). When the citizenship behaviors are directed at customers, they are referred to as "customer-focused OCBs" (Podsakoff and MacKenzie 1997). The concept of customer orientation in OCBs helps us understand the extra-role helping behaviors of employees in a service context, such as the post-implementation IT support. Therefore, we adopt the theoretical lens of organizational citizenship behavior to examine customer orientation in the context of IT support services. In particular, we address two basic but important questions: (1) Under which conditions are customer-oriented citizenship behaviors more likely to occur? and (2) What are the performance consequences of those customer-oriented citizenship behaviors? Understanding the antecedents and consequences of discretionary behaviors in the IT support context has the potential to generate new insights into the management of organizational IT resources.

We address these questions in the context of post-implementation support for ERP systems. This research context is ideal because the integrative nature and enterprise scope of ERP systems present tremendous knowledge challenges to organizations. We draw upon OCB theory and prior studies of IS post-adoptive support to develop our hypotheses. To test the hypotheses, we collected 300 support tickets from two ERP modules (HR/Payroll Management and Supplier Relationship Management) in the first 15 months after the implementation of an SAP R/3 system in a large U.S. organization. Our study contributes to the ERP literature by enhancing our understanding of ERP post-implementation support activities and extends the customer orientation in the OCB literature. To our knowledge, this study is the first to draw on the customer-oriented citizenship behavior theory to empirically examine the antecedents and effects of customer-oriented OCBs in organizational support for enterprise systems.

The remainder of the paper is organized as follows. In Section II, we review relevant literature to build our theoretical framework and develop our hypotheses. We describe our research context and research methodology in Section III, followed by data analysis and results in Section IV. Findings are discussed in Section V. We conclude the paper with implications and directions for future research in Section VI.

II. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

In this paper, we focus on IT personnel who assist ERP system users in the post-implementation stage and examine IT personnel's performance in resolving ERP usage problems. Drawing upon prior studies on IT support and on organizational citizenship behavior, we argue that customer-oriented OCBs are associated with two factors in the IT support context: task type and task complexity. In addition, we posit that OCBs have both direct and moderating effects on IT personnel's task performance, depending on the two task-related factors.

Customer-Oriented Organizational Citizenship Behavior

The topic of organizational citizenship behavior has been well studied by management and organization scholars in the past two decades. In particular, OCBs have been linked with measures of organizational effectiveness, as reflected in more than 650 articles published on the topic (N. Podsakoff, Whiting, P. Podsakoff, and Blume 2009). Organ (1988) defined OCBs as employees' behaviors that are discretionary and not explicitly recognized by organizations' reward systems. Examples of OCBs include helping a new co-worker with work-related problems and showing good sportsmanship in teamwork. Those behaviors are not part of the formal job description (Organ et al. 2006). Studies in this field suggest that when employees engage in the extra-role behaviors, i.e., those that go beyond the job responsibilities specified in their employment contracts, both

teams and organizations benefit from such behaviors (Nielsen, Hrivnak, and Shaw 2009; Podsakoff and MacKenzie 1997).

However, the distinction between OCBs and non-OCBs remains unclear. In their review, Podsakoff, MacKenzie, Paine, and Bachrach (2000) acknowledge the academic debate over the distinction between in-role and extra-role behaviors. According to the review, both employees and managers have difficulty recognizing the distinction between in-role behaviors (expected job responsibilities) and extra-role behaviors (discretionary, organizational citizenship behaviors). On one hand, employees may consider particular behaviors to be "expected" as part of their jobs, even though those behaviors are not formally rewarded by their employers. This belief may stem from employees' perceptions that they are expected to make their best effort to contribute to the effective functioning of the organization. On the other hand, managers may take all their effort (required or not) for granted when evaluating employees' performance.

The lack of consensus on the distinction between in-role versus extra-role behaviors becomes more problematic in the customer service sector. In a service-oriented workplace, the top priority of employees is to meet customers' needs, which leaves people wondering what behavior is considered *discretionary* towards customers. Prior studies have offered some insights into the characteristics of OCBs in the customer service context. For example, marketing researchers have examined customer orientation in service workers' performance and defined the concept as "an employee's tendency or predisposition to meet customer needs in an on-the-job context" (Brown, Mowen, Donavan, and Licata 2002, 111). Podsakoff and MacKenzie (1997), who propose the concept of customer-focused OCB, refer to it as employees' behaviors in serving customers' interests and needs beyond their job specifications. The two concepts share a common focus on customer service orientation. In this study, consistent with Podsakoff and MacKenzie (1997), we adopt the term "customer-oriented OCBs" and define it as IT employees' discretionary behaviors in serving user interests and meeting user needs that are not explicitly stated. The IT department in an organization provides support services to facilitate employees' use of IT, and thus becomes an appropriate context for our investigation of the customer-oriented OCB construct.

ERP Post-Implementation Support Task and Customer-Oriented OCB

ERP systems are characterized by extensive integration of business processes and data across multiple business functions within an enterprise (Davenport 1998; Gattiker and Goodhue 2005; Strong and Volkoff 2010). This integrated and organization-wide enterprise technology presents two big challenges in its post-implementation use and support. First, the business practices embedded in the packaged software impose changes on local work processes and routines and second, successful use of ERP functions requires increasing users' knowledge. That is, as ERP systems increase interdependencies among individual work tasks across business units (Kang and Santhanam 2003), performing those ERP-enabled work tasks requires users (employees) to understand how their roles and business processes have changed under the new system and to adapt to those changed roles and routines. In addition, an ERP system requires individual users to have broader IS and business knowledge (Santhanam, Seligman, and Kang 2007; Sein and Bostrom 1999). As the business processes and data are integrated and standardized in enterprise systems, users need to understand how their ERP-enabled work tasks are affected by the information flowing from the upstream business units and how their data processing affects downstream business groups and users. However, users of ERP systems continue to encounter knowledge barriers, which inhibit their ERP post-adoptive usage (Hsieh, Rai, and Xu 2011; Jasperson, Carter, and Zmud 2005; Robey et al. 2002).

IT personnel perform different types of tasks in assisting users with information technologies. In IT call centers, they respond to customer inquiries, provide customers with product and service information, and resolve customer complaints (Czegel 1998). These task types exist on a continuum

based on the degree of uncertainty and equivocality in information processing. An example of a task with low uncertainty/equivocality is responding to a request for information from documentation, while a highly uncertain or equivocal task may involve diagnosing a system use problem and developing new technical features.

Uncertainty and equivocality are considered two important dimensions in information processing in organizations (Daft and Lengel 1986). Uncertainty refers to the lack of clarity in information requirements, while equivocality implies multiple and conflicting interpretations of a situation (Daft and Lengel 1986). Organizations adopt different strategies with regard to information processing tasks as the degree of uncertainty or equivocality varies. When the information processing requirement is associated with low uncertainty, such as generating an invoice, organizations can rely on available information to execute a task. By contrast, when the information processing requirement is highly uncertain, such as in developing a new product, organizations search for more information and generate new knowledge. High equivocality in information requirements implies that actors in the user-technology-task context have different or even conflicting interpretations about how a technical feature should be used to enable a business task (Hahn and Wang 2009).

In the current study, we are unable to capture the continuum and have instead opted to focus on two tasks, one at each end of the continuum: informational tasks and diagnostic tasks. We refer to tasks that address users' information requests as informational tasks and to those that require diagnosing problems/causes and creating solutions as diagnostic tasks. Examples of information requests are "Where can I find a vendor code for creating a purchasing order?" or "How can I use the system to check the status of a purchasing order?" To perform these informational tasks, IT workers locate the sources of information (e.g., help files, knowledge database) and provide the information to users. When performing diagnostic tasks, i.e., helping users resolve their system usage problems, IT workers troubleshoot the problematic incidents, develop solutions, and communicate the results to users.

These two types of support tasks may be associated with different behaviors by IT personnel. When performing informational tasks, which are associated with low uncertainty and equivocality, IT workers are likely to process the information requirements as expected, e.g., locating and communicating information regarding a technical feature. However, when working on diagnostic tasks, IT workers deal with the information processing requirements under high uncertainty and equivocality. Under those circumstances, in addition to developing and delivering solutions, they may take extra steps to adapt the delivery of solutions to users' technology competency levels (e.g., framing problem solutions in the language that the user can easily relate to), to illustrate solutions by using examples specific to users' business contexts, or to elaborate on the consequences of the problematic incident on future work tasks enabled by the system. The extra effort extended by IT personnel, such as anticipating users' additional problems or providing personalized solutions, is associated with different levels of information processing requirements, which may influence the occurrence of customer-oriented OCBs to different extents. In other words, a customer-oriented OCB is more likely to occur with diagnostic tasks (high uncertainty and equivocality) than with informational tasks (low uncertainty and equivocality). Therefore, we hypothesize the following:

H1: Diagnostic tasks are more likely to be associated with customer-oriented OCBs than are informational tasks.

The second characteristic of ERP support tasks is task complexity, the extent to which a large number of components are related. This characteristic is similar to the component complexity proposed by Wood (1986). In the context of the ERP post-implementation stage, support tasks may be associated with various levels of complexity, as users' information needs vary from "know-what" and "know-how" knowledge about technical functions to "know-why" knowledge about the

interdependence among data elements (Santhanam et al. 2007). For instance, support tasks associated with the payment function of a purchase order (PO) are low in complexity because of the standardized process and clearly defined rules. A common rule in PO processing, called the three-way matching rule, specifies that the three elements of order, receipt, and invoice must be matched before a payment is disbursed to a vendor. With support tasks related to PO processing, IT personnel are likely to develop standard solutions or rely on FAQs to respond to users' requests, without expending additional effort. However, support tasks with regard to data-related issues in payroll processing and human resource management tend to be highly complex because of the complicated taxation laws and benefits eligibility rules. According to Wood (1986), complex tasks, with interrelated information cues, require significantly more processing effort than simple tasks. With regard to the complex circumstances in payroll processing, it will be difficult for IT personnel to develop standardized approaches across multiple user requests. As a result, IT workers may take on extra responsibilities that are not necessarily recognized and rewarded, such as taking the initiative to contact another business group on behalf of users. In the post-implementation support, such individual initiatives include acting as a bridge between users from different work units and sharing good practices associated with technology use (Pawlowski and Robey 2004; Santhanam et al. 2007). The above reasoning suggests that task complexity may influence the occurrence of customer-oriented OCBs in the provision of IT support service; customer-oriented OCBs are more likely to occur when a task becomes more complex. Formally, we state:

> **H2:** Tasks with a higher level of complexity are more likely to be associated with customer-oriented OCBs than are tasks with a lower level of complexity.

Customer-Oriented OCB and Task Performance

When investigating the effects of OCB on performance, much of the research on organizational citizenship behavior has focused on OCB's impact on group or organizational performance. For example, extra-role behaviors extended to new co-workers are likely to lead to improved performance of the work unit, while those extended to team members may enhance the morale of the team (Nielsen et al. 2009; Podsakoff and MacKenzie 1997). In a service organization, employees' extra-role behaviors are likely to increase the effectiveness of their customer service. In their literature review, Podsakoff et al. (2000) summarize the findings with regard to the relation between OCBs and customer satisfaction and show that OCBs account for 38 percent of the variance in customer service indicators, such as customer satisfaction. Schneider, Ehrhart, Mayer, Saltz, and Niles-Jolly (2005), who study employee behaviors directed to customers in 56 supermarkets, conclude that a customer-oriented citizenship behavior did more than lead to customer satisfaction; it also resulted in department sales in those supermarkets.

Yet how customer-oriented OCBs affect the efficiency of those service employees remains understudied. Understanding this relation is critical in managing customer support services such as IT support, as a service employee's performance is often evaluated by quantitative measures rather than customer satisfaction. According to *CallCentreHelper* (2012), a popular call center magazine in the United Kingdom, call center employees are evaluated by a number of generic measures, including overall volume of calls handled, percentage of calls abandoned, and average call duration time. In these circumstances, customer-oriented OCBs are likely to be negatively associated with an employee's task performance because they are likely to increase the time spent on each service interaction. For instance, Rafaeli, Ziklik, and Doucet (2008) observe that in the call centers of financial institutions, calls longer than three minutes are more likely than shorter ones to include OCBs. Similarly, in the context of organizational IT support, an IT worker who performs OCBs towards his/her customers, as reflected in the example in the Introduction, may end up spending

more time closing the ticket. When a performance measure focuses on the efficiency aspect of the support service, e.g., call volume or response time, customer-oriented OCBs are likely to be negatively associated with an individual's task performance. Therefore, we expect to see an inverse relation between customer-oriented OCBs and task efficiency. This negative relation has not been empirically tested in prior studies on customer-oriented OCBs (Podsakoff and MacKenzie 1997; Rafaeli et al. 2008). Therefore, in this study, we consider it our baseline hypothesis:

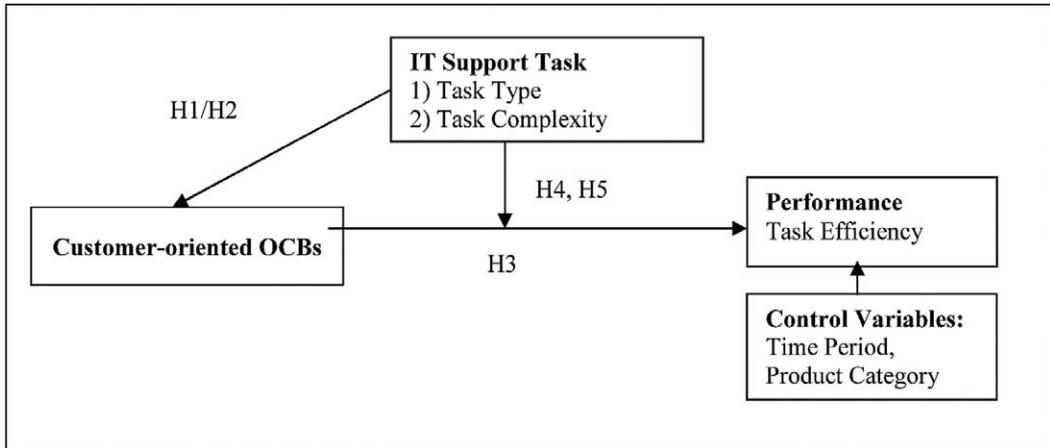**H3:** Customer-oriented OCBs are negatively related to task efficiency.

However, the above argument does not take into account the characteristics of support tasks in the ERP post-implementation stage. The first characteristic is task type, which is associated with different degrees of uncertainty and equivocality of information processing. The support work for information systems has been conceptualized as problem-solving tasks (Das 2003; Gray and Durcikova 2005). Depending on the information processing requirements of a task, IT employees have been found to adopt different moves (activities), ranging from locating information to identifying the root cause of a problem, which affect individual productivity to different degrees (Das 2003). In informational tasks when information needs are certain and clear, an extra-role behavior is likely to entail locating activities, such as introducing a new technical feature or providing an additional information source. In these situations, an OCB may take minimal additional time and effort.

In contrast, diagnostic tasks are associated with highly uncertain and equivocal information needs, which may involve different or conflicting interpretations about the causes of system use problems or about solutions to the problems. Performing such diagnostic tasks thus entails complicated moves, such as diagnosing the problem causes and searching for additional information, which often take a longer resolution time (Das 2003). To perform extra-role behaviors in instances of diagnostic tasks may require an IT worker to search for and share diverse knowledge (e.g., both technical features and business processes) to help resolve conflicting viewpoints. As a result, a customer-oriented behavior likely causes the IT worker more time and effort. Based on the reasoning above, an extra-role behavior in relation to diagnostics tasks is likely to cost IT personnel more time and effort in discussing problem scenarios and resolutions, compared to an OCB in relation to informational tasks. In other words, a customer-oriented OCB will reduce task efficiency to a larger extent when the task type is diagnostic than when it is informational. Therefore, we predict:

H4: The negative relation between customer-oriented OCBs and task efficiency is stronger when the task type is diagnostic than when it is informational.

The second characteristic of ERP support tasks is task complexity. The degree of complexity (i.e., interdependence) is also likely to affect the relation between customer-oriented citizenship behaviors and task efficiency. Simple tasks require only information acquisition or some simple calculations (Wood 1986). In the ERP support context, completing a simple task only requires an IT worker's knowledge and skills with regard to one business domain or one technical feature. On the other hand, because of the integrative structure and centralized database of the ERP system, a complex task may involve disentangling data and process issues across business units or fixing the workflows between technical functionalities (Davenport 1998; Gattiker and Goodhue 2005). In this regard, customer-oriented OCBs associated with complex tasks may entail additional activities in educating users on data and process integration or in bridging users from different user groups. Given the interrelated issues associated with complex tasks, the IT person may expend more effort on OCBs during complex tasks compared to simple tasks dealing with a single technical feature or business data. Hence, the complexity of the task may enhance the negative association between OCBs and task efficiency. Based on this reasoning, we expect the following:

FIGURE 1
Research Framework

H5: The negative relation between customer-oriented OCBs and task efficiency is stronger as task complexity increases.

Last, we explore whether the above-mentioned associations change over time. In the post-implementation stage, users' information needs are likely to change as a result of users' accumulated experience with the technologies. In an organization, individuals' system usage behavior is dynamic as individuals have different adaptation patterns in their actual employment of technical features to perform work tasks over time. For example, during the early post-implementation phases of enterprise technologies, employees engage in their initial learning both of new technologies and new work practices. Later, they engage more in the exploration of system features and accomplish different kinds of tasks (Saga and Zmud 1994). When the needs of customers (users) vary over time, the customer-oriented behaviors of IT personnel may change in response to the changes in customer needs. In this regard, examining the customer-oriented OCBs over time is likely to generate additional insights regarding the operation and management of IT support services. Since prior literature is not clear about the evolutionary patterns of customer-oriented OCBs, we do not develop formal hypotheses but investigate such longitudinal effects in an exploratory manner.

In summary, we argue that the customer-oriented citizenship behaviors of IT personnel are likely to be influenced by the type of a support task (H1) and the complexity of a support task (H2). As extending extra-role behaviors requires additional effort, we expect that customer-oriented OCBs will have a negative impact on task efficiency (H3). This inverse relation is hypothesized to be contingent upon task type (H4) and task complexity (H5). The research framework is presented in Figure 1.

III. RESEARCH METHODOLOGY

Research Context and Data Collection

The research site was a large healthcare and education organization located in the northeastern region of the United States. From January 2007 to April 2007, the organization successfully

implemented an enterprise resource planning (ERP) system, SAP/R3, across its four different institutions: two hospitals and two educational institutions. The SAP/R3 system was implemented with four modules: Human Resource/Payroll (HR/Payroll) Management, Supplier Relationship Management (SRM), Financial Management, and Special Project Management. In the first three months after the implementation, the organization offered user-training sessions, which focused on an overview of the new system and on how to obtain system access roles. A SAP support center was also set up to provide centralized support to the 11,000 business users across different organizational sites.

This study examined the support services provided by IT personnel, who were the main sources of support for the new SAP/R3 system. These IT personnel were referred to as "business solution analysts," and were expected not only to provide technical knowledge to users, but also to facilitate users' learning of business processes embedded in the SAP/R3 system. When a user (e.g., a purchasing agent) encountered a problem with the system (e.g., the SRM module), he/she would call the support center and describe the problematic incident, including the steps he/she performed on the system and the subsequent system error message. This problem description often provided IT personnel with information on the business context where a system feature was applied. After the problem was diagnosed, IT personnel would communicate directly with the user and guide the user on how to resolve the problem. Hence, the ticket resolution process reflected the process of knowledge transfer and learning between IT personnel and business users with regard to new system features and business processes.

This study focused on the IT support in the context of the HR/Payroll module and the SRM module. We considered only these two modules because of their distinct characteristics of information processing needs. The HR/Payroll module manages employee personnel and benefits information, and facilitates the processing of employees' payrolls. The SRM module integrates the procurement process between the focal organization and its suppliers such that a purchase order created in the system is automatically routed to authorized vendors preconfigured in the module. The two modules differ in the extent to which the stakeholders beyond the organization's boundary are involved. While the HR/Payroll module is internally focused, the SRM module involves external vendors and the delivery of physical goods. Thus, the problems that users encounter with the two different modules may vary and may require different levels of services from IT personnel. Such differences provide an appropriate context for us to examine the customer-oriented citizenship behaviors of IT personnel.

We randomly sampled 300 tickets from the HR/Payroll and SRM modules' ticket-tracking database for three time periods: April 2007, October 2007, and April 2008. Sampling from these three time periods allowed us to understand the ERP support services in the first 15 months after the implementation and investigate whether IT personnel's service behaviors changed across the three time periods. Our sample contained data related to the activities in solving user-reported problems with the SAP/R3 system. We also conducted a total of five interviews with the on-site manager and two IT support specialists in December 2007 and April 2008 for additional insights regarding the types of problems encountered by business users, the support staff's resolution strategies, and the challenges arising in the post-implementation support. Each interview lasted 45 to 75 minutes. Insights from the interviews were used to supplement our data analyses and were incorporated in the discussion.

Data Coding and Variables

Each support ticket in our sample is associated with one of the two modules: HR/Payroll and SRM (denoted as *PRODUCT*, equals 1 for the SRM module and 0 for the HR/Payroll module) and with one period: April 2007 (Period 1), October 2007 (Period 2), or April 2008 (Period 3). We then

manually coded the qualitative data of problem description and the solution in each ticket record. From prior studies and our discussion in Section II, we first developed a preliminary coding scheme for IT support requests, such as "information retrieval," "plan synthesis," "state abstraction," and "abductive diagnosis" used by Das (2003), and for problem domains in the ERP system context, such as "functionality problems," "data-related problems," "workflow-related problems," and "role/access problems" by Strong and Volkoff (2010). Using the preliminary scheme, we independently performed a trial coding on 40 ticket records (20 from HR/Payroll and 20 from SRM) and discussed the coding results. We found that users frequently requested IT personnel to locate information (e.g., files, FAQ), to acquire knowledge (both conceptual and procedural), and to troubleshoot a problematic incident with the new system. These tasks were similar to those in Das (2003), with the exception of "state abstraction," which refers to predicting the consequence of a contemplated action. Since users' requests for "know-what" knowledge (i.e., information retrieval) were often combined with their requests for "know-how" knowledge (i.e., plan synthesis), we considered these tasks as informational tasks. In contrast, IT personnel's activities in troubleshooting were considered as diagnostic tasks. We also found that IT workers' activities were related to four problem domains: functionality, workflow, role/access, and data. These domains were associated with different levels of complexity. After discussions with the site manager and field specialists, we derived a measure of complexity for problem domains from 1 (least complex) to 4 (most complex). The order of problems types, from the least to the most complex, is as follows: functionality-, workflow-, role/access-, and data-related.

Based on the trial coding results and our discussion, we refined the preliminary coding scheme, and independently coded the remaining 260 records. The refined coding scheme categorized the support tasks into four levels of problem complexity ranging from 1 (least complex) to 4 (most complex) and two types of tasks (diagnostic versus informational), and indicated the occurrence of an OCB. The definitions of the variables are summarized in Appendix A. When a coding discrepancy existed, we discussed the results and resolved the discrepancy. The inter-coder reliability was acceptable (Cohen's κ ranged from 0.835 to 0.938) (Lombard, Snyder-Duch, and Bracken 2002; Ryan and Bernard 2000). Appendix B provides a summary of the coding scheme and coding examples. Twenty-five ticket records did not contain sufficient information for us to perform the coding. After excluding the 25 tickets, we obtained a data sample that consisted of 275 observations (support tickets). The coding of the variables is elaborated below.

Task Type

The variable *TASK_TYPE* represents the two task types, informational (*TASK_TYPE* = 0) and diagnostic (*TASK_TYPE* = 1). The former refers to retrieving information or providing procedural instructions while the latter entails diagnosing problems and developing solutions. An example of diagnostic tasks is illustrated in the ticket record, "The posting errors were due to incorrect master data. [I found] the business unit was not set up for tax authorities in WV [West Virginia] or PA [Pennsylvania]. Master data [have been] corrected. Subsequent FI [Finance] posting errors were due to accruals attempting to post to unopened FI period. FI team [has been] notified." As shown in this ticket record, the IT staff investigated the reported system usage problem in detail to uncover the underlying causes and performed a diagnostic task. By contrast, responding to the request "How can I pay the invoices without making individual check requests" is an example of informational tasks.

Task Complexity

Task complexity in the IT support context refers to the extent to which a large number of components are related, similar to the component complexity proposed by Wood (1986). As

mentioned earlier, we considered four problem domains: functionality, workflow, role, and data. IT workers' tasks in resolving data-related problems are the most complex, while the tasks related to technical features are the least complex.

Customer-Oriented OCB

Customer-oriented OCB (denoted as *OCB*) is defined as the extra-role behavior performed by an IT worker in assisting business users with their utilization of the ERP system. For example, an IT worker recorded, "[I] told xxxxxx what to do to update the document, and how to send it into Workflow. I also advised her on what to do if document does not allow changes." The ticket record shows that the IT worker provided additional information in anticipating the user's future action(s) or request(s). In this case, the support task was associated with an occurrence of OCB. In contrast, responding to users' explicit requests was not considered as OCB, given that the primary responsibility of the IS support function was to assist users with their system usage. Our identification of OCB instances followed the guideline in Podsakoff et al. (2000): OCB is (1) not an explicit part of job description, (2) not something the IS workers were trained by the organization to do, and (3) not a behavior that was formally and explicitly rewarded when exhibited, or punished when not. In our analysis, *OCB* is a dummy variable that equals 1 if an extra-role behavior is present, and 0 if no OCB exists.[1]

Task Efficiency

TASK_EFFICIENCY is operationalized as a support worker's ticket resolution time, consistent with Das (2003). The ticketing database did not include direct efficiency measures for each ticket. It was difficult, if not impossible, for the IT support center to accurately record the time that their staff spent on solving each ticket at a fine-grained level. However, the database did include the date and time at which each ticket was opened and closed. In the context of IT support services, an individual may be assigned to multiple support tasks (tickets) in the same time period. Therefore, we adopted the effort computation algorithm developed and validated by Graves and Mockus (1998) to measure *TASK_EFFICIENCY*. To compute the individual effort per task, we assumed that each individual at the support center devoted one unit of effort per day on resolving the support tasks. Consistent with the initial estimation of effort adopted in Boh, Slaughter, and Espinosa (2007) and Narayanan, Balasubramanian, and Swaminathan (2009), we calculated the estimated effort required for a specific task, as detailed in Appendix C. This algorithm took into account the possibility that (1) an individual may be responsible for multiple tickets in the same time period, and (2) the total number of tickets assigned varies daily. For our analyses, we added a negative sign to this measure so a high effort estimate (more resolution time) refers to a low level of task efficiency, and *vice versa*.

Econometric Models

In this study, each unit of the support task (represented by a unique ticket) was assigned and completed by an IT worker, as our data of archival records and the interviews suggested. Hence, we considered it appropriate to analyze customer-oriented OCBs at the individual task level.

We use two equations to test our hypotheses. Equation (1) investigates the association between task characteristics (task types and task complexity) and the occurrence of customer-oriented OCBs,

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[1] A recent study of IS support-related activities has identified five different types of customer-oriented OCBs in the context of technical support of an ERP system (Deng and Wang 2013). However, due to lack of data on all five types of OCBs, the empirical study reported here does not focus on different types of OCBs.

as predicted in H1 and H2. Equation (1) is estimated by using a logistic regression model with Huber-White standard errors. Equation (2) examines the performance consequence of customer-oriented OCBs as well as the potential contingent effects of OCBs. Equation (2) is estimated using an ordinary least squares (OLS) model with Huber-White standard errors. Both equations are estimated by using the pooled data from all three periods. We also explore the possible time effect by using the data from each time period:

$$OCB = \alpha_0 + \alpha_1 PRODUCT + \alpha_2 TASK\_TYPE + \alpha_3 TASK\_COMPLEXITY + \alpha_4 PERIOD1 \\ + \alpha_5 PERIOD2 + \varepsilon. \tag{1}$$

$$TASK\_EFFICIENCY = \beta_0 + \beta_1 PRODUCT + \beta_2 TASK\_TYPE + \beta_3 TASK\_COMPLEXITY \\ + \beta_4 OCB + \beta_5 Interaction + \beta_6 PERIOD1 + \beta_7 PERIOD2 + \zeta. \tag{2}$$

The variables in Equation (1) and Equation (2) are defined in the "Data Coding and Variables" section. In Equation (2) the variable *Interaction* represents the interaction terms between *OCB* and *TASK_TYPE,* and *OCB* and *TASK_COMPLEXITY*. Based on H1 and 2, we expect to see $\alpha_2 > 0$ and $\alpha_3 > 0$. In addition, we expect to see $\beta_4 < 0$ (H3). A negative coefficient is expected on the interaction term *OCB* and *TASK_TYPE* (H4), and on the interaction term *OCB* and *TASK_COMPLEXITY* (H5).

IV. RESULTS

Descriptive Statistics

The descriptive statistics and the frequency distributions of the variables are presented in Table 1 based on the number of observations that were used in our analyses. Table 1, Panel A presents means, standard deviations, and correlations among the variables. The average resolution time (*TASK_EFFICIENCY*) is 0.407 units of effort, with a standard deviation of 0.780. Note that, in our analyses, we added a negative sign to this measure for easier interpretation of the results. On average, about 32 percent of the tickets involve extra-role behaviors of IT personnel. About 50 percent of the tickets are related to diagnostic tasks (*TASK_TYPE*), and the average complexity of the tickets is 2.655 (out of 4). Significant correlations exist between the variables. Task type significantly relates to customer-oriented OCBs (r = 0.34, p < 0.05), and customer-oriented OCBs are significantly related to task efficiency (r = −0.171, p < 0.05).

Table 1, Panel B shows the frequency distributions by task type and task complexity. For informational tasks, 80.57 percent (19.42 percent + 61.15 percent) of the tickets are workflow and role-related problems, but for diagnostic tasks, the observations spread more evenly across three of the four levels of complexity. Panel C compares the HR/Payroll tickets and the SRM tickets by complexity levels and task types. Overall, the tickets associated with the HR/Payroll module have a slightly higher percentage of diagnostic tasks than informational tasks, while the support tasks of the SRM module are more informational in nature. For SRM tickets, 81.62 percent (30.88 percent + 50.74 percent) of the tickets are about workflow or role-related problems. By contrast, the complexity of HR/Payroll tickets is more evenly spread across three of the four levels. Last, as shown in Panel D, the percentage of complex tasks for data-related problems decreases across the three time periods, 47.83 percent versus 30.43 percent and 21.74 percent.

Results of the Econometric Models

The results for Equation (1) are presented in Table 2. As shown in Table 2, task type is positively and significantly associated with the occurrence of OCBs. An OCB is more likely to

TABLE 1

Descriptive Statistics and Frequency Distribution

Panel A: Descriptive Statistics (n = 275) and Spearman Correlation

Variable	Mean	Std. Dev.	*TASK_ EFFICIENCY*	*OCB*	*TASK_ TYPE*	*TASK_ COMPLEXITY*
Continuous Variable						
TASK_EFFICIENCY	−0.407	0.780				
Dummy Variable/Categorical Variable						
OCB	0.320	0.467	−0.171*			
TASK_TYPE	0.495	0.501	−0.289*	0.340*		
TASK_COMPLEXITY	2.655	0.888	−0.074	0.038	−0.028	
PRODUCT	1.495	0.501	0.358*	−0.010	0.092	−0.037

Panel B: Frequency Distribution of Task Complexity and Task Types

Task Complexity	Freq.	(%)	Diagnostic		Informational	
TASK_COMPLEXITY = 1 (function)	31	(11.27%)	15	(11.03%)	16	(11.51%)
TASK_COMPLEXITY = 2 (workflow)	79	(28.73%)	52	(38.24%)	27	(19.42%)
TASK_COMPLEXITY = 3 (role)	119	(43.27%)	34	(25.00%)	85	(61.15%)
TASK_COMPLEXITY = 4 (data)	46	(16.73%)	35	(25.74%)	11	(7.91%)
Total	275	(100.00%)	136	(100.00%)	139	(100.00%)

Panel C: Frequency Distribution of Task Complexity and Task Type by System Modules

		HR/Payroll		SRM	
Task Complexity	TASK_COMPLEXITY = 1 (function)	20	(14.39%)	11	(8.09%)
	TASK_COMPLEXITY = 2 (workflow)	37	(26.62%)	42	(30.88%)
	TASK_COMPLEXITY = 3 (role)	50	(35.97%)	69	(50.74%)
	TASK_COMPLEXITY = 4 (data)	32	(23.02%)	14	(10.29%)
Task Type	TASK_TYPE = 1 (diagnostic)	75	(55.15%)	64	(46.04%)
	TASK_TYPE = 0 (informational)	61	(44.85%)	75	(53.96%)

Panel D: Frequency Distribution of Task Complexity and Task Type by Time Periods

		Period 1		Period 2		Period 3	
Task Complexity	TASK_COMPLEXITY = 1 (function)	0	(0.00%)	12	(38.71%)	19	(61.29%)
	TASK_COMPLEXITY = 2 (workflow)	20	(25.32%)	23	(29.11%)	36	(45.57%)
	TASK_COMPLEXITY = 3 (role)	49	(41.18%)	39	(32.77%)	31	(26.05%)
	TASK_COMPLEXITY = 4 (data)	22	(47.83%)	14	(30.43%)	10	(21.74%)
Task Type	TASK_TYPE = 1 (diagnostic)	47	(34.56%)	44	(32.35%)	45	(33.09%)
	TASK_TYPE = 0 (informational)	44	(31.65%)	44	(31.65%)	51	(36.69%)

occur when a support task is diagnostic than when it is informational, which supports H1. However, H2, which states a positive relation between task complexity and OCB, was not supported. This was somewhat surprising given the level of interdependency inherited in the post-adoptive use of enterprise technologies (Robey et al. 2002). We will discuss this finding in detail in Section V.

TABLE 2

Task Characteristics and Customer-Oriented OCB
Dependent Variable: Customer-Oriented *OCB*

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Intercept	−0.496	−0.286	−0.333	−0.633	−0.493
	(−1.06)	(−0.54)	(−0.67)	(−1.06)	(0.79)
PRODUCT	0.127	0.983	0.097	0.482	0.312
	(0.46)	(0.36)	(0.28)	(0.55)	(0.34)
TASK_TYPE	1.543***	2.388**	1.882***	1.525***	1.872***
	(5.39)	(2.26)	(4.19)	(5.34)	(4.17)
TASK_COMPLEXITY	0.104	0.258	0.086	0.157	0.150
	(0.65)	(0.14)	(0.54)	(0.74)	(0.68)
TASK_TYPE ∗ *TASK_COMPLEXITY*		−0.311			
		(−0.84)			
TASK_TYPE ∗ *PRODUCT*			−0.624		−0.641
			(−1.04)		(−1.07)
TASK_COMPLEXITY ∗ *PRODUCT*				−0.135	−0.158
				(−0.43)	(0.49)
PERIOD1	0.162	0.172	0.132	0.154	0.122
	(0.46)	(0.49)	(0.37)	(0.44)	(−0.34)
PERIOD2	0.060	0.077	0.045	0.023	−0.000
	(0.17)	(0.22)	(0.13)	(0.06)	(0.00)
n	275	275	275	275	275
Log pseudo likelihood	−155.95	−155.59	−155.39	−155.87	−155.28
Pseudo R^2	0.10	0.10	0.10	0.10	0.10

*, **, *** Significant at 10 percent, 5 percent, and 1 percent, respectively.
z-statistics are in parentheses with Huber-White standard errors.

The results for Equation (2) are presented in Table 3. H3, our baseline hypothesis that predicts the negative association between OCB and task efficiency, received full support. As shown in Table 3, Panel A, *OCB* is significantly and negatively associated with task efficiency in Model (3) (−0.245, $p < 0.05$), suggesting that IT personnel took a longer time to complete a support task when extending extra-role behaviors. Similarly, H5, which states that task complexity moderates the relation between OCB and task efficiency, also received full support. As shown in Model (4), the coefficient of the interaction term (*OCB* ∗ *TASK_COMPLEXITY*) is significantly negative (−0.323, $p < 0.05$), which suggests that the negative association between OCB and task efficiency was heightened as task complexity increased. Finally, H4 only received weak support. The coefficient of the interaction term (*OCB* ∗ *TASK_TYPE*) is negative (−0.342) but only significant at 10 percent level. Potential explanations for this weak result are offered in Section V.

As Table 3 shows, task type, task complexity, and product category are all significantly related to task efficiency, supporting our decision to control for these factors when predicting the performance consequence of OCBs. First, task types and task complexity show significantly negative associations with task efficiency in Model (2), suggesting that diagnostic tasks and complex tasks negatively influenced the resolution time of IT support tasks. Second, product category is significantly and positively related to task efficiency, suggesting that SRM-module-related tickets (*PRODUCT* = 1) were resolved more efficiently (requiring less effort) than HR/Payroll-module tickets. Given the significant influence of these factors, we also explored whether

TABLE 3

The Effect of Customer-Oriented OCB on Task Performance
Dependent Variable: *TASK_EFFICIENCY*

	Model (1)	Model (2)	Model (3)	Model (4)
Intercept	−0.987***	−0.709***	−0.505***	−0.664***
	(−7.24)	(−4.38)	(−4.27)	(−5.70)
PRODUCT	0.515***	0.485***	0.460***	0.425***
	(5.96)	(5.70)	(5.79)	(5.80)
TASK_TYPE		−0.225**	−0.127*	−0.046
		(−2.59)	(−1.76)	(−0.60)
TASK_COMPLEXITY		−0.144**	−0.162***	−0.063
		(2.38)	(3.00)	(1.55)
OCB			−0.245**	−0.503*
			(−2.56)	(−1.85)
*OCB * TASK_TYPE*				−0.342*
				(−1.87)
*OCB * TASK_COMPLEXITY*				−0.323**
				(−2.40)
PERIOD1	−0.183**	−0.090	−0.024	−0.010
	(−2.29)	(−0.91)	(−0.31)	(−0.12)
PERIOD2	−0.430***	−0.436***	−0.432***	−0.437***
	(−4.01)	(−4.30)	(−4.25)	(−4.35)
n	300	280	275	275
Adj. R2	0.14	0.18	0.22	0.25

*, **, *** Significant at 10 percent, 5 percent, and 1 percent, respectively.
t-statistics are in parentheses and are estimated with Huber-White standard errors.

there existed interaction effects between *TASK_TYPE* and *PRODUCT* as well as *TASK_COMPLEXITY* and *PRODUCT* on *TASK_EFFICIENCY*. The untabulated results show positive interactions of *TASK_TYPE* and *PRODUCT* as well as *TASK_COMPLEXITY* and *PRODUCT*, suggesting that IT personnel spent less time on resolving SRM-module tickets when the task type is diagnostic or when the task complexity is high.

Last, there seem to be some time effects. We explored the time effect by performing the analysis based on the data from three time periods. The untabulated findings are largely consistent with those in Table 3 (the pooled data) except for period 3. Specifically, most of the coefficients in period 3 are insignificant with very low adjusted R^2. One possible explanation for the insignificant results in period 3 might be the learning-from-experience effect of IT personnel (Kim, Krishnan, and Argote 2012); they learned from their support work experience and thus could extend citizenship behaviors to their customers effortlessly. However, the main results of the three periods seem to be mixed, so the results regarding the time effect need to be interpreted with caution.

V. DISCUSSION

Our findings show that the type of support task is a significant antecedent of customer-oriented OCBs. Compared to informational tasks, diagnostic tasks are more likely to be associated with OCBs. About 50 percent of the 275 support tickets used in our analyses are diagnostic-related tasks (Table 1, Panel B). When delivering solutions to their business colleagues' system usage problems,

IT personnel did not simply offer guidelines or step-by-step instructions; rather, they often demonstrated customer-oriented citizenship behaviors by articulating the causes of the problems or explaining the consequences of the solutions.

Given the variety of system usage problems, the IT workers in our study transferred to users their knowledge about the technical system (SAP/R3), about the new business processes, and about the details of individual problem incidents, even when such knowledge was not specifically requested by the users. By hypothesizing and testing the association between task types and customer-oriented OCBs, this study enhances our understanding of the context-specific drivers (work-related factors) for service providers' extra-role behaviors, extending prior studies on the motivational factors for OCBs (Wegge, van Dick, Fisher, Wecking, and Moltzen 2006).

Our analysis also provides empirical evidence that customer-oriented OCBs are associated with lower task efficiency, supporting our baseline hypothesis (H3). Efficiency (i.e., adjusted ticket resolution time) is an important measure in evaluating IT support performance, as timely resolutions of customers' problems enable the customers to perform their business tasks, such as submitting a purchase order or processing payrolls, enhancing organizational performance in the long run (Rice and Cooper 2010). The efficiency measure is commonly used by IT call centers when their focus of the support service is on the technical product itself, such as adding a missing functionality or debugging a coding error (Czegel 1998; Das 2003). Our field interviews with the site manager and specialists implicitly revealed that their customers (business users) were more satisfied when they experienced customer-oriented extra-role behaviors by IT personnel. However, it is beyond the scope of this study to empirically test the relation between OCBs and the effectiveness of support services (i.e., customer service quality or customer satisfaction).

Moreover, our data analysis reveals that the negative impact of OCB on task efficiency is related to task complexity, supporting H5. The significant and negative coefficient of the interaction term ($OCB * TASK\_COMPLEXITY$) in Table 3 suggests that the occurrence of OCBs reduces task efficiency to a greater extent when task complexity increases. Prior ERP post-implementation studies have shown the benefits of interdependence on plant-level outcomes (Gattiker and Goodhue 2005). However, our study presents the challenges that arise in assisting individual users to understand the effect of interdependence on their routine usage of the technical system.

Our data analysis provides no support for the predicted association between task complexity and OCB (H2), and weak support for the moderating effect of task type on the relation between OCB and task efficiency (H4). The lack of support for H2 may be due to the rough measure of task complexity in this study: we relied on insights from the informants at the research site and viewed the four types of system usage problems (functionality, role, workflow, data) as increasingly complex. An additional ANOVA analysis of complexity levels and OCB occurrences did not reveal significant differences in OCB occurrence among the four levels of complexity (Mean OCB values are 0.226, 0.380, 0.269, and 0.413 for the complexity levels 1–4, respectively). A fine-grained measure of task complexity in the IT support context may provide different results. Regarding H4, the negative coefficient of the interaction term ($OCB * TASK\_TYPE$) is significant but only at the 0.1 level. Distinguishing uncertainty from equivocality, the two dimensions of information processing in IT support tasks, may help generate more robust and interesting results.

Practically, our study offers useful implications for organizations and their post-implementation IT support. Organizational information technologies are integrated into a larger work system consisting of employees, procedures, tasks, and technical functions (Jasperson et al. 2005). In this regard, effective IT support is critical to meeting organizational needs for information technologies and realizing the business value of IT investment (Barki, Titah, and Boffo 2007; Hsieh et al. 2011). Our investigation of the service interactions between business users and IT personnel suggests that customer service behaviors should be incorporated into the evaluation of IT personnel's performance. Prior studies have suggested the customer service perspective in studying the

post-implementation support of IT (Carr 2006; Gallagher et al. 2010) and provided evidence that the information needs of business users have increasingly gone beyond technical functionalities (Santhanam et al. 2007; Sein and Bostrom 1999). To extend this line of research, our study highlights the importance of the IT employees' customer orientation in promoting the organizational use of IT.

Our study further suggests that organizations should incorporate their post-implementation IT support as part of their overall IT training strategy to enhance their employees' understanding of important business context factors, including business processes, task interdependence, and work flow across business functions. The integrated structure and enterprise scope of the technology (Davenport 1998; Gattiker and Goodhue 2005) complicate the operation of ERP support, demanding new roles of IT personnel, such as playing the bridging roles across user groups (Pawlowski and Robey 2004), and increasing the need for knowledge transfer by IT personnel (Santhanam et al. 2007). In this regard, our empirical investigation of customer-oriented OCBs suggests that an organization could rely on its IT personnel's customer-oriented behaviors to integrate the IT support service with the user training such that user training programs are customized and adapted to meet users' changing needs (Gwinner, Bitner, Brown, and Kumar 2005). To some extent, customer-oriented OCBs make it possible for ERP post-implementation support to become an integral part of the ongoing ERP training process (Kang and Santhanam 2003; Sein and Bostrom 1999), which incorporates individual users' information needs and task characteristics (Grabski et al. 2011).

VI. CONCLUSIONS

In knowledge-intensive customer service work such as the ERP post-implementation support reported in this study, IT personnel, through their customer-oriented discretionary behaviors, can facilitate their business colleagues' learning of IT systems. Our research objective was to understand the conditions under which such discretionary behavior is likely to occur and the performance consequence of the extra-role behavior. By carefully examining the records of the interactions between IT personnel and business users during the 15-month post-implementation period, we found that the type of support task influences the occurrence of OCBs. Moreover, our data analysis confirms the negative impact of OCB occurrences on individual task efficiency, but reveals that the negative effect of OCBs on efficiency is contingent upon task type and task complexity.

This study contributes to the IS discipline by demonstrating that customer-oriented OCB theory is relevant for understanding the customer service behaviors of IT personnel in the technology support context. The challenges that IT personnel encounter in the IS post-implementation context are not new, but prior studies present mixed views of the role of IT support desks and their capabilities in assisting users with information technologies. For example, Santhanam et al. (2007) emphasize the effectiveness of IT help desks in transferring technical knowledge ("know-how" and "know-what") to users. However, other studies, such as Govindarajulu (2002), suggest that IT help desks are often overwhelmed and lack business domain expertise. Our study reveals that IT personnel go beyond explicit requests for assistance and offer additional knowledge and advice to business users in the challenging environment of organizational IS support. This finding partially explains the contradictory views in prior studies. Moreover, this customer orientation perspective has an important implication for post-implementation IS usage in organizations. In contrast to the dominant paradigm of the three key elements of IS usage (Barki et al. 2007; Burton-Jones and Straub 2006)—technology, user, and task—this research is one of the first to introduce OCB theory to explain the service interactions between end users and IT personnel in the context of the organizational use of IT.

The support service for enterprise technologies, such as ERP, is challenging and constantly evolving. Our study highlights a promising approach to better managing the changes and challenges in organizational support of IT: to facilitate IT employees' service interactions with users and to nurture and motivate IT employees' extra-role behaviors in their service interactions with users. By applying the perspective of customer-oriented citizenship behavior to organizational support of IT, our study has made an initial effort to expand the boundaries of current accounting information systems (AIS) research by highlighting the importance of customer service in the post-implementation phase of organizational information technologies.

We would like to acknowledge the following limitations of our study. We examined the IT support function within an organization, i.e., an in-house operation of IT support. Those IT personnel are employees at the multi-site organization that adopted SAP/R3. Prior studies on IT personnel have suggested that a different status may affect employees' psychological contract with the organization, thus leading to different performance outcomes (Ang and Slaughter 2001). When some or all of the IT services are outsourced, e.g., to the vendor or an IT consulting firm, IT personnel from those firms may show customer-oriented behaviors to a different degree, or witness different consequences from their customer-oriented OCBs. Differentiating the extra-role behaviors by employee status could be one promising area for future research. In addition, as our study focuses on the enterprise technology support in one large U.S. organization, the findings should be applied to other organizations and settings with some caution. Last, conceptually OCB is a continuous variable, but we were not able to generate a continuous numeric measure of OCB through manually coding the contents of the IT support tickets.

Future research can be extended in two directions. One promising direction is to conduct longitudinal studies of ERP usage in functional areas, such as financial auditing, to sufficiently investigate micro issues, such as the factors unique to a targeted ERP functionality (i.e., financial controls and internal auditing). As the Sarbanes-Oxley (SOX) legislation puts more emphasis on internal controls, firms with ERP systems are taking advantage of the built-in controls and features in ERP to help them improve their internal controls over financial reporting (Morris 2011). A longitudinal view of adapting ERP usage to the external environment (i.e., regulatory changes) will generate new insights into achieving optimal value from the ERP investment. Another research direction is to view the service interactions between business users and IT personnel as an ongoing co-learning process, while incorporating the viewpoints of customers (business users) into IT support (Carr 2006) and taking into account the different types of customer-oriented OCB demonstrated by IT personnel (Deng and Wang 2013).

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APPENDIX A

Definitions of Variables

Variable	Definition
OCB	An indicator of organizational citizenship behavior that is a dummy variable equal to 1 if some OCB information is provided in the solution; 0 if no OCB information is provided in the solution.
TASK_EFFICIENCY	An IT personnel's adjusted estimation of effort per task (i.e., per ticket). We assume that each individual at the support center devoted one unit of effort per day on resolving all the open tickets in that day. Our calculation of this task efficient measure is consistent with initial estimation of efforts adopted in Boh et al. (2007) and Narayanan et al. (2009). See Appendix C for the calculation details.
TASK_TYPE	A dummy variable that indicates the type of tasks equals 0 if the task is informational; 1 if the task is diagnostic. This dummy variable is intended to reflect the uncertainty and equivocality level of the task. Diagnostic tasks are more uncertain and equivocal than informational tasks.
PRODUCT	A dummy variable that indicates the module of the ERP system, equals 1 if the ticket belongs to the SRM module; 0 for the HR/Payroll Management module.
TASK_COMPLEXITY	It ranges from 1 (the least complex) to 4 (the most complex). A support task with complexity level of 1 often refers to a system usage problem about technical functionality, while tasks with complexity level of 4 are often related to data-related system usage problems.

APPENDIX B

Coding Scheme and Examples

	Definition	Example
Task Complexity		
TASK_COMPLEXITY = 4 (Data-Related Problems)	Problems arising from users' lacking or insufficient knowledge of *data*, or problems arising from software lacking/missing data.	"Shopping Cart: user tried GL (general ledger) acct number and received error message 'customer entered 63xxxx "000000000063xxxx does not exist'."
TASK_COMPLEXITY = 3 (Role-Related Problems)	Problems arising from users' lacking or insufficient knowledge of *individual user roles* in the new technical application, or problems arising from software lacking/missing role assignment.	"Shopping Cart: user said that he has this role already, but still unable to approve."
TASK_COMPLEXITY = 2 (Workflow-Related Problems)	Problems arising from users' lacking or insufficient knowledge of *workflows* in or across modules, or problems arising from the tight control and integration imposed by the enterprise system.	"This user resolved payment issue, and now needs to be able to relate Invoices to purchase orders (POs). I showed her the R3 transaction to review Invoices."

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APPENDIX B (continued)

	Definition	Example
TASK_COMPLEXITY = 1 (Function-Related Problems)	Problems arising from users' lacking or having insufficient knowledge of *technical functions*, or problems arising from system malfunctions, such a missing a field in the screen, system crashes, etc.	"Online Payment Request: user needs assistance with locating an old check request and needs to know how to copy. Doc no. 19xxxxxxx."
Task Type		
TASK_TYPE = 0 (Informational)	Locate specific information and provide information or seek procedures to achieve task goals.	"When I have more than one invoice for a vendor, how can I pay them without making individual check requests?... the system will allow you to enter multiple invoices as long as the reference field is a unique set of characters..."
TASK_TYPE = 1 (Diagnostic)	Generate hypotheses that explain the observed malfunction, replicate the problem to find the root cause to the problems, provide remedy for the user to seek general orientation and an understanding of concepts.	"...The posting sim errors were due to incorrect master data. HS is not set up for tax authorities WV or PA. Master data corrected. Subsequent FI posting errors due to accruals attempting to post to unopened FI period. FI team notified. Period opened temporarily."
Customer-Oriented Organizational Citizenship Behavior		
OCB = 0 (None)	No OCB instance identified.	"... trained the customer as to the correct procedure"
OCB = 1	Extra-role behaviors are performed, such as in anticipating customer requests (sharing consequence/ next action).	"...Told xxxxxx what to do to update the document, and how to send it into Workflow. Also advised her what to do if document doesn't allow changes."

APPENDIX C
Computation of *TASK_EFFICIENCY* in IT Support

This appendix explains how we calculate task efficiency. The archival records extracted from the organization's IT support ticketing database including the date and time at which each ticket was opened and closed, but this elapsed time does not equal to the efficiency of a support task, as IT personnel can be working on multiple support tickets at the same time. However, we can obtain a good estimate of the task efficiency per ticket (support task) if we keep track of the number of tasks each individual staff works on in each day. According to the algorithm developed by Graves and Mockus (1998), each IT personnel's daily effort is equally divided among the open tickets (tasks) that the individual is working on. Consistent with initial estimations of efforts adopted in Boh et al. (2007) and Narayanan et al. (2009), we employed the following procedure to compute the efficiency of a specific task.

Step 1

Divide the daily effort (1 unit) across all the open tickets on a particular day for each individual to obtain the daily share of effort per ticket. If there were n tickets under "OPEN" status for an individual worker for a given day, then the effort for a ticket on that day was calculated by "$1/n$." For example, consider the workload of an IT worker over 3 days: two tickets (A and B) open on Day 1, four tickets (A, B, C, and D) open on Day 2, and only 1 ticket (D) open on Day 3. The effort expended on ticket A and B includes 1/2 unit on Day 1, 1/4 unit on Day 2. Similar, the effort expended on ticket C is 1/4 unit. If Day 3 is the last open day for ticket D, then the effort expended on ticket D is 1/4 unit on Day 2, and 1 unit on Day 3.

Step 2

Sum up the daily effort of that ticket across all the days during which the ticket remained "OPEN" status. In the above example, the initial estimations of the total effort are: 0.75 units for ticket A and ticket B, 0.25 for ticket C, and 1.25 for ticket D.

Step 3

Standardize the initial estimation of total effort, and use the standardized measure in the regression model, i.e., Equation (2).

The above estimation is based on the assumption that each individual at the support center devoted one unit of effort per day on resolving all his/her open tickets in that day.