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Extracting Business Value from IT: A Sensemaking Perspective of Post-Adoptive Use

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How can firms extract value from already-implemented information technologies (IT) that support the work processes of employees? One approach is to stimulate employees to engage in post-adoptive extended use, i.e., to learn and apply more of the available functions of the implemented technologies to support their work. Such learning behavior of extending functions in use is ingrained in a process by which users make sense of the technologies in the context of their work system. This study draws on sensemaking theory to develop a model to understand the antecedents, contingencies, and consequences of customer service employees' extended use of customer relationship management (CRM) technologies. The model is tested using multisource longitudinal data collected through a field study of one of the world's largest telecommunications service providers. Our results suggest that employees engage in post-adoptive sensemaking at two levels: technology and work system. We found that sensemaking at both of these levels impacts the extended use of CRM technologies. Employees' sensemaking at the technology level is influenced by employees' assessment of technology quality, whereas employees' sensemaking at the work system level is influenced by customers' assessment of service quality. Moreover, in the case of low technology quality and low service quality, specific mechanisms for employee feedback should be conceptualized and aligned at two levels: through employee participation at the technology level and through work system coordination at the work system level. Such alignment can mitigate the undesirable effect of low technology quality and low service quality, thereby facilitating extended use. Importantly, we found that extended use amplifies employees' service capacity, leading to better objective performance. Put together, our findings highlight the critical role of employees' sensemaking about the implemented technologies in promoting their extended use of IT and improving their work performance.

Key words: business value; information technology; post-adoptive behavior; extended use; sensemaking; feedback mechanisms; customer relationship management; CRM technology
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1. Introduction

How can firms extract more value from information technology (IT), while making relatively low incremental investments? This question is important to managers and generates interest among scholars (Bharadwaj et al. 2007, Venkatesh and Bala 2008, Ho et al. 2011). An effective approach to reach this goal is to encourage users to enrich their use of already-implemented technologies (Rai et al. 2002). This approach emphasizes the importance of users making sense of the implemented technologies (Jasperson et al. 2005). "Sensemaking" generally refers to individuals' developing cognitions; from this perspective, using a technology is a cognitive process by which users construct meaning of the technology, which affects their subsequent interactions with it (Weick 1990, 1995). Sensemaking is thus a useful perspective to further our understanding of individual engagement in making richer, deeper, extended use of technologies.

We apply the sensemaking perspective to examine users' post-adoptive behavior of extended use. *Post-adoptive behavior* describes individual users' technology usage behavior after firms adopt and implement an information technology (Saga and Zmud 1994). During the post-adoptive stage, after employees start using an implemented IT and follow management's expectation to routinely use the technology as part of their normal activities, they may engage with more of the functional features of the technology (Hsieh and Wang 2007, Schwarz 2003). By learning and using more of the functions available in the technology, users make deeper use of the technology to support their work. Such post-adoptive behavior is referred to as *extended use*, in that users extend the scope of the functions that they use through post-adoptive learning.

We investigate extended use in the work system context, which refers to the context in which employees perform their assigned work (Gibson et al. 2000). A work system is "IT enabled" if enterprise software applications are used to enable or support its work tasks (Jasperson et al. 2005). Specifically, an IT-enabled work system consists of the employees, the work that is assigned to them, the information technologies that enable them to perform their work, the managerial activities that direct their work-related behaviors, and the communication channels that they use to coordinate activities with others (Gibson et al. 2000). The purpose of this study is to develop a theoretical framework and offer empirical evidence for the antecedents, contingencies, and performance impacts of extended use in the context of IT-enabled work systems. In doing so, we answer three research questions, as detailed below.

First, we are motivated by the call for research to develop *theoretical* perspectives to detail the preconditions of post-adoptive behavior (Venkatesh and Bala 2008). As noted above, sensemaking is a lens that could be useful in this regard. From this perspective, factors pertaining to individuals' sensemaking—i.e., their cognitive interpretation of a technology—are salient antecedents affecting how they accept and use the technology (Weick 1990, 1995). Because sensemaking occurs at two distinct levels during the post-adoptive stage, the technology level and the work system level (Jasperson et al. 2005), we aim to identify antecedents of extended use at each level, which leads to our first research question:

Research Question 1. *What are the factors at the technology level and at the work system level that impact employees' extended use of IT*?

Second, the sensemaking perspective helps us to analyze the mechanisms that may promote extended use even in the presence of unfavorable antecedents. Weick (1995, p. 30) emphasizes the notion of *enactive* sensemaking in that "people receive stimuli as a result of [their] own activity." If some activity by technology users stimulates their ensuing sensemaking, then the activity may shift the users' interpretation about the technology that they formed based on previous antecedents. As such, the activity may have a moderating or a "contingency" effect on the path from previous antecedents to extended use. For employee users, one such activity is to offer feedback about how to realize the potential of implemented IT more fully. We choose to address user feedback because extended use resembles users' learning behavior at the post-adoptive stage as learners' feedback plays a critical role in adjusting their ensuing learning (Orlikowski 2000, Scott 2002). Organizations can structure practices to elicit and coordinate employee feedback and can establish feedback mechanisms at the technology level and the work system level (Jasperson et al. 2005). Thus, we ask the following:

Research Question 2. *How do feedback mechanisms affect the relationship between unfavorable antecedents* (*at the technology level and the work system level*) *and employees' extended use of IT*?

Third, although IS scholars have generally postulated that post-adoptive use will generate performance benefits, there is limited understanding about the relationship between specific post-adoptive usage behaviors and specific performance outcomes (Hsieh and Wang 2007). Extended use is a specific post-adoptive behavior that enables users to leverage technology functions to a fuller extent, thereby developing higher capacity for better work performance. This motivates us to relate extended use to its specific *performance impacts*, i.e., impacts on users' capacity to perform their work as well as their actual work performance. Thus, we ask the following:

Research Question 3. *What are the performance impacts of employees' extended use of IT*?

2. Investigative Context

The investigative context of this study is an *IT-enabled customer service work system*. More specifically, we focus on customer service work systems in retail stores in which frontline customer service employees (CSEs) undertake customer-facing service work, such as answering customer inquiries, offering information about products and promotions, processing transactions and payments, and providing post-sales support (Sergeant and Frenkel 2000). Such customer service work systems typically use customer relationship management (CRM) technology to support or enable service work in order to deliver service efficiently and to meet customer needs effectively, thus improving customer satisfaction (Mithas et al. 2005). As customer satisfaction is vital in today's competitive environments, CSEs' use of CRM technology and their performance resulting from such use deserve special attention.

In understanding the use of CRM technology, it is important to differentiate between operational and analytical CRM (Karimi et al. 2001): *analytical CRM* (ACRM) technology describes IT applications that incorporate analytical methods (e.g., data mining) for discovering and predicting customer behaviors to formulate marketing strategies; *operational CRM* (OCRM) technology refers to enterprise applications that digitize CSEs' tasks in marketing, sales, and post-sales support. The performance of ACRM technology is mainly determined by the effectiveness of the analytical methods (Padmanabhan et al. 2006). In contrast, OCRM technology offers a variety of rich functions to support CSEs' service operations (Jayachandran et al. 2005, Sundaram et al. 2007). It is the extent to which CSEs apply the functions (i.e., extended use) that may affect user performance (Hsieh and Wang 2007). Therefore, the customer service work system enabled by OCRM technology is a suitable context to examine the drivers and performance impacts of extended use. Because customer service employees are the "users" that use OCRM technology to assist their service encounters with customers, we use the two terms users and customer service employees interchangeably.

In our research context, investigating CSEs' cognitions and technology usage behaviors need to accommodate analysis at two levels: technology level and work system level (Jasperson et al. 2005). Whereas users' cognitive interpretation of a technology is formed in the process of interacting with the technology (Weick 1990, 1995), their cognitions and behaviors are situated within work systems (Robey et al. 2002). These two levels are distinct as work systems are "social systems of collective action that structure and regulate the actions and cognitions of organizational participants.... As such, the rich and dynamic interplay that occurs within systems of collective action...influences individuals' cognitive processing" (Jasperson et al. 2005, p. 533). The collective action of the work system is beyond technology usage by CSEs; rather, it occurs through specific mechanisms to coordinate efforts of various work system members to integrate technologies with work processes. Our theoretical development thus seeks to identify factors affecting users' cognitions and technology usage behaviors at two distinct levels.

3. Theoretical Framework and Hypotheses Development

To answer our research questions, we build on the sensemaking perspective to develop a theoretical framework for the antecedents, contingencies, and impacts of extended use (Figure 1). The framework relates extended use to antecedents pertaining to sensemaking at two levels: (1) the technology level and (2) the IT-enabled work system level (Jasperson et al. 2005). As explained above, the technology refers to the OCRM technology, and the work system refers to the customer service work system. At each of the two levels, the antecedent's effect is contingent on the specific feedback mechanism that facilitates sensemaking at the corresponding level. Finally, the framework links extended use to its performance impacts.

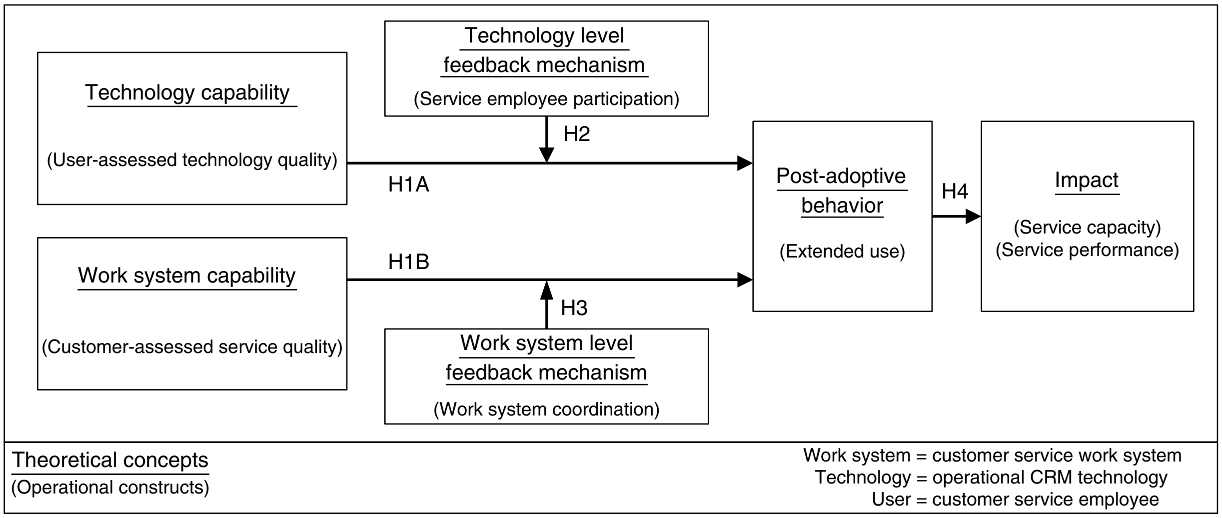
We select sensemaking as the theoretical basis for our model development because it describes individuals' cognitive process of learning (Weick 1990, 1995).[1] As defined in the introduction, *extended use* resembles post-adoptive learning in that CSEs seek to learn more functions of the OCRM technology to support their work (Hsieh and Wang 2007). Following organizational adoption of a technology, individual users begin to use the technology. Users typically start from using a limited portion of all the available functions. Over time, users gradually become more familiar with the technology, moving into the stage of routine use in which using the technology is no longer perceived as out of the ordinary but actually a normal activity in their routine work (Saga and Zmud 1994). After users become familiar with the technology, they may not be content with their current use situation and want to learn and apply more of the available functions (Robey et al. 2002). As such, extended use is essentially voluntary on the user's behalf. Although companies can require CSEs to use the technology, users retain substantial discretion to determine the *extent* to which they volitionally engage in learning new functions (Carlson and Zmud 1999, Robey et al. 2002).

Sensemaking theory (Weick 1995, 2001) emphasizes seven properties of users' learning process of developing cognitions (summarized in Table 1). Following the literature (Tallon and Kraemer 2007), our theoretical development is based on an integrative understanding of the seven properties of sensemaking.

First, sensemaking is grounded in *identity construction;* in customer service work systems, employees generally want to construct an identity of having the capacity to serve customers effectively (Kelly 1992). CSEs use OCRM technology and, because of identity construction, would assess how the technology supports their service tasks. Importantly, based on their *experience* of using OCRM technology, CSEs can offer feedback about how to improve the technology and better integrate the technology into the work system to support service tasks. These actions create *enacted* cues that lead CSEs to form *plausible* interpretation with regard to the OCRM technology. Here the term enacted means that CSEs' own actions produce (part of) the environment from which they extract salient

[1] Although rational task-technology fit models may be ideal for explaining adoption behaviors, IS scholars have recommended studying post-adoptive behaviors through a learning lens, which points to the importance of sensemaking (Robey et al. 2002, Saga and Zmud 1994, Jasperson et al. 2005, Boudreau and Seligman 2005).

Figure 1 **Research Framework**



informational cues for sensemaking. These actions take place in a *social context* where CSEs and other work system members coordinate their feedback. Finally, sensemaking is *ongoing*, which is consistent with the view that post-adoptive learning is continuous in nature (Jasperson et al. 2005). Together these seven properties lead to the key concepts of our research framework and the associated hypotheses, as presented in turn below.

3.1. Antecedents of Extended Use: Quality Signals

Given the feature of identity construction of sensemaking, CSEs generally care about the implications of using a technology for their work performance (Kelly 1992). Therefore, after applying the OCRM technology, users would assess the technology and the outcomes of their technology application. They would interpret the results of this assessment as signaling the *capabilities* of the technology and the work

Table 1 **Properties of Sensemaking**

General description	Relevance to CSEs' sensemaking
1. *Grounded in identity construction* Individuals care about their identity, or image, in an organization.	CSEs care about, and therefore assess, how the use of OCRM technology may influence their work performance.
2. *Salient information cues* To avoid information overload, sensemakers use salient information cues, extracted from their environment, to develop cognitions.	*Quality signals*—about OCRM technology and customer service enabled by OCRM technology—are the salient information cues for CSEs to assess performance implications of OCRM technology.
3. *Retrospective* Sensemaking is based on previous experiences.	The quality signals are derived from CSEs' prior experience with OCRM technology.
4. *Enactive* Sensemakers can take actions to create (part of) the information cues for sensemaking.	CSEs can offer feedback about how to improve the technology and better integrate it into the work system to support service tasks so as to realize the technology's potential more fully. As such, CSEs' own activities create enacted cues that could alter how they interpret the unfavorable quality signals.
5. *Social context* Sensemaking is "social when people coordinate their actions" (Weick 1995, p. 42).	Effective coordination among work system members can harmonize their distinctive knowledge so as to better integrate the OCRM technology into the work system.
6. *Plausibility* The outcome of sensemaking is driven by individuals' plausible interpretations of information cues, which may occur before the truths related to the cues surface.	Once CSEs offer their feedback, they may develop a plausible interpretation that their feedback may help induce constructive changes for the technology and customer service enabled by the technology.
7. *Ongoing* Sensemaking is an ongoing activity that is continuous over time.	CSEs continuously update their perceptions about the OCRM technology and about the outputs of the IT-enabled service work system.

Source. Adapted from Weick (1995, 2001).

system, thus forming their own cognitions about these capabilities (Weick 1990, 1995). When forming their assessment, CSEs would perceive and rely on salient informational cues at two distinct levels (Jasperson et al. 2005).

At the technology level, users perceive technology capability: users desire a high-quality information technology that can support their task performance (DeLone and McLean 2003). Accordingly, CSEs may perceive *technology quality* and interpret higher quality as signaling a greater capability of the OCRM technology. In the rest of the paper, technology quality refers to technology quality perceived by CSEs. Specifically, when making sense about the implemented IT, users generally are concerned about two major aspects of quality that affect their technology application: the quality of the information made available by the technology (i.e., *information quality*) and the quality of the technical aspects of the technology (i.e., *system quality*) (DeLone and McLean 1992, 2003; Seddon 1997). These two elements, information quality and system quality, jointly determine technology quality (Gable et al. 2008).

At the work system level, users perceive whether the work system is capable of delivering high-quality output. In the context of customer service work systems, output quality is synonymous to *service quality* (Parasuraman et al. 1991, Malhotra and Mukherjee 2004). During service encounters, CSEs can sense if the customers are satisfied with service quality (Zeithaml and Bitner 2002); more favorable customer feedback about service quality indicates a greater capability of the customer service work system.

The above-developed cognitions (i.e., technology quality and system quality), in turn, affect CSEs' extended use of OCRM technology. Extended use, as a voluntary learning behavior, can be motivated but not mandated (Hsieh and Wang 2007). When IT use is obligatory in organizations, users have to use the technology even if they have mentally rejected it (Seddon 1997). But, the dissonance between users' mental state and their actual behavior will result in rote and superficial use (Nah et al. 2004). As a result, CSEs' extended use of OCRM technology will be low as they will engage in such use only when they mentally accept the technology (Jasperson et al. 2005). In contrast, when CSEs perceive the technology to be of high quality based on their earlier interactions with the technology, and when customers experience high-quality service delivered by the service work system, CSEs can appreciate the technology's support of their work tasks. These encouraging perceptions (i.e., high technology quality as assessed by CSEs and high service quality as assessed by customers) can bring about CSEs' strong belief in the functional value of the technology (i.e., perceived usefulness) and favorable attitude toward the technology (i.e., user satisfaction) (Bhattacherjee 2001, Seddon 1997). CSEs' positive instrumental belief in, and satisfaction with, the technology represent their mental acceptance of the technology, which promotes extended use (Jasperson et al. 2005).

Hypothesis 1A (H1A). *Technology quality will positively affect CSEs' extended use of the OCRM technology.*

Hypothesis 1B (H1B). *Service quality will positively affect CSEs' extended use of the OCRM technology.*

3.2. Contingencies of Extended Use: Feedback Mechanisms

Following the above discussion, when users confront low technology quality or low service quality, they may form unfavorable cognitions about the technology and its potential to support work tasks, which, in turn, may restrain extended use. To alleviate the negative influence of low-quality signals, the key is to capitalize on work system members' various expertise to solve quality problems related to the technology and the work system (Orlikowski 2000, Jasperson et al. 2005). This approach points to the abovementioned enactive sensemaking (Weick 1995, 2001).

In the context of post-adoptive use of OCRM technology, enactment may occur through *feedback mechanisms*, which refer to organizations' practices to elicit and coordinate employee feedback. Based on their experience of using the OCRM technology, CSEs gain insights about the technology's strengths and problems. If they offer feedback about how to improve the technology and the IT-enabled work system, such actions may create enacted cues. Here enacted means that CSEs' own actions may enable them to adjust their interpretation with regard to the low-quality signals because CSEs may expect constructive changes at the technology level and at the work system level. Therefore, feedback mechanisms may play a moderating role to mitigate unfavorable impacts of low-quality signals, if any.

At the technology level, feedback mechanisms should aim to overcome the barrier to extended use because of low technology capability. Toward this end, the key is to encourage feedback from CSEs on how to improve technology capability (Hunton and Price 1997, Ravichandran and Rai 2000). Through actually using the technology, CSEs may have found errors and problems that make the technology unreliable. Also, they may perceive the technology as having a low capability of generating needed information. It is widely noted that technology users are a primary source of feedback for technology improvement. (See He and King 2008 for a review.) We thus focus on *service employee participation* as feedback mechanisms at the technology level, by which CSEs raise their concerns about the capability of the technology and suggest needed improvement to make the technology more reliable and useful.

As predicted by H1A, low technology quality may impede extended use. CSEs' participation in technology improvement may mitigate the unfavorable impact of low technology quality because user participation allows for useful insights to solve technology problems (Hunton and Price 1997, Ravichandran and Rai 2000). By offering their recommendations for technology improvement, CSEs may form a plausible perception that the technology could be better configured for their service work (Gefen and Ridings 2002). This may offset the negative impacts of low technology quality, if any, on users' mental acceptance of the technology. The literature on user participation has long noted such a psychological function of user participation: that is, to induce favorable individual attitudes toward the technology (e.g., King and Lee 1991). A recent meta-analysis based on 82 studies finds consistent support for the positive psychological effect of user participation on users' attitudinal acceptance of IT (He and King 2008). This is consistent with Weick's explanation about how people carry out sensemaking through enactment: "action is crucial in sensemaking . . . people receive stimuli as a result of their own activity" (Weick 1995, p. 32). In this vein, CSEs' own action of providing feedback may stimulate ongoing sensemaking, potentially adjusting their previous interpretation about the technology. The learning literature also contends that learner input can serve as a powerful mechanism to improve individuals' learning processes and induce their motivation for further engagement (Orlikowski 2000, Scott 2002). Hence, once CSEs have been encouraged to actively participate in offering feedback, their own action for technology improvement may lead them to be more positively disposed toward the technology. As such, even if the previously assessed technology quality is low, service employee participation may shift CSEs' behavioral attitudes toward a greater willingness to learn and use the technology more extensively.

Hypothesis 2 (H2). *Service employee participation in technology improvement moderates the positive relationship from technology quality to extended use such that service employee participation mitigates the negative effect of lower technology quality on extended use*.

At the work system level, feedback mechanisms should aim to overcome the barrier to extended use because of low work system capability. A major cause of low work system capability is that the enabling technology is not effectively integrated with the work system (Armstrong and Sambamurthy 1999, Purvis et al. 2001). The literature emphasizes that effectively integrating an enabling IT with a work system requires knowledge from various members who are experts in different functional areas of the work system (Bharadwaj et al. 2007). In our research context, these include CSEs who are familiar with frontline service operations, managers who oversee and are knowledgeable about the work system, and IT staff who support the technology. Therefore, in contrast to service employee participation that aims to improve the OCRM technology per se, improving work system capability concerns how to take advantage of various members' distinct knowledge about how to better integrate the technology to support the work system (Bharadwaj et al. 2007). To that end, effective mechanisms at the work system level are required to harmonize the efforts of various work system members and coordinate their input (Chatterjee et al. 2002). This leads to *work system coordination* (Boh and Yellin 2006, Chatterjee et al. 2002), which is defined as the extent to which a collection of coordination mechanisms is used to coordinate feedback from various work system members to determine how to better integrate the OCRM technology to support service work.

As predicted by H1B, low service quality may curtail CSEs' engagement in extended use. To mitigate such undesirable impact of low service quality, various work system members may have different understandings about the problems causing low service quality as well as about possible solutions to these problems (Bharadwaj et al. 2007). CSEs have first-hand information about their technology-assisted service tasks; technology support members have more knowledge about the technical details; and managers have a high-level understanding about the overall work system. Leveraging their distinct knowledge taps the "social" feature of sensemaking in that various work system members coordinate to synthesize cross-functional ingenuity (Weick 1995, 2001). Through coordination, synthesized insights may be achieved about how to better integrate the OCRM technology with service activities (Boh and Yellin 2006, Chatterjee et al. 2002). CSEs can benefit from the synthesized insights and, therefore, develop a plausible expectation for better work system output. Such plausible expectation is enacted by CSEs' coordination with other work system members. It may mitigate the unfavorable influence of prior low service quality, if any, on users' cognition of the IT-enabled work system. As such, even if the previously assessed service quality is low, work system coordination may transform CSEs' attitudes toward a greater willingness to engage in extended use.

Hypothesis 3 (H3). *Work system coordination moderates the positive relationship from service quality to* *extended use such that work system coordination mitigates the negative effect of lower service quality on extended use.*

Note that work system coordination can be achieved through a collection of coordination mechanisms (Galbraith 1977). First, formalized operating procedures, such as regular meetings with prespecified structures and formalized processes to report and track issues, institutionalize coordination in work systems. These practices formalize and streamline communication among work system members but are also costly because they need to be established officially as routine activities, require several parties to formally participate in the processes, or demand human effort to transcribe/code the issues into formal documentations (Mintzberg 1979). Second, at the other extreme of the coordination spectrum, direct contact (e.g., between CSEs and the IT support staff) is the least institutionalized. This mechanism tends to be ad hoc and generally lacks the comprehensive structure like formalized procedures for synthesizing diverse input; thus, it is difficult to guarantee its effectiveness (Galbraith 1977). Third, coordination can be achieved via "mediating roles" of liaison personnel who support communication between work system members. The mediation mechanism, however, is less structured than the formalized procedures (Galbraith 1977). Because information is transmitted via a middle person, information distortion may occur; prior research suggests that it may be difficult, or even counterproductive, to achieve coordination through liaison personnel (Boh and Yellin 2006). Fourth, direct supervisors[2] may coordinate more effectively than liaison personnel because supervisors' performance is usually tied with their subordinate CSEs' performance. As a result, direct supervisors tend to have a greater incentive to strengthen work system coordination in order to enhance subordinates' performance. Also, compared to liaison personnel, supervisors typically have superior hierarchical positions for cross-functional communication and more knowledge of the business processes, organizational policies, and products and services; thus, they are generally better positioned than liaison personnel to achieve effective work system coordination.

In sum, these coordination mechanisms—formalized operating procedures, coordination via mediating roles played by liaison personnel or direct supervisors, and direct contact—differ in their abilities and costs to support coordination. As a result, they may play differential roles in enabling work system coordination. Given that we are interested in a higher level of abstraction (i.e., work system coordination and extended use), our construct specification of work system coordination follows the suggestion by Chin (1998) and Law et al. (1998) to model these four coordination mechanisms as collectively forming work system coordination and, then, relate work system coordination to extended use.

3.3. Performance Impacts of Extended Use

As shown in our framework (Figure 1), we investigate the performance impacts of extended use by examining CSEs' work capacity and work performance. Regarding *CSEs' work capacity*, sensemaking theory suggests that, in general, the goal of CSEs' behavior is to construct their identity of having the *capacity to satisfy customers* (Weick 1995, 2001). This capacity is critical for CSEs' identity construction in their organization because it represents CSEs' core capability in service work systems (Sergeant and Frenkel 2000). As for *CSEs' work performance*, the CRM literature views OCRM technology's payoffs as customer acquisition (attracting new customers), as well as retention and enhancement (keeping existing customers, and further enhancing service performance by cross-selling and up-selling) (e.g., Thomas 2001, Bolton and Tarasi 2006). Therefore, customer acquisition and sales volume indicate CSEs' *service performance*.

Extended use of OCRM technology can enhance CSEs' capacity to satisfy customers by helping CSEs to perform their service work more efficiently and effectively. OCRM technology automates and thus helps CSEs speed up sales and service delivery (Ahearne et al. 2008). OCRM technology captures rich information about customers, such as customers' requests, response to campaign and promotion, and purchasing history (Bhattacharya and Bolton 1999). These customer records, together with external market information (e.g., demand trends, competitors' offerings, local market conditions, etc.) and internal offering information (e.g., products, services, promotion, up-sell, cross-sell, and phase-in and phase-out information), constitute a rich pool of business intelligence made available to CSEs (Bolton and Tarasi 2006). To utilize the vast amount of intelligence further, OCRM technology usually comes with a variety of functions that recommend the most appropriate responses for CSEs to interact with a specific customer according to the customer's profile (Sundaram et al. 2007), prompt when circumstances allow for up-sells or cross-sells (Jayachandran et al. 2005), and enable configure-to-order offerings to meet each customer's unique requirements (Karimi et al. 2001). Extended use of these functions helps expand CSEs' capacity to

[2] Although there may be several managers who oversee and are responsible for a customer service work system, a specific service employee typically reports to his or her direct supervisor, who is also a manager. In other words, a direct supervisor is the manager who has the authority to directly manage the specific employee's activities.

meet customer demand more effectively in a contextual manner, leading to greater customer satisfaction (Mithas et al. 2005).

Improved work capacity generally leads to better work performance, which is supported by research in a variety of contexts (e.g., Bharadwaj et al. 2007, Ahearne et al. 2008, Ray et al. 2005). Specifically in our research setting, having a higher capacity to satisfy customers will improve CSEs' service performance, which will be reflected by having a greater number of customers and a higher volume of products/services sold. The marketing literature is replete with evidence that customer satisfaction leads to service subscription and repeat purchase (Bolton and Lemon 1999, Mittal and Kmakura 2001). Customer satisfaction also results in positive word of mouth, which may further improve service performance (Duan et al. 2008).

Hypothesis 4 (H4). *Extended use of the OCRM technology will positively affect CSEs' capacity to satisfy customers, which will positively affect CSEs' service performance.*

4. Methodology

To test our theoretical framework and hypotheses empirically, we conducted a longitudinal field study and collected data through a multiwave, multisource research design. The unit of analysis is the individual CSE who uses OCRM technology in customer service work. We describe the site of investigation, measurement, and data-collection process in this section.

4.1. Research Site

The context of our investigation is the largest mobile phone service provider in China. By the end of 2007 (the year when we conducted the field study), the firm had achieved a subscription base of 369.3 million phone numbers and annual revenue of almost $40 billion (US$). The OCRM technology installed in the company has basic functions to process transactions. It is also equipped with more advanced functions to help CSEs search and process customer-oriented data, including information about their customers (personal profiles, billing history, preferences, and purchase records), products/services, promotions, business processes, organizational policies, external market conditions, and competitors' offerings. These functions enable CSEs to relate with customers in a personalized manner, offer customized recommendations that match individual consumer preferences, and identify and capture cross-selling and up-selling opportunities. These functions can be used by CSEs at different stages of their service interactions with customers, subject to the purposes of customer inquiries and the evolution of the interactions.

By the time of data collection (April 2007), the firm had implemented the OCRM technology accompanied by standardized service processes across all 31 provinces (states) in China. To manage the scope of the field investigation, we chose to conduct this study in one typical province in which the firm had successfully installed and used the technology for 16 months. As discussed earlier, extended use usually occurs after an IT has stabilized and has been used on a routine basis (Saga and Zmud 1994, Robey et al. 2002). Although prior literature does not indicate the specific time that will be needed for attaining routine use of a complex IT like enterprise resource planning (ERP) or CRM technology, empirical evidence suggests that users employing a complex IT for 15 months after its initial implementation may still not be using the technology to its fullest potential (Boudreau 2003). Thus, we believed that 16 months after the implementation of the technology was an appropriate time to investigate extended use.

4.2. Measures

Most constructs were operationalized as multi-item scales, and most measures were adapted from existing scales for the investigative context (see Appendix A). These measures were collected from three data sources: customer service employees, customers, and the focal firm.

4.2.1. CSE Data. CSEs were asked questions about *Technology Quality*, *Extended Use*, *Service Employee Participation*, *Work System Coordination*, and *Capacity to Satisfy Customers*.

Technology Quality (*TechQual*) is measured as a higher-level construct with two formative dimensions: *Information Quality* (*InfoQual*) and *System Quality* (*SysQual*) (Gable et al. 2008). Three items for *Information Quality* and three items for *System Quality* were both adapted from Wixom and Todd (2005).

Measures of *Extended Use* (*ExtU*) were adapted from Hsieh and Wang (2007) and Schwarz (2003). As *ExtU* may not occur on a daily basis, Schwarz (2003) and Hsieh and Wang (2007) suggest that *ExtU* be operationalized against a certain time frame. Based on these prior studies, the items of *ExtU* were measured against, as well as controlled within, a two-month time frame.

The measurement scale for *Service Employee Participation* (*SEP*) was adapted from Ravichandran and Rai (2000). The above four constructs were all operationalized as seven-point Likert scales, with anchors for each item ranging from strongly disagree (1) to strongly agree (7).

Items for *Work System Coordination* (*WSC*) were adapted from Kumar and Seth (1998) and Chatterjee et al. (2002) to evaluate the degree to which four available mechanisms are used for CSEs, the managers, and the IT support staff to coordinate on how to better integrate the OCRM technology in service work. The four mechanisms include (a) formalized operating procedures (e.g., regular meetings, formalized processes to report and track issues); (b) mediated coordination via the CSE's direct supervisor; (c) mediated coordination via liaison personnel; and (d) direct contact with the technology support staff. These items were all measured as Likert scales from never (1) to very often (5). Finally, items for *Capacity to Satisfy Customers* (*CSC*) were adapted from Sergeant and Frenkel (2000) to evaluate how often CSEs feel they satisfy their customers, with each item measured on a five-point Likert scale ranging from never (1) to very often (5).

4.2.2. Customer Data. The measurement for *Service Quality* (*ServQual*) is based on the Parasuraman et al. (1991) instrument, which has five dimensions, including reliability, responsiveness, assurance, empathy, and tangibles. Scholars have advised that the *ServQual* instrument be contextualized to the investigative setting (Malhotra and Mukherjee 2004). Given our focus on the output quality of customer service work systems, we called each customer to evaluate his or her perception with regard to a specific service contact. To make customers comfortable with the length of the telephone interview, we followed prior studies and measured each *ServQual* dimension with two items (Gotlieb et al. 1994, Froehle 2006). All items were measured as Likert scales ranging from strongly disagree (1) to strongly agree (5). For a robustness check, we also used another single-item measure (Zeithaml et al. 1996), which asked each customer to assess, from extremely poor (1) to extremely good (5), how satisfied he or she was with the specific service contact. Both scales of *ServQual* yielded highly consistent results.

4.2.3. Company's Archival Data. For each service employee, the company provided us with monthly archival data for the exact numbers of *Customers Signed In* (i.e., new customers to the company's products/services) and *Services/Products Sold* (i.e., amount of sales to both new and existing customers). These are the two primary indices for evaluating CSE performance (both of which were log transformed to smooth out data skewness).

4.3. Data Collection Procedure

Data collection consisted of multiple steps at different points of time. Table 2 reports the timeline and scope of our data collection. First, our measures were adapted from prior studies published in English and our surveys were conducted in Chinese. To ensure that the measures were conceptually consistent when presented in Chinese, two certified professional translators independently translated and back translated the questionnaire between English and Chinese (Brislin et al. 1973). Next, questionnaires in Chinese were distributed to 35 randomly selected CSEs as part of a pilot study to examine construct validity and reliability preliminarily. We also pilot tested the *ServQual* instrument by telephone interviewing 30 randomly selected customers. Some customers complained about the length of the *ServQual* instrument. To address this issue, we dropped the tangible dimension items (i.e., appearance of physical facilities and personnel). Although the OCRM technology can be instrumental for improving CSEs' performance in the other four *ServQual* dimensions (reliability, responsiveness, assurance, and empathy), it has little association with the appearance of physical facilities and personnel. The shortened instrument was further tested with 15 customers. No further complaints were received and some minor modifications in wording

Table 2 **Data Collection Timeline and Scope**

Data collection timeline	Time 1	Time 2 (four months after Time 1)	Time 3 (one month after Time 2)
		Theoretical variables	
Service employee data	*Information Quality, System Quality*	*Service Employee Participation, Work System Coordination, Extended Use, Capacity to Satisfy Customers*	—
Customer data	*Service Quality* (seven customers per employee)	—	—
Company's archival data	—	—	*Customers Signed In, Products/Services Sold*
		Control variables	
Service employee data	*Age, Gender, Education, Prior Usage Experience, Prior Service Experience*	—	—
Company's archival data	*CSE Prior Performance, Store Prior Performance*	—	*Store Location, Store Service Area, Store Marketing Budget, Store IT Budget, Store PC Quantity, Store Employee Number*

were made based on the feedback from CSEs and customers.

The first wave of the survey (at Time 1) involved 300 randomly sampled CSEs across retail stores in the selected province. In total, 248 CSEs returned the survey. Four months later (Time 2), we conducted the second wave of data collection by distributing surveys to the 248 employees; we received 196 responses. Importantly, to encourage responses and ensure data confidentiality, we explicitly emphasized that we coded subjects' identity in such a way that only the research team could match data from different sources and across different time points and that no one in the company could identify the subjects. We also assured the CSEs that we would only present aggregate statistics. The company later offered us access to its archival data about CSEs' service performance at Time 3 (one month after Time 2).

During the three data collection time points, some of the 196 respondents at Time 2 experienced promotion, change of functions, or transfer to different stores. Therefore, we retained a subject for analysis only if (1) he or she had performance data at Time 3 and (2) he or she remained in the same retail store as a CSE throughout the three points of time in order to control for potential confounds because of changes in the working environment. This left us 148 subjects (in 53 stores) for empirical analysis.

For each CSE that responded at Time 1, the firm randomly sampled seven customers that he or she served in the same week and immediately called these customers to obtain their perceptions of service quality with regard to their encounters with the corresponding CSE. Because this type of survey requires significant time and effort, the firm's decision to obtain responses from seven customers for each CSE is the result of resource consideration. Then, for each measurement item of *ServQual*, the average of the seven customers' responses was used as the score for that item. The overall inter-rater reliability among customer responses for each CSE was 0.82, suggesting substantial agreement among customer evaluations toward CSEs' service quality (James et al. 1984).

4.4. Control Variables

Technology usage behavior may vary across users with different demographic characteristics (e.g., Agarwal and Prasad 1999, Venkatesh et al. 2002), such as age, gender (1 = male, 0 = female), education (1 = elementary or below, 2 = junior high, 3 = senior high, 4 = college, 5 = bachelor or above), prior technology usage experience (i.e., number of months using OCRM technologies), and prior service experience (i.e., number of months working as a CSE). We collected information about these demographic characteristics and included them as control variables.

CSEs' service performance may be correlated with their prior performance and also with the performance of the stores in which they work (Zeithaml and Bitner 2002). We thus controlled for these two performance variables, which were evaluated by the firm at the end of the year prior to this study. CSEs' performance may also be affected by resources that support their service operation (Ray et al. 2005). We included the stores' service area (i.e., area within a store used for service encounter, in square meters). We also included the stores' annual marketing budgets to represent resources devoted to customer services, as well as annual IT budgets to represent available IT resources (Mithas et al. 2005, Ray et al. 2005). The IT and marketing budgets were annual budgets for the year in which this study was conducted. Given that CSEs mainly use PCs when applying the OCRM technology, we also controlled for the number of PCs available in each store. We obtained these variables to control for resources, and divided them by the number of employees in each store for size adjustment.

In addition, because large and small stores may differ in inertia because of size and their potential to leverage slack resources (Mithas et al. 2005), we controlled for store size (number of employees, log transformed). Because consumers in rural and urban areas may differ in income and demand for telecom services (Chen et al. 2010, Hsieh et al. 2011), we controlled for store location (0 = rural, 1 = urban). Finally, by focusing on one company, we controlled for industry-specific factors that may cause systematic differences in the OCRM technology's functions. This helps us to understand how users' post-adoptive behavior is related to sensemaking and particular feedback mechanisms at the levels of the technology and work system.

5. Data Analysis and Results

5.1. Measurement Model

We chose PLS-Graph 3.00 (Build 1126) for data analysis. We modeled each construct as reflective, with two exceptions: *WSC* and *TechQual*. Jarvis et al. (2003) suggest specifying measures as formative if they (1) do not necessarily covary; (2) need not be interchangeable; and (3) cause their construct, as opposed to being caused by it. The four mechanisms for *WSC*, as discussed earlier, differ in their abilities and costs to coordinate, and so are not interchangeable and do not have to covary; also, the direction of causality is from the items to the construct. The two dimensions of *TechQual*—*System Quality* and *Information Quality*—are conceptually distinct and not interchangeable, do not necessarily have to covary, and collectively determine the quality of the IT artifact (Gable et al. 2008). Therefore, it is appropriate to model *WSC* and

TechQual as formatively measured. We further applied the vanishing tetrad analysis (Bollen and Ting 2000) to evaluate whether the measures for the constructs should be modeled as reflective or formative. The results support modeling *WSC* and *TechQual* as formative measures and modeling the other constructs as reflective.

For constructs with reflective measures, we assessed internal consistency and convergent validity by examining item loading, composite reliability, and average variance extracted (AVE). Item loadings are significant and of high magnitude (see Appendix B.1). As shown in Table 3, composite reliabilities are all higher than 0.707 and AVE values are all above 0.50 (Fornell and Larcker 1981). Next, for each pair of constructs, the absolute value of their correlation is less than the square root of each construct's AVE (Appendix C), which supports discriminant validity (Fornell and Larcker 1981).

For constructs with formative items, we examined item weights (Appendix B.2). All indicator weights for *TechQual* were positive and significant. Interestingly, the indicator weights for *WSC* included significant and insignificant ones, as well as positive and negative ones. We followed Cenfetelli and Bassellier (2009) to interpret and assess the weights for *WSC*.

The key to the interpretation of formative indicators is to distinguish relative versus absolute contribution of the indicators to their focal construct. "As important as formative indicator weights are for determining their *relative* contribution to their assigned construct, it is also possible to evaluate the *absolute* importance of an indicator to its construct" (Cenfetelli and Bassellier 2009, p. 697). Specifically, Cenfetelli and Bassellier (2009) suggest that we assess the indicator's absolute importance (to the construct) by examining its zero-order correlation with the formatively measured construct, and that we interpret an indicator's weight on its formatively measured construct as its relative contribution to the construct when controlling for the effects of all other indicators. Following this suggestion, we examined zero-order correlations among *WSC* and its four indicators (Appendix B.3). On the one hand, each indicator had a significant and positive correlation with the *WSC* construct, suggesting each indicator is an important aspect of *WSC* of its own accord. On the other hand, the negative weight for WSC3 and the insignificant weight for WSC4 (see Appendix B.2) should be interpreted as their relative contribution to *WSC* after controlling for the other channels.

We further assessed WSC3 and WSC4 to determine whether to retain them, following the procedures

Table 3 Descriptive Statistics and Construct Reliability

Construct[a]	Mean	Median	Std. dev.	Composite reliability	Average variance extracted
Theoretical variables					
Extended Use (3)	6.22	6.34	1.09	0.85	0.66
Technology Quality (2)[b]	4.77	4.92	1.29	—	—
System Quality (3)	4.31	4.20	1.32	0.97	0.91
Information Quality (3)	4.76	5.23	1.24	0.97	0.92
Service Quality (8)	5.06	5.04	0.33	0.90	0.53
Service Employee Participation (5)	5.02	5.18	1.33	0.93	0.72
Work System Coordination (4)[b]	2.21	2.23	0.96	—	—
Capacity to Satisfy Customers (3)	4.74	4.63	0.68	0.89	0.73
Customers Signed In (1)	3.99	4.44	1.50	—	—
Products/Services Sold (1)	4.90	5.15	1.17	—	—
Controls					
Age (1)	24.32	24.00	1.99	—	—
Gender (1)	0.78	1.00	0.42	—	—
Education (1)	3.88	4.00	0.63	—	—
Prior Usage Experience (1)	29.33	32.00	14.73	—	—
Prior Service Experience (1)	35.30	36.00	20.12	—	—
User Prior Performance (1)	84.08	82.50	8.05	—	—
Store Prior Performance (1)	86.62	87.50	6.63	—	—
Store Geographical Location (1)	0.99	1.00	0.12	—	—
Service Area per Employee (1)	15.85	13.57	13.67	—	—
Marketing Budget per Employee (1)	144.25	79.84	144.53	—	—
IT Budget per Employee (1)	1.95	1.00	2.03	—	—
Number of PCs per Employee (1)	0.79	0.78	0.21	—	—
Store Size (1)	2.32	2.20	0.43	—	—

[a]The numbers in parentheses indicate the number of items/subconstructs in the scale.

[b]*Technology Quality* is formatively measured by *System Quality* and *Information Quality*; *Work System Coordination* is also formatively measured. Composite reliability and average variance extracted are not reported for these two constructs.

suggested by Cenfetelli and Bassellier (2009). For a negatively weighted item (e.g., WSC3), we should retain it if there is no harmful collinearity and no strong suppressor effect (Cenfetelli and Bassellier 2009). The low variance inflation factors (VIFs) suggest no harmful collinearity (see Appendix B.3); additional tests suggest no strong suppressor effect.[3] For an insignificant item (e.g., WSC4), we should retain it if it is theoretically relevant to its construct and has significant absolute contribution to the construct (Cenfetelli and Bassellier 2009). In our case, WSC4 is theoretically a possible coordination channel and has no conceptual overlap with other channels; the correlation between WSC4 and its construct is significant, suggesting its absolute importance (Appendix B.3). We thus retain WSC3 and WSC4.

In sum, these results are consistent with our expectation that the four coordination mechanisms (WSC1–WSC4) may assume different importance and that some may even present a negative effect *relative to* others (Boh and Yellin 2006). Therefore, based on both theoretical rationale and statistical evidence, using the four channels as a collection to formatively measure work system coordination is justified. After establishing an adequate measurement model, we proceed to hypothesis testing using the above constructs along with other control variables. (See Table 3 for the mean, median, and standard deviation of each variable.)

5.2. Structural Model

Figure 2 presents our structural model, reporting the estimated path coefficients and R^2s. We examined Cook's D and found no influential cases, and checked VIFs and found no harmful collinearity (Karimi et al. 2007). Below we discuss the results of the hypothesis testing.

H1A and H1B propose *Technology Quality* (*TechQual*) and *Service Quality* (*ServQual*) as antecedents of *Extended Use* (*ExtU*). Figure 2 shows significant paths from *TechQual* and *ServQual* to *ExtU*. We thus found support for H1A and H1B.

H2 predicts that *Service Employee Participation* (*SEP*) moderates the impact of *TechQual* on *Extended Use*. To test this prediction, we formulated an interaction term *SEP* × *TechQual* based on the approach by Chin et al. (2003) and Goodhue et al. (2007); and we found a significant ($p < 0.05$) and negative path from the interaction term to *Extended Use*.[4] The interaction diagram (Figure 3(a)) revealed a more nuanced understanding about the form of the interaction. In the diagram, the low, middle, and high levels of a variable indicate sample mean minus one standard deviation, sample mean, and sample mean plus one standard deviation, respectively (Aiken and West 1991). As expected, even if the previously assessed technology quality is low (say, in the case of low *TechQual* in Figure 3(a)), *SEP* facilitates CSEs to use the technology more extensively. *SEP* thus mitigates the negative effect of low technology quality on extended use. This supports H2.

H3 hypothesizes that *Work System Coordination* (*WSC*) moderates the impact of *ServQual* on *Extended Use*. Similar to the procedure for testing H2, we created an interaction term *WSC* × *ServQual* and found a significant ($p < 0.01$) and negative path from it to *Extended Use*. Consistent with our anticipation, the interaction diagram (Figure 3(b)) reveals that, even if the previously assessed service quality is low, *WSC* facilitates CSEs to use the technology more extensively. This result supports H3 that *WSC* mitigates the negative effect of lower service quality on extended use.

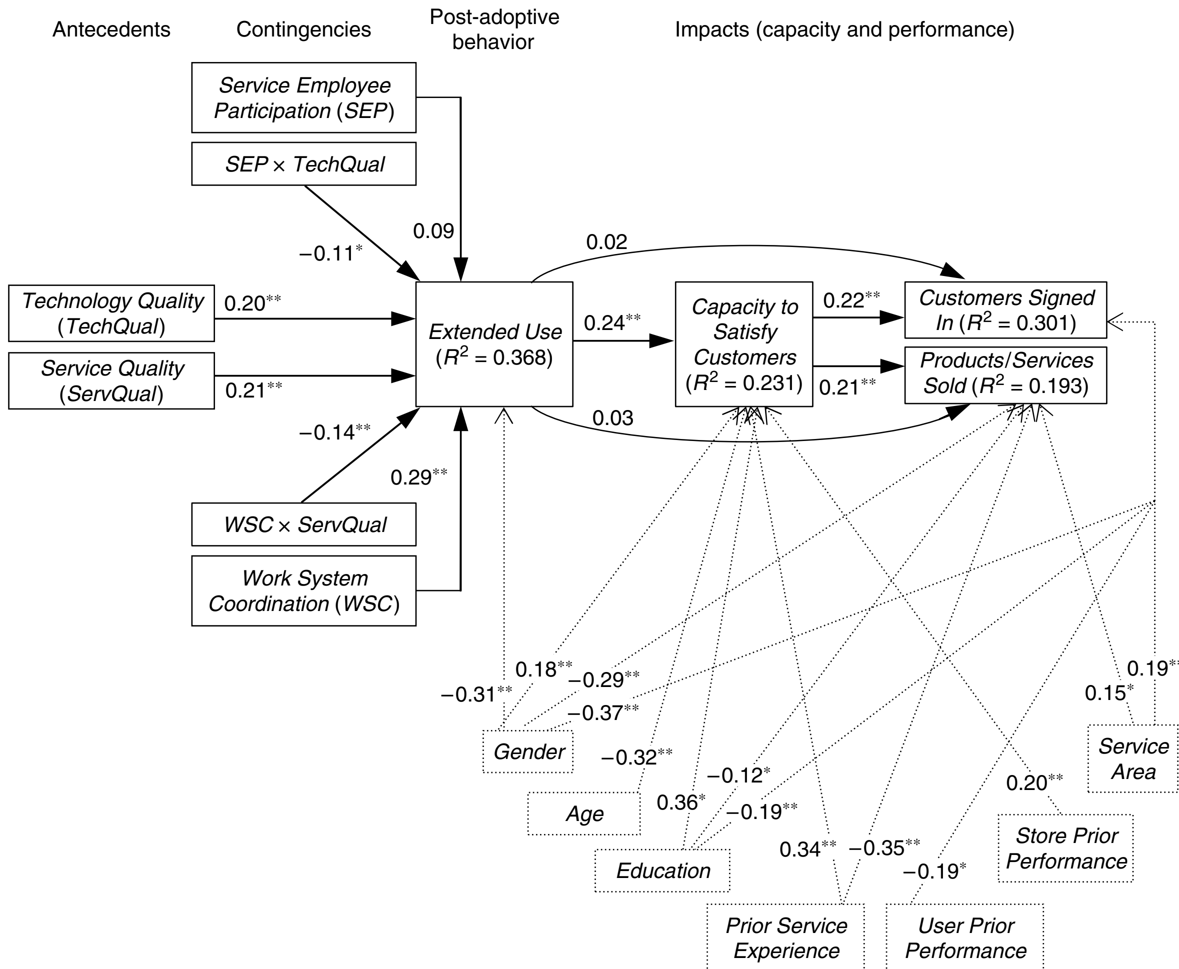
As for H4, Figure 2 shows a positive link from *Extended Use* to *Capacity to Satisfy Customers*, which, in turn, has a positive link to each of the two objective indices for *Service Performance—Number of Customers Signed In* and *Products/Services Sold*. These results indicate mediated paths (*Extended Use* → *Capacity to Satisfy Customers* → *Service Performance*). To assess the mediated paths, we added direct links from *Extended Use* to the two objective indices; neither of the two direct paths was significant (Figure 2). In addition, we followed the procedure suggested by Hoyle and Kenny (1999) to use z-statistics to assess the significance of mediated paths. We found significant z-statistics, confirming salient mediated paths. These results collectively suggest significant relationships from *Extended Use* to *Capacity to Satisfy Customers to Service Performance*, thereby supporting H4.

Finally, we assessed the explanatory power of *Extended Use*, our primary interest of research. We compared the structural model (Figure 2) with a partial model without *Extended Use*; we found that *Extended Use* explains an incremental variance of 0.049 in *Capacity to Satisfy Customers* beyond the controls.

[3] We estimated regressions using the PLS construct score of *WSC* as the dependent variable, and WSC3 and any of the other two indicators for *WSC* as the independent variables. In each of the regressions, the coefficient of WSC3 is negative and significant. This suggests that there is no strong suppressor effect.

[4] When formulating an interaction effect using PLS, a formative construct should be represented by its construct score. (See Appendix D of Chin et al. 2003.) A reflective construct requires at least 150 observations per four indicators when using the product-indicator approach to form an interaction (Chin et al. 2003); if the actual sample size does not meet this requirement, then the reflective construct should be represented by its construct score (Goodhue et al. 2007, Tanriverdi 2006). We followed these suggestions to multiply the mean-centered construct scores of *SEP* and *TechQual* to create their interaction term. Additionally, the interaction effect can be assessed by moderated regression analysis (MRA) (Chin et al. 2003, Hsieh et al. 2008, Venkatesh and Bala 2008). We applied both MRA and PLS methods and found highly consistent results.

Figure 2 Structural Model



Note. This figure includes significant controls only.
$^{*}p < 0.05$; $^{**}p < 0.01$.

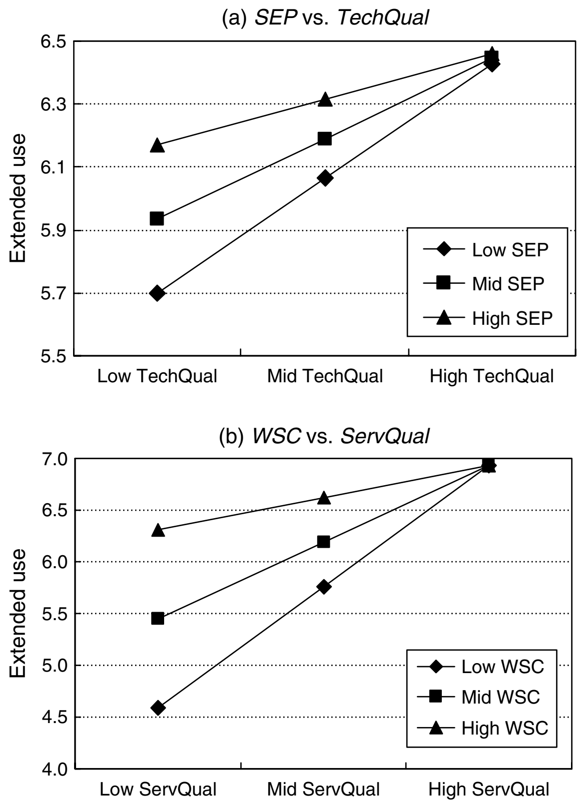
The incremental variance is associated with an effect size of 0.064, between a small and a medium effect size (Ellis 2010). Therefore, the impact of extended use is both statistically significant and pragmatically meaningful.

The research design proposed a total of thirteen control variables, but the sample size ($N = 148$) could not adequately support a model consisting of the theoretical variables along with all of the controls simultaneously. Therefore, we followed the approach by Liang et al. (2007) to evaluate the implications of retaining only the significant controls. Specifically, we compared three models: one with no controls, one with all 13 controls included, and one with the significant controls retained. We found qualitatively consistent results across the three models: no significant theoretical relationships became insignificant, and vice versa, and no significant theoretical relationships changed in sign. Figure 2 presents the PLS results with the significant controls. The results show that female CSEs reported higher levels of *Extended Use* and had better performance. CSEs in stores with higher prior performance, CSEs with more service experience or education attainment, and younger CSEs had greater *Capacity to Satisfy Customers*. Interestingly, CSEs with higher education level, more service experience, or better prior performance signed in fewer customers and sold fewer products/services. A possible explanation is that those employees were assigned more responsibilities in activities other than serving customers (e.g., assisting in administrative functions, training, etc.). Finally, CSEs in stores with larger service areas had better performance.

5.3. Additional Analysis

We bolstered the above results with a battery of additional analysis. We briefly present the additional analysis below and report statistical details in the electronic companion (available at http://arunrai.us/eCompanion_Msci_Extracting_Business_Value.pdf).

Figure 3 Interaction Diagrams



5.3.1. Causation Between Service Quality and Extended Use. We conducted a two-step Heckman analysis (Bharadwaj et al. 2007) to evaluate reverse causation that *Extended Use* may help improve *Service Quality*. The results of this Heckman analysis (Appendix EC-1, electronic companion) suggest that our original results are robust after addressing potential reverse causation.

5.3.2. Controlling for Performance Impacts of Use Time. We examined the robustness of our finding on *Extended Use* (*ExtU*) by taking into account *Use Time*, measured as a 0–100% ratio scale representing the percentage of CSEs' work time spent using the technology (Rai et al. 2002). The results in Appendix EC-2 (electronic companion) show that, with *Use Time* added, all paths associated with *ExtU* remained highly consistent compared to those in Figure 2. By contrast, *Use Time* had no significant performance impact. Whereas *Use Time* captures the pervasiveness of technology use, *ExtU* reflects the proficiency of use. CSEs can achieve better performance through active learning and deeper use of the technology but not necessarily through longer time of use. This analysis provides complementary evidence underscoring the theoretical importance of *Extended Use*.

5.3.3. Robustness of the Feedback Mechanisms. We further conducted a series of robustness checks for the two feedback mechanisms. As detailed in Appendix EC-3 (electronic companion), we (1) examined partial models and included additional two-way and three-way interactions in the models (Carte and Russell 2003), (2) used group analysis by splitting CSEs with high/low *SEP* or high/low *WSC* (Venkatesh 2000), (3) used an alternative *ServQual* measure to double check the effects of the feedback mechanisms (Zeithaml et al. 1996), and (4) winsorized the two interaction terms (*SEP* × *TechQual*, *WSC* × *ServQual*) to reduce their variations (Carte and Russell 2003). The results of these additional tests suggest that the results in Figure 2 are robust to alternative model specifications. In particular, we found that our PLS results (Figure 2) remained qualitatively unchanged after adding two cross interactions (*SEP* × *ServQual*, *WSC* × *TechQual*), and the cross interactions turned out to be insignificant. This confirms our earlier argument that appropriate feedback mechanisms need to be implemented at the technology level and at the work system level.

6. Discussion

Drawing on the sensemaking perspective, we developed a framework (Figure 1) and conducted an empirical test to advance our understanding of the antecedents of extended use and, importantly, how the mechanisms that facilitate employee feedback can promote extended use even in the presence of unfavorable antecedents. Our results also have significant implications for research on post-adoptive IT use and its impacts, as we find extended use to have significant effects on users' work performance. With these findings, we make important theoretical and practical contributions.

6.1. Contributions to Research

First and foremost, our work highlights the value of the sensemaking perspective as an overarching theoretical lens for understanding post-adoptive IT use. In particular, we demonstrate that the core properties of sensemaking (Table 1) are instrumental for conceptualizing the antecedents, contingencies, and performance impacts of extended use, as well as for theorizing the underlying rationale for their relationships. Our research design with data collected over time is also consistent with the perspective that sensemaking is ongoing. This work thus pushes the envelope of theoretical development and research design to understand IT usage behavior in the post-adoptive stage. Although our study focuses primarily on the post-adoptive stage, we encourage interested scholars to examine the role of sensemaking theory in understanding other stages of the IT implementation process.

Second, our study identifies that sensemaking about the post-adoptive use of IT occurs at two levels: the technology level and the work system level. Our study suggests that quality signals at these two distinct levels (technology quality at the technology level and customer service quality at the work system level) affect extended use positively. We advance our theoretical understanding about post-adoptive IT usage behavior by identifying the two key quality signals through which users make sense of the IT that they are using and of the IT-enabled work system in which the IT use is situated. Importantly, our study elaborates on the quality antecedents that are typically considered in the IS success discourse (e.g., DeLone and McLean 1992, 2003). Although IS success models have typically focused on technology quality, our study demonstrates the importance of not only considering the quality of IT but also considering the quality of the output that is produced by the IT-enabled work system. Given that a variety of enterprise applications enable or support contemporary work systems, it is important to broaden IS success models to incorporate the quality of the IT-enabled work system, not just IT, as affecting users' attitudes, beliefs, and behaviors.

Third, tightly coupled with the above two-level conceptualization, our study sheds light on how feedback mechanisms, as contingencies at the technology level and the work system level, shape the link from quality signals to extended use. Our results suggest the need to shift more attention to how negative influences of low quality can be transcended through user input for technology improvement and through coordination mechanisms for the synthesis of various work system members' knowledge. These feedback mechanisms—user participation and work system coordination—pertain to the learning process during the post-adoptive stage (Jasperson et al. 2005, Saga and Zmud 1994) in which end users gradually realize the strengths and weaknesses of the technology and express their views in this regard, and in which work system members, including users, managers, and IT support staff, develop and synthesize insights into integrating the technology and work system. These learning activities facilitate sensemaking about the opportunities at the technology and work system level and mitigate barriers to extended use that emerge from low IT quality and low work system quality. As such, combining the sensemaking perspective and the role of learning offers a useful integrative lens through which future research can examine how to promote deeper technology use during the post-adoptive stage in complex IT-enabled work systems.

In addition, our work yields a nuanced understanding about the distinct need to leverage feedback mechanisms at the technology and work system levels. Our results suggest that specific mechanisms can only be effective when they are applied where appropriate (as summarized in Table 4). Our findings suggest that we can expand our understanding of feedback mechanisms by theorizing and testing their effects at finer-grained levels, such as at the technology level and the work system level in the present study.

Fourth, regarding the specific feedback mechanism at the technology level, our study reveals that user participation plays a critical role in the post-adoptive stage and extends our understanding on its pivotal role in the early stages of the IT implementation process (He and King 2008). Past studies have typically focused on the importance of eliciting user input in the early stages of the IT implementation process so as to capture system requirements effectively. However, if we conceive IT implementation as an extended learning process, user participation that helps to elicit user insights is a valuable practice throughout the various stages of IT implementation. Specifically, in the early stages of IT implementation, user participation facilitates requirements elicitation and users' initial acceptance of the system; whereas in the post-adoptive stage, it facilitates extended use by mitigating the negative effects of low technology quality. As

Table 4 **The Contingency Effect of Feedback Mechanisms on the Role of Quality Signals**

	Quality signals	
Feedback mechanisms	Employee-assessed technology quality (technology level)	Customer-assessed service quality (work system level)
User participation in technology quality improvement (technology level)	Effective	Not effective
Work system coordination (work system level)	Not effective	Effective

Note. In this table, "effective" indicates that the feedback mechanism plays a significant contingency role in shaping the link between the quality signal and extended use.

for the specific feedback mechanism at the work system level, our results shed light on the nature of coordination in the IT-enabled work system. Although the extant IT literature (e.g., Boh and Yellin 2006, Chatterjee et al. 2002) has mainly studied coordination channels at the firm level, we extended this stream of research to the work system level and identified its contingent role in promoting extended use in case of low service quality.

Our last contribution lies in identifying and showing the effects of CSEs' extended use on their *actual* performance; in this regard, we contribute to the literature in three ways. First, as the literature has noted the importance of IT use as a link to IT benefits (e.g., Rai et al. 2002; DeLone and McLean 1992, 2003; Devaraj and Kohli 2003), we provide new evidence emphasizing the beneficial impact of users' active learning and using additional functions (in the form of extended use). This is different from the traditional conceptualization of technology use that focuses on the pervasiveness of use (e.g., time, frequency, etc.). As IS scholars increasingly elaborate the traditional conceptualization of IS use (Boudreau and Seligman 2005), our study advances this discussion by revealing the concrete impacts of extended use beyond use time. Second, our results indicate that extended use of the OCRM technology provides the function of capacity augmentation for CSEs to satisfy their customers. The mediated relationships (i.e., *Extended Use* → *Capacity to Satisfy Customers* → *Customers Signed In* and *Products/Services Sold*) shed light on the critical pathway to realize the technology's benefits. Third, we add to the customer relationship management literature by suggesting alternative ways to examine the impacts of CRM technology. Our study, focusing on technology use by individual CSEs, extends previous research on CRM technology use at the firm and business process levels (e.g., Mithas et al. 2005, Ray et al. 2005, Jayachandran et al. 2005). We provide a complementary view for assessing the usage and impacts of OCRM technology by attributing the technology's benefits to extended use. This contributes to the ongoing debate on the mixed performance impacts of OCRM technology (e.g., Ray et al. 2005, Jayachandran et al. 2005).

6.2. Managerial Implications

Confronted with the increasingly demanding business environment and particularly the financial downturn, firms should consider how to extract the value of already-implemented technologies more fully. Toward this end, this study showcases the positive performance outcomes brought about by post-adoptive extended use of IT. Once OCRM technology has been successfully implemented and utilized on a regular basis, managers should shift their attention beyond mandatory use and encourage higher-level usage behavior, such as extended use, in order to maximize the returns of the technologies in which they have invested.

Extended use is a voluntary behavior and, in essence, reflects whether employees identify with the technology and are willing to learn and utilize more of the available functions to support their work. In this vein, managers should focus on the quality signals that reflect the capabilities of both the technology and the technology-enabled work system. In the presence of positive signals about the technology (i.e., *Technology Quality*) and about the technology-enabled work system outcomes (i.e., *Service Quality*), employees can smoothly engage in extended use behavior. Nevertheless, unfavorable quality signals can destructively introduce a vicious learning cycle such that employees are unwilling to expand their knowledge and use of the additional functions in the installed technology. To rectify this vicious cycle, managers can resort to such feedback mechanisms as user participation in technology quality improvement and work system coordination for integrating the technology with the work system.

When applying feedback mechanisms to attain more extensive use of the installed IT, managers should understand the contingencies between different mechanisms and quality signals. Specifically, to deal with low technology quality, managers should solicit employee input for technology improvement. To address the issue of low service quality, it is critical to leverage cross-functional work system coordination to synthesize distinctive knowledge from users, managers, and IT support staff (of the work system). Importantly, there are different channels that can be used for work system coordination (i.e., standard operating procedures, coordination via direct supervisors, coordination via liaison personnel, and direct contact), and each is associated with different capacities and costs. Managers should, therefore, deploy these channels with careful consideration.

6.3. Limitations and Future Research

Although this study focuses primarily on extended use, there are other types of post-adoptive usage behaviors that deserve further attention, e.g., adaptive use (Sun and Zhang 2008) and innovative use (Nambisan et al. 1999, Ahuja and Thatcher 2005). When choosing the usage behaviors for investigation, researchers should consider two contextual factors: technologies and tasks. For technologies that are malleable and allow for creating new applications (such as analytical CRM technology) and for tasks that require a lot of creativity, innovative use may be the suitable focus of investigation.

We model WSC as a formative measure consisting of the four coordination channels. One potential alternative is the dimension set approach that models the four channels as four separate constructs. Regarding this alternative approach, methodologists contended that although "analyses of the relations between specific dimensions of a multidimensional construct with other constructs may enrich our understanding of the construct, treating dimensions as a set of individual variables precludes any general conclusion about the relations between a multidimensional construct and other constructs" (Law et al. 1998, pp. 749–750). Given our focus on achieving an overall understanding about the role of WSC in the research model, our aggregated approach is appropriate in this study. Importantly, our conclusion on work system coordination is qualitatively unaffected even if we use the dimension set approach. (See Appendix IV, electronic companion.) Yet, the negative and insignificant weights for some of the WSC items suggest that one must be careful when interpreting the results and using the measurement in future research. In particular, Cenfetelli and Bassellier (2009) argued that, if repeated studies find an indicator to be negative, the indicator could be "measuring something else" and should not be part of the formative construct. Further research is needed to sort this out.

Our empirical study was only conducted in one firm in the telecom service industry. However, we believe the nature of employee-customer interactions is similar across many service industries, such as in financial services and insurance services, if not in all industries. Moreover, because China has become one of the most important emerging markets in the world, multinational firms that are interested in capitalizing on the Chinese market should pay particular attention to research findings in this region. Further research can seek to verify if our framework is also applicable to other cultural and economic contexts. For instance, prior research has indicated that the effect of social influence is contingent upon cultural contexts (e.g., Srite and Karahanna 2006); it would thus be interesting to examine whether the importance of the feedback mechanisms varies across populations with different cultural backgrounds.

Drawing on the sensemaking perspective, our framework was conceived specifically for customer service work systems enabled by OCRM technology in the post-adoptive stage. Thus, the antecedents, contingencies, and consequences of the focal construct—extended use—were also specific to the investigative work system, and the results should be interpreted as such. However, information technologies can be deployed for various kinds of work systems, including manufacturing, design, logistics, human resource, finance, and accounting work systems. Scholars who are interested in post-adoptive behavior are encouraged to extend our framework to other work systems.

Finally, given that CSEs' sensemaking is ongoing, it consists of cycles from using technology to performance impact to perceiving service quality. We focused on the role of service quality as an antecedent of extended use, and designed our research and conducted our analysis accordingly. A useful direction for future research is to look deeper into the dynamic, causal relationship between extended use and the ensuing service performance.

7. Concluding Remarks

We draw upon the sensemaking perspective to formulate a theoretical framework around post-adoptive IT usage behavior (specifically extended use) and identify its antecedents, contingencies, and performance impacts in the context of customer service work systems enabled by OCRM technology. Using longitudinal and multisourced data collected from a telecom service firm, our results suggest that customer service employees' extended use is impacted by quality signals, which reflect the capabilities of the technology and the technology-enabled work system. In the presence of low-quality signals, effective mechanisms eliciting and harmonizing feedback from work system members can mitigate the undesirable influence arising from low technology quality or from low customer service quality, thereby promoting extended use. In addition, feedback mechanisms are effective only when they are applied to the appropriate levels. Specifically, service employee participation is effective at the technology level, and work system coordination is effective at the work system level. Finally, extended use can enhance service employees' capacity to satisfy customers, which in turn contributes to their performance outcomes. These results, as a whole, extend our theoretical and practical understanding of users' post-adoptive sensemaking and of applying effective feedback mechanisms in order to extract more fully the potential of information technologies at the post-adoptive stage.

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Appendix A. Measurement Items

Constructs	Measures	Sources
	Data collected from customer service employees	
System Quality 1 = Strongly disagree 7 = Strongly agree	SysQual1: In terms of systems quality, I would rate the OCRM technology highly. SysQual2: Regarding the OCRM technology, overall, its information systems are of high quality. SysQual3: Overall, I would give the quality of the CRM technology a high rating.	Wixom and Todd (2005)
Information Quality 1 = Strongly disagree 7 = Strongly agree	InfoQual1: Overall, I would give the information from the OCRM technology high marks. InfoQual2: Overall, I would give the information provided by the OCRM technology a high rating in terms of quality. InfoQual3: In general, the OCRM technology provides me with high-quality information.	Wixom and Todd (2005)
Extended Use 1 = Strongly disagree 7 = Strongly agree	ExtU1: Over the last two months or so, I often use most of the functions of the OCRM technology to support my work. ExtU2: Over the last two months or so, I have learned about and used new functions of the OCRM technology to support my work. ExtU3: Over the last two months or so, I use more functions of the OCRM technology than I normally use to support my work.	Schwarz (2003), Saga and Zmud (1994), Hsieh and Wang (2007)
Service Employee Participation 1 = Strongly disagree 7 = Strongly agree	You are encouraged to actively participate in . . . SEP1: Routine test of the OCRM technology SEP2: Reporting errors/bugs in the OCRM technology SEP3: Recommending how to improve the current functions SEP4: Suggesting new functions for the OCRM technology SEP5: Requesting hardware update for the OCRM technology	Ravichandran and Rai (2000)
Work System Coordination 1 = Never 5 = Very often	According to your experience, which channels are used for you to coordinate with the IT support staff and your managers on how OCRM technologies can be better integrated into your customer service activities? WSC1: Formalized operating procedures (e.g., regular meetings, formalized process to report, and track issues, etc.) WSC2: Coordination with managers and IT support staff through your direct supervisor WSC3: Coordination with managers and IT support staff through liaison personnel WSC4: Direct contact with IT support staff[a]	Chatterjee et al. (2002), Kumar and Seth (1998)
Capacity to Satisfy Customer 1 = Never 5 = Very often	How often do you feel that CSC1: You are confident about your ability to satisfy customers CSC2: You are making customers happy CSC3: You can satisfy customer requirements	Sergeant and Frenkel (2000)
Use Time (0–100% ratio scale)	What is the percentage of your work time spent using the OCRM technology to support your work?	Rai et al. (2002)
Service Quality 1 = Strongly disagree 5 = Strongly agree	Please consider your experience with the service provided by the specific service employee at (time and date) at (retail store): ServQual1: The service employee showed a sincere interest in serving you. ServQual2: The service employee was professional. ServQual3: The service representative gave you prompt service. ServQual4: The service employee was very responsive to your needs. ServQual5: The service employee was courteous with you. ServQual6: The service employee had the knowledge to answer your questions. ServQual7: The service employee understood your personal requirement. ServQual8: The service employee addressed your problems and needs thoroughly.	Parasuraman et al. (1991), Froehle (2006), Gotlieb et al. (1994)

[a]We did not include direct contact with managers in our list of channels, because we discovered that all CSE contact with managers was mediated by either supervisors or liaison personnel.

Appendix B.1. Loadings of Reflective Items

Item	Loading	t-stat.	Item	Loading	t-stat.
Extended Use			*Service Quality*		
ExtU1	0.81	15.38	ServQual1	0.77	4.72
ExtU2	0.88	28.80	ServQual2	0.73	4.12
ExtU3	0.74	12.58	ServQual3	0.73	4.13
System Quality			ServQual4	0.79	3.85
SysQual1	0.95	77.19	ServQual5	0.73	3.75
SysQual2	0.97	144.42	ServQual6	0.76	3.47
SysQual3	0.94	87.55	ServQual7	0.76	3.47
Information Quality			ServQual8	0.50	2.63
InfoQual1	0.96	128.96	*Service Employee Participation*		
InfoQual2	0.97	119.18	SEP1	0.81	18.10
InfoQual3	0.94	58.05	SEP2	0.86	30.14
Capacity to Satisfy Customers			SEP3	0.87	33.71
CSC1	0.92	36.27	SEP4	0.84	22.35
CSC2	0.88	25.73	SEP5	0.86	31.31
CSC3	0.75	10.77			

Appendix B.2. Weights of Formative Items

Item	Loading	t-stat.	Item	Loading	t-stat.
Technology Quality			*Work System Coordination*		
SysQual	0.57	6.86	WSC1	0.87	3.89
InfoQual	0.48	5.87	WSC2	0.39	2.14
			WSC3	−0.51	−1.91
			WSC4	0.03	0.17

Appendix B.3. Summary Statistics for Items of Work System Coordination

			Zero-order correlation				
Item	Mean	Std. dev.	WSC1	WSC2	WSC3	WSC4	Variance inflation factor (VIF)
WSC1	2.61	0.98					1.85
WSC2	2.66	0.94	0.61**				1.81
WSC3	2.27	1.01	0.45**	0.52**			1.67
WSC4	2.65	0.94	0.55**	0.47**	0.57**		1.76
Construct score			0.91**	0.76**	0.23**	0.52**	

$^{*}p < 0.05$; $^{**}p < 0.01$.

Appendix C. Zero-Order Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(1) *Extended Use*[a]	*0.81*																					
(2) *System Quality*[a]	**0.40**	*0.95*																				
(3) *Information Quality*[a]	**0.36**	**0.80**	*0.96*																			
(4) *Service Quality*[a]	**0.16**	−0.04	0.03	*0.73*																		
(5) *Service Employee Participation*[a]	**0.29**	**0.41**	**0.43**	−0.04	*0.85*																	
(6) *Work System Coordination*	**0.32**	**0.34**	**0.35**	**−0.16**	**0.33**	—																
(7) *Capacity to Satisfy Customer*[a]	**0.20**	0.15	0.07	−0.13	**0.17**	0.04	*0.85*															
(8) *Customers Signed in*	**0.20**	**0.25**	**0.19**	−0.10	0.08	0.17	0.16	—														
(9) *Products/Services Sold*	0.15	0.14	0.09	−0.11	−0.02	0.07	0.17	**0.73**	—													
(10) *Age*	**−0.20**	**−0.24**	**−0.20**	0.01	−0.15	**−0.23**	−0.10	**−0.36**	**−0.22**	—												
(11) *Gender*	**0.32**	0.10	0.08	0.04	0.03	−0.10	−0.04	**0.36**	**0.31**	**−0.18**	—											
(12) *Education*	−0.01	−0.09	−0.10	0.00	**−0.19**	−0.11	**0.23**	−0.07	−0.07	**0.18**	−0.05	—										
(13) *Prior Usage Experience*	−0.06	−0.23	−0.12	0.12	−0.17	−0.20	−0.06	−0.19	−0.04	0.38	0.15	−0.22	—									
(14) *Prior Service Experience*	−0.10	−0.14	−0.06	0.04	−0.03	**−0.18**	0.04	**−0.25**	−0.05	**0.48**	0.09	**−0.26**	**0.76**	—								
(15) *User Prior Performance*	−0.12	**−0.17**	**−0.18**	−0.03	**−0.19**	−0.11	0.09	−0.12	**−0.20**	**0.19**	−0.08	0.08	−0.05	0.02	—							
(16) *Store Prior Performance*	0.00	−0.08	−0.06	0.04	−0.02	−0.01	**0.21**	−0.05	−0.10	−0.04	−0.02	0.07	−0.14	−0.08	**0.23**	—						
(17) *Store Geographical Location*	−0.05	**−0.18**	−0.14	−0.01	−0.05	−0.01	−0.10	0.10	0.05	0.08	0.08	−0.02	0.08	0.06	0.06	−0.11	—					
(18) *Service Area Per Employee*	**−0.16**	−0.08	−0.05	−0.07	−0.15	−0.09	0.07	0.16	0.13	−0.02	0.03	**0.18**	0.11	0.03	0.06	0.03	0.03	—				
(19) *Marketing Budget per Employee*	−0.05	−0.07	−0.02	0.07	−0.07	−0.05	0.03	0.14	0.08	−0.05	0.06	**0.18**	0.14	0.11	0.16	**−0.21**	0.10	**0.63**	—			
(20) *IT Budget per Employee*	−0.04	−0.02	−0.09	0.08	0.05	0.03	−0.15	0.02	−0.11	0.03	0.00	0.04	−0.08	−0.03	0.02	−0.15	0.04	0.14	**0.22**	—		
(21) *Number of PCs per Employee*	−0.07	0.04	0.04	−0.05	−0.14	0.07	0.10	−0.07	0.03	−0.13	**−0.19**	−0.01	−0.16	−0.09	0.06	0.14	**−0.38**	−0.02	−0.01	−0.05	—	
(22) *Store Size*	0.14	−0.07	−0.05	−0.07	0.10	−0.01	−0.10	−0.06	−0.04	0.07	**0.18**	0.03	0.11	0.09	−0.06	**−0.21**	**0.30**	**−0.16**	−0.02	−0.09	**−0.53**	—

Note. Bold indicates significant correlations ($p < 0.05$).
[a]Square root AVE is shown on the main diagonal.

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