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The Impact of Institutional Distance on the Joint Performance of Collaborating Firms: The Role of Adaptive Interorganizational Systems

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Abstract. Firms have made extensive use of interorganizational systems (IOSs) to share knowledge and pursue superior joint performance. Contemporary firms are using IOSs to collaborate widely across the value chain and in an ever-expanding geographic landscape. Thus, institutional distance, which is the difference between the firms' respective institutional fields, has become a prominent challenge. In this study, we investigate the extent to which institutional distance affects IOS-enabled knowledge sharing and its impact on the joint performance of collaborating firms. We also explore the extent to which IOS adaptability could be a design solution for improving IOS-enabled knowledge sharing, given the challenge of institutional distance. Drawing on institutional theory, we propose that institutional distance, differentially influential via its normative, cognitive, and regulative aspects, not only reduces IOS-enabled knowledge sharing but also weakens the positive impact of such sharing on joint firm performance. Next, extending boundary object theory to the institutional context, we propose that IOS adaptability could be a solution to the challenge of institutional distance because it can directly strengthen IOS-enabled knowledge sharing as well as mitigate the negative effect of institutional distance on such sharing. Our hypotheses were tested through a field study that collected dyadic data from 141 distinct buyer/supplier channel relationships in 4 industries. The results from partial least squares modeling fully support our hypotheses with regard to cognitive distance, partially support those related to normative distance, but do not support those related to regulative distance. We discuss the implications of these findings for theory development and professional practice.

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1. Introduction

In today's hyperconnected business environment, firms increasingly rely on external knowledge resources to gain a competitive advantage by tightly collaborating with other firms along different tiers of the value chain and across varied geographical locations (Barrett et al. 2011, Chi et al. 2010, Velu et al. 2013). To sustain business growth, for instance, many firms develop global and/or nationwide distribution networks by collaborating and sharing knowledge with downstream distributors in remote locations (Yang et al. 2012). In this context, interorganizational systems (IOSs), defined as IT applications deployed to exchange information between firms (Bensaou 1997, Choudhury 1997), are known to play a key role in spanning geographical boundaries and in enabling knowledge sharing between firms across the value chain. Research, to date, clearly shows that IOSs improve the performance of interfirm relationships by enabling digital access and knowledge sharing between partners (Malhotra et al. 2005, 2007; Saraf et al. 2007).

Along with collaboration between different tiers of the value chain and across varied geographical locations, there are increasingly widening differences between the institutional environments of collaborating firms (hereafter termed as *institutional distance*) (Yang et al. 2012). The concept of institutional distance originated in the management field and sizeable distances have been found to generally reduce interfirm knowledge sharing because it is so difficult for collaborating firms to interpret ambiguous information shared by partners in a "distant" institution (Yang et al. 2012).

However, unlike general knowledge sharing, knowledge shared via an IOS is codified and explicit and hence not as likely to be misinterpreted. As such, conventional wisdom suggests that an IOS is unproblematic in facilitating knowledge sharing in an interorganizational relationship across different institutional environments (Zhou and Benton Jr 2007). We aim to challenge this conventional wisdom by our first research question: To what extent does institutional distance matter to IOS-enabled knowledge sharing, and subsequently, the joint performance of an interorganizational relationship?

An answer to this question is both practically meaningful and theoretically important. Practically, it is important for firms to understand how the institutional profile of each partner may affect the use of IOS for sharing knowledge and ultimately building a successful collaboration. This is particularly relevant to interorganizational relationships operating with an ever expanding geographical spread of supply chain, distribution networks, and outsourcing partners. Theoretically, despite the distinction between knowledge sharing in general and that taking place via IOSs, most prior IOS research has only examined knowledge sharing generically (Im and Rai 2008; Malhotra et al. 2005, 2007; Saraf et al. 2007) resulting in the fact that little effort has been made to date to examine *knowledge sharing specific to IOS*. Moreover, while IOS research has drawn on institutional theory, little accounts for institutional distance impacting interfirm collaboration. The limited IOS research that draws on institutional theory concerns itself with how the institutional environment forces a firm to adopt (Liu et al. 2010, Teo et al. 2003) or assimilate IOS technology (Bala and Venkatesh 2007, Sodero et al. 2013). This scant literature has seldom considered institutional effects on the outcomes of interfirm digital collaboration, for example, knowledge sharing via IOS and performance of channel relationships. As we argue later, institutions inscribe their institutional logic about channel relationships onto the firms operating across institutional boundaries and on the information systems (ISs) that the firms use, thus creating institutional misalignment that makes it difficult for firms to share knowledge via IOSs to meet higher performance goals. Our study contributes by addressing this research opportunity.

To the extent that institutional distance does matter, it is critical to understand how IOSs can be designed to better support IOS-enabled knowledge sharing in view of the challenge of institutional distance. The extant literature specifies several IOS design characteristics (e.g., data connectivity, process modularity, application integration, and interface standardization) that can respond to a variety of business needs, including knowledge sharing (Gosain et al. 2004; Malhotra et al. 2005, 2007; Saraf et al. 2007). However, to our knowledge little research has examined which IOS characteristics could address the challenge of institutional distance with respect to IOS-enabled knowledge sharing. This motivates our second research question: What IOS design characteristics address the knowledge sharing challenge arising from institutional distance across an interorganizational relationship?

To answer these two research questions, we extend institutional theory to model the effect of institutional distance on IOS-enabled knowledge sharing and on joint performance in interorganizational relationships (Kostova 1999, Scott 2001). The model focuses on tightly coupled and deliberately designed value chain relationships, for example, channel relationships (Jap 1999). We assume this focus because IOS-enabled knowledge sharing is crucial to the business success of these types of relationships (Lorenzoni and Lipparini 1996, Velu et al. 2013). Specifically, we propose that institutional distance not only directly and negatively affects IOS-enabled knowledge sharing but also undermines its positive impact on performance. Second, we identify those IOS characteristics most suitable for dealing with institutional distance by extending the boundary object literature (Carlile 2002, Star and Greisemer 1989) to the institutional context. Specifically, we argue that the construct of IOS adaptability is instrumental to IOS-enabled knowledge sharing, which is itself shackled to the institutional distance between collaborating firms. We test our research model through a field study using data collected from a dyadic sample survey of 141 distinct buyer/supplier channel relationships in four industries, within a large-scale emerging economy that features subnational institutional distances.

This study makes major theoretical contributions to the literature (see Table 1 for a summary). First, we extend institutional theory to examine the intermediate outcome of using IOSs (i.e., knowledge sharing) as well as ultimate performance outcomes, by accounting for institutional distance regarding interfirm relationship management. Prior IOS research has only applied institutional theory to examine IOS technology adoption and assimilation (Liu et al. 2010, Teo et al. 2003); it has not considered how institutional distance between the partners regarding interfirm collaboration affects the outcomes of IOS use. We thus add to the IOS literature by introducing the concept of institutional distance and uncovering its effect on the outcomes. Second, this study extends our understanding of how to improve IOS-enabled knowledge sharing in the face of wide institutional distances through more effective IOS designs. That is, extending the boundary object literature to the institutional context, we offer insights into how IOS adaptability can overcome the challenge of institutional distance for deeper IOS-enabled knowledge sharing. Finally, this study has an

Table 1. Preview of Study Contributions

No.	Contribution	State of the literature
1.	Brings a new theoretical perspective, "institutional distance," to explain intermediate and performance outcomes (i.e., IOS-enabled knowledge sharing and joint performance)	Prior IOS research explains knowledge sharing in general, by drawing on the firm and interfirm and technical perspectives of the literature. Institutional theory is used only to explain how the institutional environment of IOS technology affects IOS adoption and assimilation
2.	Introduces the construct of IOS adaptability and examines how it improves IOS-enabled knowledge sharing despite the challenge of institutional distance, by extending the boundary object perspective to the institutional context	Prior IOS research has identified IOS characteristics, but little work has addressed the challenge that sizeable institutional distances present to knowledge sharing in the IOS context

empirical strength in that it tests the research model by using a respectable sample developed through a robust dyadic research design.

2. Theoretical Background

2.1. IOS-Enabled Knowledge Sharing

IOS-enabled knowledge sharing refers to the extent to which an IOS is configured to exchange and process, in a timely manner, useful information (also called explicit knowledge) between collaborating firms. We focus on explicit knowledge (i.e., knowledge that is codified and communicable) because knowledge must be made explicit before it can be shared via information technology (IT). An IOS can be deployed to share explicit knowledge between firms by configuring the systems within various business functions (e.g., production, logistics management, marketing/sales, and finance). With respect to our primary focus, an IOS can be used to share a large quantity of information by means of channel relationships (Chesbrough 2003), depending on the extent that the collaborating firms codify knowledge into its explicit, shareable forms (i.e., information). This information can include market conditions (e.g., market trends, customer needs, preferences), products (e.g., product offerings and status), and business processes (e.g., the collaborative process) (Frazier et al. 2009), all of which are critical to the joint success of partnerships (Im and Rai 2008). Indeed, prior research generally agrees that knowledge sharing between collaborating firms, with the support of IOS, can improve joint firm performance (Gosain et al. 2004, Im and Rai 2008, Saraf et al. 2007, Straub et al. 2004).

Prior IOS literature has explained knowledge sharing by means of several theoretical angles, such as the relational view of the firm (Saraf et al. 2007), absorptive capacity (Malhotra et al. 2005), organizational learning (Im and Rai 2008), and boundary spanning (Malhotra et al. 2007). These theories use the relational, organizational, or technical aspects of knowledge sharing played out within an interorganizational relationship with a purpose of focusing on achieving a common understanding.

Our definition of IOS-enabled knowledge sharing is different from that of other scholars, and in several important ways. Prior IOS research has considered knowledge sharing to be a broad concept involving both tacit and explicit knowledge. In our study, IOS-enabled knowledge sharing focuses on *sharing explicit knowledge using IOS*. This difference, albeit subtle, is important. As stated earlier, knowledge shared via IOSs has already been made explicit. So, unlike tacit knowledge, it is much less likely to be misunderstood once codified and transmitted. This distinction requires us to explain IOS-enabled knowledge sharing not in terms of *interpretation*, but in terms of how an IOS is *collectively appropriated* by collaborating firms to make as much explicit knowledge available as possible before transmission. The extent of IOS-enabled knowledge sharing will be greater when the collaborating firms enable their IOS to make the maximum amount of explicit knowledge available for exchange.

2.2. Review of Institutional Theory in the IOS Literature

The notion of institution has been used to characterize the social context in which firms operate. It refers to multifaceted, durable, and resilient social structures consisting of symbolic elements, social activities, and material resources (Scott 2001). Institutional theory posits that structural and behavioral patterns in organizations are driven by the need for organizational legitimacy, that is, the need to comply with the surrounding institutional context (DiMaggio and Powell 1983). According to institutional theory, the institutional context of a given region can be characterized according to the three pillars of society, namely, the regulative, cognitive, and normative aspects (Scott 2001).

Of these three, the regulative aspect is the existing formal laws, regulations, and rules in a particular domain that force certain types of behaviors and restrict others (Scott 2001). Here, legal sanction is the basis of legitimacy. Second, the cognitive aspect is the schemas, frames, inferential sets, and representations that are widely shared by people in a given domain and those that shape the way people identify, categorize, and interpret stimuli (Markus and Zajonc 1985, Scott 2001). Hence, the basis of legitimacy is common business practice, taken-for-granted conventions, and customs. Finally, the normative aspect is the social values, beliefs, assumptions, and norms held by people in a given domain that introduce "a prescriptive,

evaluative, and obligatory dimension into social life" (Scott 2001, p. 37). Here, social norms are the basis of legitimacy.

Although these three institutional pillars reflect different aspects of the same institutional environment, they each have distinct mechanisms for forming social patterns (Scott 2001). Thus, we start by separately investigating each of the three pillars, following the approach taken by prior research in the domains of strategy (Kostova and Roth 2002) and IS (Gosain 2004, Liang et al. 2007, Sodero et al. 2013).

Institutional theory has been previously used to explain IOS adoption (Liu et al. 2010, Teo et al. 2003) and assimilation (Bala and Venkatesh 2007, Sodero et al. 2013). The institutional environment described in these studies refers to the institutional context of adopting an IOS as an enterprise technology. These studies posit that firms adopt IOSs (Liu et al. 2010, Teo et al. 2003) and subsequently assimilate IOSs into their operational routines to facilitate interorganizational information exchange (Bala and Venkatesh 2007, Sodero et al. 2013) and to conform with institutional pressure to use IOS technology.

This institutional perspective is useful for explaining IOS adoption and assimilation; however, it does not apply to knowledge sharing via IOSs between institutionally distant firms, for two reasons. First, prior research assumes that the focus of the institution is to adopt IOS technology. It does not account for the institution that concentrates on the business context that an IOS is designed to support, for instance, channel management in our study. The institution surrounding the business domain embodies the assumptions, values, rules, and social expectations about how businesses should be managed. It can influence how the organization appropriates an adopted enterprise technology to facilitate local business activities (Gosain 2004), specifically, in our case, knowledge sharing across channel partners. Furthermore, prior IOS research has never addressed the "institutional duality" of IOS, meaning that because of its interorganizational nature, the collective use of IOSs is always influenced by *both* of the institutional environments in which collaborating firms are, respectively, situated. Thus, we need to apply an IS-novel concept—*institutional distance*—to capture this institutional duality, a concept that spawns reflection on the social norms and expectations of managing interfirm relationships.

2.3. Institutional Distance

The notion of *institutional distance* was originally used to capture the difference in institutional environments between the home country and the host country of a multinational firm (Kostova 1999). In our study, we use the construct to capture the difference between two institutional environments in which channel partners are situated. This definition extends institutional distance from its original context of multinational firms to the context of channel relationships in three major ways. First, similar to multinational firms, interorganizational relationships, such as channel partners, are influenced by multiple institutional environments. Multinational firms practice in different nations. To be considered legitimate in different markets, they need to comply with multiple institutional environments (Kostova 1999). Similarly, channel relationships, particularly those with geographically distant partners (e.g., Yang et al. 2012), are subject to the influence of dual institutional environments. To collaborate legitimately, the channel partners need not only to comply with their respective local institutional requirements but also attend to the distinctive institutional requirements of their partners. Hence, institutional distance is a construct that can readily be extended to channel relationships.

Second, institutional distance can exist not only across nations but also across regions within a nation. The extant literature tends to specify institutional distance based on the jurisdictional range of the institutional form under investigation (Scott 2001). In the management literature, this construct was originally tied to country boundaries, that is, it was specified and studied at the national level (Kostova 1999, Kostova and Roth 2002, Kostova and Zaheer 1999, Xu and Shenkar 2002). However, recent studies confirm that it can also occur at other levels, such as the supranational (e.g., the European Union) and the intranational (e.g., a region within a single nation) (Kostova et al. 2008, Phillips et al. 2009).

In fact, the extant literature has acknowledged that institutional conditions could vary across regions within a nation, especially in emerging economies such as China (Peng et al. 2008), Russia (Peng et al. 2008), and Vietnam (Meyer and Nguyen 2005). This is most certainly due to geographically bounded norms, localized cultural traditions, and decentralized regulative reforms in these economies (Wright et al. 2005). In this paper, we study such intranational institutional distances empirically observed in channel relationships in the large emerging economy of China.

On a more subtle note, geography is not the only way to differentiate institutional boundaries. For example, boundaries may exist between tiers of the value chain (manufacturers, distributors, end users) (Bhakoo and Choi 2013) because organizations along the chain could have their own formally constituted legal body or professional associations that set institutional rules and norms.

Third, institutions should be studied in ways specific to the key phenomenon being investigated (Kostova and Zaheer 1999, Scott 2001), and so should institutional distance. Prior multinational research has studied institutional distance within the domain of total

quality management (TQM) (Kostova and Roth 2002). Our study focuses on IOS-enabled knowledge sharing in the professional domain of channel management. Thus, we define institutional distance as the differences between the institutional environments with respect to *channel management* by considering the regulative, cognitive, and normative aspects of these distances.

The channel management literature offers several relevant definitions of distance between two institutional environments (Yang et al. 2012). *Regulative distance* is the difference in how formal regulations are enacted and enforced on channel activities among institutions. *Cognitive distance* is the difference in socially shared professional knowledge, taken-for-granted conventions about channel implementation, operations, and management. *Normative distance* is the institutional difference in shared values, assumptions, and social norms in channel relationships, such as norms concerning trust and cooperation, moral obligation to provide high-quality services/products, and standards of business conduct (Scott 2001, p. 48).

Note that institutional distance is largely exogenous to channel relationships. As elaborated earlier, institutional distance characterizes the differences between the institutional environments that are external to and surround channel partners. Firms maintain their legitimate status by striving to comply with the institutional environment, but they do not typically try to change the environment (Scott 2001). Similarly, channel partners can share knowledge to align their mutual understanding and enhance collaboration, but they cannot truly close the gap between their respective institutional environments.

Prior research has found that institutional distance creates conflict between institutionally distant firms because of differences in legitimacy requirements and ambiguous information from the distant institution (Yang et al. 2012). Institutional distance means that one firm may not fully recognize the practices used by the other as socially appropriate (Kostova and Zaheer 1999, Kumar and Das 2007). While there is little evidence about the direct performance impacts of institutional distance, partnering firms whose legitimacy is under threat have been found to be less cooperative with and committed to each other. For instance, they offer each other less social and informational support and fewer resource endowments (Kumar and Das 2007, Scott 2001); they are less likely to accept the business practices of the other side (Kostova and Roth 2002); they are less motivated to develop new businesses into the other side (Xu and Shenkar 2002); plus they do not handle conflicts in an integrative manner (Kumar and Das 2007).

A careful scrutiny of the institutional literature reveals that institutional distance leads to these complications because it creates *misalignment of the institutional logic* between the partnering firms. Institutional logic is defined as the assumptions, values, taken-for-granted beliefs, and rules that guide the practice and behavior of the organizations situated in the institutional environment (Scott 2001). The regulative, cognitive, and normative aspects of institutional logic underlying a firm are shaped by the different aspects of the surrounding institutional environment. To gain legitimacy, organizations tend to be "institutional carriers" (Scott 2001, p. 48), incorporating organizational structures and business practices that are socially legitimate, that is, isomorphic or consistent with the institutional logic of the environment in which they operate (Meyer and Rowan 1977, Powell and DiMaggio 1991). Also, organizational members are themselves carriers of the institutionalized knowledge of the field and, as such, tend to design or accept practices that are compatible with the dominant institutional logic (Selznick 1996). Firms will not incorporate a new business practice if it is not consistent with the embedded institutional logic, lest it undermine the firm's legitimacy (Kostova 1999, Kostova and Roth 2002).

Similarly, enterprise technologies, which are configurable tools to accommodate and automate business practices, also tend to incorporate the institutional logic of the organization once they have been deployed (Gosain et al. 2004). Introducing a new enterprise technology embeds the institutional logic of external referent firms and may create institutional misalignment between the incumbent institutional logic of the firm and the institutional logic embedded in the new system, thus creating a potential for conflicts (Gosain et al. 2004). To resolve institutional misalignment, the firm has to be more selective in its appropriation of the new technology. For example, it should scale down customizing software in the case of off-the-shelf technologies (Sia and Soh 2007).

Extending the mechanism of institutional logic to the IOS context, it is reasonable to posit that the greater the institutional distance, the more difficult it is for an IOS to be compatible with the institutional logics of both sides at the same time. This in turn may lead the collaborating firms to be more selective in using IOSs for knowledge sharing. In other words, the larger the difference between the institutional logics of two organizations, the greater the institutional misalignment, and, because of legitimacy concerns, the less capable and willing firms are to exchange knowledge via an IOS.

When partnering firms are exposed to misaligned institutional logics to which they cannot fully conform, they have to develop tactful solutions to address legitimacy concerns to gain performance outcomes from enduring collaboration (Yang et al. 2012). Recent institutional research acknowledges that organizations with misaligned institutional logics are conscientious about the need to resolve the institutional misalignment for more favorable outcomes. They are found to play an

agency role in tactfully responding to the legitimacy concern arising from competing, enduring institutional logics by keeping incompatible institutional logics separate (Crilly et al. 2012), compromising/negotiating through crafting an acceptable balance, or selectively combining competing logics (Besharov and Smith 2014, Greenwood et al. 2011). These tactful solutions might also shed light on how partnering firms resolve misaligned institutional logics when such misalignments surface during collaboration.

In the IOS context, how should the institutionally distant partners design IOSs to enable knowledge sharing, despite the negative impact of institutional distance? An IOS interconnects the respective enterprise technologies of collaborating firms and must be interoperable across platforms. It must be tightly coupled and partners should proceed cautiously before adopting any idiosyncratic configurations of IOSs. To this end, we sense that an adaptable IOS that can be easily adjusted and reconfigured could help to tactfully craft a carefully selected configuration of system elements that maximally satisfy the demands of different institutional logics. We thus conceptualize an IOS as a boundary object capable of bridging institutional distance between firms; it does this by extending the *boundary object* perspective, which articulates how man-made artifacts function to bridge different institutional "thought worlds."

2.4. IOS Adaptability as a Boundary Object Characteristic to Span Institutional Boundaries

Boundary objects are artifacts or other forms of reification around which different communities of practice organize their interconnections (Wenger 1998, p. 107). They have been used in various subject domains to characterize a broad range of artifacts, such as physical product prototypes (Bechky 2003, Carlile 2002), design drawings (Bodker 1998), and even IT-related tools such as electronic archives and enterprise resource planning (ERPs) (Boland and Tenkasi 1995, Pawlowski and Robey 2004, Star and Greisemer 1989). Boundary objects are thought to enable knowledge sharing across functional, organizational, or community boundaries because they are "robust enough to maintain a common identity across sites" (Star and Greisemer 1989, p. 393). That is, they can establish a common referent point for both sides. Boundary objects help improve information exchange between communities (Lawrence and Lorsch 1967) by imposing a common reference vocabulary that maps out local terms and practices to a common referent and explains the differences between interconnected communities (Carlile 2002, 2004).

Prior research has discovered that a common IOS interface protocol enhances knowledge sharing by standardizing interorganizational process links and data structures and by creating a standardization protocol, which in turn increases the information-processing capacity of the partners and automates the flow of information (Malhotra et al. 2007). This standardized interface enhances interorganizational collaboration and information sharing among consortium members (Gosain et al. 2003, Malhotra et al. 2007). Similarly, other researchers have discovered that the presence of digital boundary objects across organizational boundaries enables interfirm knowledge sharing by standardizing processes and data configurations and using shared definitions as key business parameters (Im and Rai 2008).

However, even with the use of standardized boundary objects, knowledge sharing across a boundary may still be ineffective because of the significant differences that exist between two social contexts, such as markedly different functional departments (Carlile 2002) and project teams (Sapsed and Salter 2004). That is, the variation in assumptions, norms, and cognitive schemas between two highly variant social contexts can make it difficult for actors situated in their respective "thought" worlds to effectively communicate with each other (Dougherty 1992, Star and Griesemer 1989).

Similarly, collaborating firms with a standardized IOS may face problems when sharing knowledge across their respective institutional environments, each of which has its own cognitive schema, social norms/assumptions, and regulative expectations. In fact, a standardized, but not reconfigurable IOS may even reinforce the tendency of collaborating firms to fit incoming data from a different context into preexisting local categories, thus potentially discounting uncategorized, yet important signals that would otherwise offer new insights (Day and Schoemaker 2004). Thus, simply standardizing a boundary object is not the sole solution to the knowledge sharing problem arising from institutional distance.

We extend the existing understanding of IOSs as boundary objects by introducing *adaptability* as a key IOS characteristic to facilitate IOS-enabled knowledge sharing between institutionally distant partners. We define IOS adaptability as the capacity of IOS to be readily adjusted and reconfigured to respond to the need for change. Our development of IOS adaptability is grounded in boundary object theory (Star and Greisemer 1989) and addresses the practical need for a technical solution to the institutional misalignment issue discussed earlier. The theoretical underpinning of this construct is the proposition that boundary objects should not only be standardized, as noted earlier, but also "plastic enough to adapt to local needs and constraints of the several parties employing them" (Star and Greisemer 1989, p. 393). That is, in addition to remaining sufficiently common to allow shared use (through standardization) (Neumann and Star 1996), a

boundary object should be adaptive enough to accommodate multiple local meanings and visions of use (Carlile 2004). Such adaptability reflects the extent to which a boundary object can be readily reconfigured and adjusted as needed (Carlile 2002). From a practical perspective, we reason that there is great organizational value in an IOS that is malleable enough to develop a common ground that can accommodate two different institutional logics.

Indeed, the boundary object literature has produced evidence that adaptable boundary objects respond more readily to local specificities arising from both sides of a boundary (Pawlowski and Robey 2004) and remain more current in situations of change (Carlile 1997) by allowing an iterative process of creating and negotiating new agreements with respect to the interface between both parties (Carlile 2004). Consequently, a more adaptive boundary object can more effectively reconcile or selectively accommodate the differences across the boundary so as to better enable the sharing of new, updated information (Carlile 2004).

We believe that IOS adaptability, theoretically derived from boundary object theory, is a valuable addition to the cornucopia of IOS characteristics. Prior research has specified a number of IOS characteristics, including application integration, data compatibility, analytic ability, evaluation ability, and alertness, but has *not* identified IOS adaptability as one of these (see Saeed et al. 2011 for a comprehensive review of prior IOS research). The most similar concepts are probably the constructs of IS flexibility introduced by Saraf et al. (2007) and IT integration introduced by Rai and Tang (2010). These constructs generally capture the ability of a firm to quickly and economically reconfigure its applications to changing business requirements, thereby reflecting the IS characteristics of a single firm. IOS adaptability extends these concepts to the networked, interorganizational context.

We posit that adaptable IOS can not only directly improve IOS-enabled knowledge sharing but also mitigate the negative effect of institutional distances on such sharing. We do so by extending the boundary object perspective to the institutional level, a theorizing effort that takes the boundary object literature beyond the existing context of the project team (Sapsed and Salter 2004), the functional department (Carlile 2002, Dougherty 1992), and the organizational community (Boland and Tenkasi 1995, Wenger 1998).

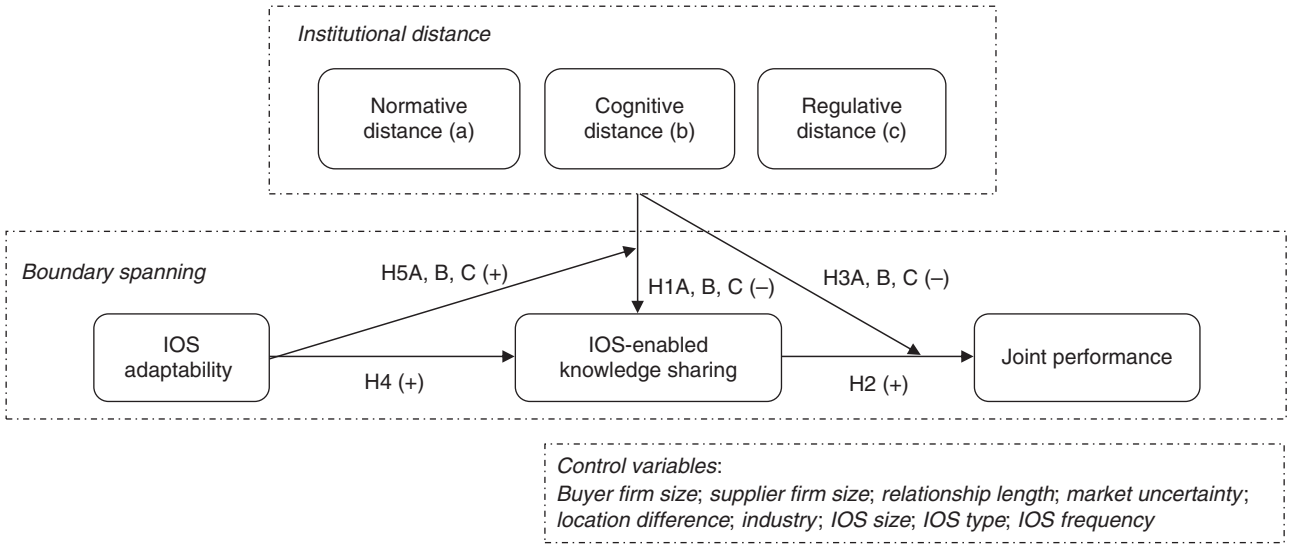
3. Model and Hypotheses Development

Drawing on institutional theory, we proffer a model where institutional distance (manifested as normative, cognitive, and regulative distance) not only reduces IOS-enabled knowledge sharing but also weakens the positive effect of IOS-enabled knowledge sharing on the joint performance of channel partners from different institutional environments. Integrating the boundary object perspective into institutional theory, we further suggest that IOS adaptability is the critical design characteristic that not only directly improves IOS-enabled knowledge sharing but also indirectly helps by mitigating the negative effect of institutional distance on such sharing. Figure 1 shows our fully specified research model.

3.1. The Effects of Institutional Distance on IOS-Enabled Knowledge Sharing and Joint Performance

Based on institutional theory, we expect that the normative, cognitive, and regulative distance between two

Figure 1. The Research Model



channel partners will each reduce IOS-enabled knowledge sharing between them, albeit in different ways. First, in the presence of normative distance, there are differences in shared values and social norms concerning trust and cooperation, moral obligation to quality, and standards of conduct between the channel partners (Yang et al. 2012). Thus, the institutional logics embedded in the respective partners regarding the normative aspect of channel management are not aligned. To retain legitimacy in the presence of normative distance, firms tend to avoid practices that are not consistent with the institutional logic that manifests the local, societal, and professional norms (Yang et al. 2012). To the extent that an IOS embeds normative institutional logics, firms avoid configuring it with institutional logics that are inconsistent with local social norms (Gosain et al. 2004, Scott 2001). As such, the channel partners prefer to be more selective in appropriating IOS, hence limiting IOS use for knowledge sharing.

An instance of this may help to elucidate the concept. In one case, let us say, a collaborating partner in an institution with normatively lower standards about providing quality goods and services would care less about developing practices to manage negative customer feedback (Frazier et al. 2009). As such, this partner would be less motivated and ill-equipped to collect, organize, codify, and share such customer-related knowledge via IOS because such work requires extra administrative effort but does not align with its local social norms. In this case, an institutionally more advanced partner would, in the face of this, find it more difficult to require the focal firm to use an IOS to collect, organize, and share customer feedback information that could meet the expectation of sharing customer-related knowledge in terms of timeliness, range, and quality. Hence there would be limited knowledge sharing in this situation.

Second, in the presence of cognitive distance, there are differences in institutional logics between channel partners regarding socially shared professional knowledge about channel implementation, operations, and management (Yang et al. 2012). Specifically, a firm in an environment with more advanced professional knowledge and experience in channel management would more fully appreciate sharing channel information of relevance, timeliness, and quality than its partner in a less sophisticated institution (Yang et al. 2012). With such variations in the institutionally subscribed professional knowledge, the partners will be more conservative in configuring IOSs in ways that do not conform to their respective taken-for-granted channel conventions, or even share cognitively undesirable information. Specifically, because of this cognitive distance, the partner in the less sophisticated institution would be less motivated to configure IOSs for sharing information when doing so requires extra effort but is not aligned with their local business conventions (even if it is not against their institutional rules) and hence limiting their IOS-enabled knowledge sharing. Moreover, cognitive structures also affect employee learning processes; it is much easier to learn to use a technology to support practice when the practice is consistent with the prevalent cognitive schemas than when it is not (Markus and Zajonc 1985).

Third, regulative distance, which is the difference in how formal regulations are enacted and enforced on channel activities, could also create institutional misalignment that may create issues for an IOS to reconcile. If a firm perceives that a practice conflicts with local legal codes and conduct, it is unlikely for the firm to configure its IOS to allow information exchange related to that practice even if the IOS technically supports doing so. This would result in more limited use of an IOS for sharing knowledge between channel partners. Taken together, we argue that the three aspects of institutional distance could create misfit between the institutional logics of the channel partners through different institutional mechanisms. As such, the partners have to limit their use of their IOS for knowledge sharing, lest it undermine firm legitimacy. We hypothesize the following:

Hypothesis 1 (H1A–H1C). *Normative* (a), *cognitive* (b), *and regulative distance* (c) *are negatively related to IOS-enabled knowledge sharing between two channel partners.*

In addition to direct effects, we expect that institutional distance will weaken the positive impact of IOS-enabled knowledge sharing on the joint performance of collaborating firms. We expect an overall positive effect of IOS-enabled knowledge sharing on joint performance because prior research has acknowledged that knowledge sharing between collaborating firms improves joint firm performance by informing collaborative planning and execution of necessary competitive actions (Gosain et al. 2004, Im and Rai 2008). By the same token, we submit that the greater the IOS-enabled knowledge sharing, the more timely, useful, and explicit knowledge that can be shared between partners, and the better the collaborative planning and execution of competitive actions, thereby improving joint firm performance. Thus, we hypothesize the following:

Hypothesis 2 (H2). *IOS-enabled knowledge sharing positively affects joint performance between two channel partners.*

More important, we argue that, when institutional distance is greater, collaborating firms are less cooperative because they are less motivated to act on knowledge shared through an IOS, thereby undermining joint performance. As discussed earlier, institutional

distance introduces a legitimacy concern in that collaborating firms will not fully recognize their institutionally distant partner as socially appropriate in their local environment (Kostova and Zaheer 1999, Kumar and Das 2007). As a result, they are less cooperative (Kumar and Das 2007), less willing to accept business practices suggested by their partners (Kostova and Roth 2002), and less motivated to handle possible conflicts in an integrative manner (Kumar and Das 2007). Hence, institutional distance should moderate the effect of IOS-enabled knowledge sharing on joint performance to the extent that cooperative effort is a key mechanism through which collaborating firms apply knowledge shared through IOSs to generate joint performance.

Specifically, the three pillars of institutional distance have moderating effects through different mechanisms. First, normative distance influences collaborating firms' normative legitimacy by negating the extent to which they embrace socially accepted values and norms. For example, a firm in a normative institution with a stringent code of conduct will perceive a partner from a low-normative environment to be less legitimate (Kostova and Zaheer 1999). When they have to collaborate to enhance channel efficiency, and this collaboration builds on information shared through an IOS, the focal firm will be less willing to fully adopt (or discount) action points proposed by a normatively distant partner, in this case the proposed practices embedding different value systems and norms that undermine firm legitimacy (Kostova and Zaheer 1999). This diminishes the ability of the shared information to enable a collaborative plan for better performance outcomes (Cai et al. 2010).

Second, cognitive distance compromises a firm's social legitimacy through social interactions in which cognition and knowledge are embedded (Scott 2001). A firm that perceives its partner to be less professional in channel management will be less engaged in cooperating with this partner to execute a new practice because it is cognitively difficult to judge the practice as legitimate (Kostova and Zaheer 1999). As such, firms may react differently to proposed collaborative actions based on information shared through an IOS, because of the different cognitive structures of channel partners; this could also compromise the outcome of their collaborative efforts.

Our in-depth interviews with channel partners in the appliance industry confirmed this point in the channel management context. We found that firms with less advanced customer management cognitions were not sensitive to (and thus depreciated) information about negative customer feedback. Consequently, they were less cooperative when a more advanced partner proposed follow-up action, which, in turn, reduces the effectiveness of leveraging the information for improved performance benefits.

Third, regulative distance affects regulative legitimacy by impacting the way firms react to local regulations. If a firm perceives a practice to be in conflict with local regulatory institutions, it is unlikely to effectively use it (Kostova and Zaheer 1999). For example, in regions with varied contract enforcement regimes, channel partners (i.e., manufacturer and distributor) tend to prefer different approaches to collecting delinquent customer receivables, when information about the need for contract enforcement is promptly shared via an IOS. The partner located in the region with more efficacious contract enforcement may tend to use litigation as a compliance tool and the partner in the region with weaker contract enforcement might prefer personal persuasion. Hence, these firms would be less likely to cooperate in resolving the issue since their partner differs from their own local legal practice. In sum, when normative, cognitive, and regulative distances are greater, IOS-enabled knowledge sharing will not be as effectively converted into joint performance benefits as when the respective institutional distance is smaller, because of different legitimacy concerns. Thus, we hypothesize the following:

Hypothesis 3 (H3A–H3C). *Normative* (a), *cognitive* (b), *and regulative distance* (c) *negatively moderate the effect of IOS-enabled knowledge sharing on joint performance between two channel partners, such that the effect is stronger when the distance is small.*

3.2. IOS Adaptability, Knowledge Sharing, and Institutional Distance

We propose that, in light of concerns over institutional distance, IOS adaptability is the key to improving IOS-enabled knowledge sharing. A highly adaptable IOS can be readily adjusted and reconfigured, making it easier to redact existing interorganizational process/content interfaces and structures. Such IOSs can also help create new interface standards between firm boundaries, enhancing information exchange by allowing multiple iterations.

IOS adaptability is made possible by several organization-level initiatives. Some initiatives can be broadly categorized as structural elements that pertain to the design and organization of IT artifacts (Nelson and Ghods 1998), such as using open-standard technological architecture (e.g., XML rather than electronic data intercharge (EDI)) (Subramani 2004, Zhu et al. 2006), standardizing process and content interfaces (Gosain et al. 2004, Malhotra et al. 2007), and applying a modularized architecture and structured data formats (Gosain et al. 2004). Apart from such structural elements, IOS adaptability can also be enabled by relational and organizational elements, such as interfirm mutual trust and governance mechanisms (Barrett et al. 2011).

IOS adaptability facilitates IOS-enabled knowledge sharing in several ways. First, it offers the necessary

capacity to dynamically adjust process interfaces and content structures so that, when the need arises, it is easier for firms to codify a broad range of knowledge from diverse business domains for transfer between collaborators. For instance, a highly adaptable IOS can more easily launch a new or revise an existing, digital process linkage to meet new or emerging information requirements (e.g., to generate and share advanced shipping or sales information). As an account manager mentioned during our content validation interviews:

> We review the use of [our] IOS and adjust it regularly and frequently together with our buyer.... Recently we added a function in the IOS to collect the information about the end customers' satisfaction levels. The idea of this alteration came from the interaction with our buyer. As we both agreed to this change and were highly capable in making changes in our IOS, the adjustment of [the] IOS was quite smooth and swift. Because of this change, now both our buyer and ourselves can easily have more in-depth understanding of our end customers.

Second, a highly adaptable IOS increases the quality of knowledge codification (i.e., timeliness, accuracy, and relevance) by reconfiguring data definition and granularity and developing a new choreography of a business process, revising the existing process, or even by eliminating irrelevant exchanges that are causing information overload (Malhotra et al. 2007). For instance, a highly adaptable IOS can enhance the quality of information originating from an existing digital module by adapting the IOS use of existing functions. This was also pointed out by one manager during the interviews:

> The IT design of our IOS is flexible. Our IOS requires the buyer to choose a reason from a select list why a potential customer does not purchase this time. Based on our buyer's request, one open-ended choice was added for this question. Now the buyer can write down the reasons that were not listed in the system and indicate the value of such information. Both our firm and our buyer benefit from this enriched information sharing. We can alter our product design and marketing strategy based on these new demands of the customers, and the buyer can carry on more targeted follow-up activities to the potential customers.

Third, IOS adaptability can be leveraged to facilitate the exchange of sensitive information between firms. Sensitive information is unique, situation specific, and susceptible to change (Frazier et al. 2009). It most likely requires a separate and distinct process and content structure that spans collaborating firms. Partners with highly adaptable IOSs will find it easier to reconfigure their IOSs to exchange information of this nature. Thus, we hypothesize the following:

Hypothesis 4 (H4). *IOS adaptability positively affects IOS-enabled knowledge sharing between channel partners.*

We expect that IOS adaptability not only directly improves IOS-enabled knowledge sharing but also has an indirect effect by weakening the negative relationship between institutional distance and IOS-enabled knowledge sharing. As discussed earlier, a boundary object provides a shared foundation on which divergent viewpoints can be built and specified using a common protocol (Dougherty 1992). An adaptable boundary object can be helpful in responding to the emerging differences across a boundary by reconfiguring itself to recreate a common ground and thus facilitate knowledge sharing across the boundary (Carlile 2002, 2004). Indeed, building on Dougherty (1992), Carlile (2004) demonstrates how an adaptable boundary object can be instrumental in spanning a knowledge boundary, i.e., when a boundary object is more malleable, the capacity of this object to bridge the difference for knowledge sharing is greater.

Extending this logic to the IOS context, we posit that IOS adaptability can mitigate the negative effect of institutional distance on IOS-enabled knowledge sharing. As argued earlier, sizeable institutional distance can misalign the institutional logic between two collaborating firms, which then reduces their capability and willingness to appropriate IOS for knowledge sharing. However, an adaptable IOS can be adjusted to mitigate this negative effect of institutional distance by responding to the misalignment of the institutional logics as they emerge during channel collaboration. For instance, an adaptable IOS can configure an otherwise disputable functional module by selectively activating the parts that are acceptable to both firms (Malhotra et al. 2007) or by revising an otherwise conflicting business process to reach an acceptable balance. By contrast, when an IOS is not adaptable, e.g., cannot be revised and selected, it is less likely to resolve the negative effect of institutional distance on knowledge sharing via the IOS.

Specifically, the three pillars of institutional distance give rise to differing demands for IOSs to find ways to mitigate the respective negative effect of each pillar on IOS-enabled knowledge sharing. Normative distance creates the need to strategically accommodate varying social values, assumptions, and norms in channel relationships. Cognitive distance creates the need to reconcile different socially shared conventions and knowledge about channel matters. Regulative distance creates the need to comply with different legal codes and conduct in channel relationships (Yang et al. 2012). When IOS adaptability is substantive, the ability of the IOS to reconfigure itself to reach a common protocol (or a segment of the protocol) that conforms to both institutional logics is higher and hence, the stronger is the ability of the IOS to mitigate the negative influence of the various aspects of institutional distance on knowledge sharing via IOS. Conversely, when IOS adaptability is minor, the ability of the IOS to revise itself to

accommodate diverse institutional needs is weaker and hence the ability to mitigate the negative influence of the institutional distance is likewise weaker.

The customer feedback example discussed earlier illustrates our point. Let us assume that an IOS contains a module that allows the channel partners to codify, analyze, and share customer feedback to reflect products and sales outlet experience. While both of the normative institutions value customer feedback for the products sold through the channel, they vary in how they value customer feedback for the sales outlet. If the IOS module is more adaptable by being selective in how it processes customer feedback, the channel partners might benefit from shared customer knowledge on products, given that this adaptable IOS module can now provide selective support for practices acceptable to both partners (i.e., customer feedback on products). However, if this module is not adaptable such that the module must be used wholly and in its entirety, the channel partner might defer their use of this module for collecting, organizing, and sharing all of the customer feedback because part of the customer feedback is not subject to their own local social values and norms. Thus, we hypothesize the following:

Hypothesis 5 (H5A–H5C). *IOS adaptability positively moderates the negative relationship between normative* (a)*, cognitive* (b)*, and regulative distance* (c) *and IOS-enabled knowledge sharing between channel partners, such that the negative effect is weaker when IOS adaptability is higher.*

4. Research Method

4.1. Research Approach and Sampling

Our hypotheses were tested using a field study of a pair-matched sample of 141 distinct buyer-supplier channel dyads (i.e., dyads consisting of a single supplier and a single buyer from different suppliers and buyers). We used a dyadic survey design, that is, querying both sides of the channel dyads (John and Reve 1982). This design has at least three strengths. First, it enhances measurement validity by cross-referencing the perceptions of both sides of a dyad (Klein 2007). Second, it reduces common method bias by collecting predictor and criterion data from multiple and independent sources (Podsakoff et al. 2003). Third, it eliminates the concern of reduced variance with respect to the single-supplier/multiple-buyer dyadic designs, commonly seen in prior IOS research (e.g., Im and Rai 2008, Klein 2007).

The channel dyads were sampled from four Chinese industries (furniture, home appliance, automotive, and industrial lighting). These settings are appropriate to our study objectives for several reasons. First, China is a typical large and emerging economy that possesses notable intranational institutional differences (Schotter and Beamish 2011). This variation is due to the uneven distribution of China's natural resource endowments, different levels of economic development, and a heterogeneous sociocultural heritage across regions (Ke and Zhang 2002, Lau et al. 2002, Peng et al. 2008, Schotter and Beamish 2011). This within-country heterogeneity is made clear in a World Bank report (2008) showing that local regulative practices, such as contract enforcement, vary greatly across regions in China. Second, the four chosen industries have nationwide distribution networks (Li et al. 2008), which increases the chances that we will observe variance in institutional distance by sampling channel dyads from these industries. Third, IOSs are widely deployed in the four sampled industries. Our pretest interviews with buyers and suppliers revealed that suppliers rely heavily on IOSs to communicate with buyers because buyers expect that products be built to individual specifications and delivered in short lead times.

4.2. Measurement Development

The research instrument was first developed in English and then translated into Chinese. Two professional translators adopted the back translation approach to ensure conceptual equivalence (Hoskisson et al. 2000). The questionnaire was then pilot tested and further refined (MacKenzie et al. 2011) (see Appendix A for a list of scale items).

Institutional distance in channel management was measured as the extent to which two firms in a channel dyad were situated in differing normative, cognitive, or regulative environments. Extant institutional research recommends that these measures be domain specific (Abelson and Black 1986, Walsh 1995) and, for this reason, they were chosen to reflect differences at the intranational level. Because we did not have access to domain-specific archival data about channel management, we adapted the perceptual measures originally put forth by Yang et al. (2012). To adapt these cross-national measures to the intranational context of our study and to ensure content validity, we modified the items based on the opinions of 14 channel managers. The items were measured on a seven-point interval scale (1, not different at all to 7, completely different).

Normative distance was measured by four items borrowed from Yang et al. (2012). These captured differences in norms and values in channel management practices. The items pertain to the moral obligation to provide quality products and services, cooperative norms among channel members, societal-level trust, and standards of business conduct. One item about the intensity of trade associations was dropped because most trade associations in China are nationwide, with very few intranational differences. *Cognitive distance* was measured by three items originally developed by Yang et al. (2012). These capture institutional differences in professional knowledge and skills specifically

related to channel management (Busenitz et al. 2000). The three items referred to professional knowledge of channel management, implementation of channel management programs, and the conventions of channel management. Yang et al.'s (2012) other two items about national environment were also dropped because they were not relevant to our intranational context. *Regulative distance* was measured by two items that captured institutional differences relative to two legal issues essential to channel relationships: dispute resolution and contract enforcement (Antia and Frazier 2001, Cai et al. 2010, Kostova and Roth 2002). Despite being generally consistent at the country level, these two items focus on the enforceability and effectiveness of regulations and laws, which can vary across regions. Finally, we did not use the other three Yang et al. (2012) items because they were not relevant to the intranational context or the channel management domain.

IOS adaptability was measured by adapting a scale of IS flexibility (Saraf et al. 2007) to the interfirm context, a scale that captures the degree to which an IOS can be readily adjusted and reconfigured to respond to change. *IOS-enabled knowledge sharing* was measured using self-developed items that captured the extent to which an IOS was used to share timely, relevant, and useful information within the relationship. These two IT-related constructs were elicited from a business rather than a technical perspective to ensure that the respondents, who were business professionals in charge of channel relationships, could readily answer the questions based on their personal experience.

Joint performance was measured by an established three-item perceptual measure of the joint profit gains of the channel dyad (Jap 1999). A profit-related indicator aggregates the key performance measures of revenue growth and cost savings underlying product distribution to market and is likely to be more accurate (Jap and Anderson 2003) than other performance indicators often used in supply chain research (e.g., operating efficiency, customer satisfaction, and new product introduction speed) (Im and Rai 2008, Luo et al. 2006). We used a nonnumerical, nonarchival performance measure because (1) unlike supplier and buyer profits that are more easily acquired, no accounting measure in itself readily quantifies the joint profit resulting from a dyad's collective effort (Jap and Anderson 2003); and (2) perceptual measures are not subject to product category or industry-specific effects (Zhou et al. 2005).

We included several control variables to rule out alternative explanations. At the environment level, we controlled for industry and market uncertainty because they could affect the quality of the channel relationship and its performance (Jap and Anderson 2003, Wathne and Heide 2000). Dummy variables were used to represent the four industry sectors. Market uncertainty was measured using a four-item scale adapted from Kumar et al. (1995). At the organizational level, we controlled for firm dominance using supplier firm size and buyer firm size (Zaheer and Venkatraman 1994), as measured by number of employees. Then we controlled relationship length, as measured by years of collaboration (Dyer and Singh 1998, Williamson 1985). We normalized the data on buyer size, supplier size, and relationship length through log transformations. We also created dummy variables to control for the location difference between buyer and supplier (0, same city; 1, different city but same region; 2, different region; and 3, different country).

At the IOS level, we controlled for IOS size, IOS type, and IOS use frequency (Chi et al. 2007). IOS type referred to the various functional categories of IOS. Three dummy variables specified the most frequently used IOS functions: (1, marketing and sales information management; 2, order and inventory management; 3, finance management; and 4, others[1]) (Gosain et al. 2003). IOS size was measured using the number of functions supported in an IOS, ranging from one (only one function, e.g., marketing and sales information management) to four (i.e., the IOS supports more than three major functions) (Chi et al. 2007). Frequency of IOS use was measured relative to the industry average.

4.3. Data Collection Procedure

As shown in Figure 1, data for the endogenous variables (i.e., IOS-enabled knowledge sharing and joint performance) were collected from both sides of the dyad, whereas the exogenous variables were mainly measured from the buyer side (except for supplier size, a figure that was best reported by the suppliers). To ensure that our measures of the exogenous variables from the buyer side represented a consensus of both sides, we asked the matched suppliers four omnibus items for the four exogenous variables (i.e., IOS adaptability, regulative distance, normative distance, cognitive distance).[2] The data for these four variables collected from the two sides are highly correlated (IOS adaptability, 0.66; regulative distance, 0.72; normative distance, 0.86; cognitive distance, 0.87), suggesting high consensus between the buyer and supplier.

Our data collection design was based on several key empirical considerations. First, collecting exogenous and endogenous variables from separate, independent sources mitigates concern about common method bias (Podsakoff et al. 2003). Second, although it would be ideal to collect all variables from both sides, we wanted to control the length of the survey, particularly on the supplier side. We did this to address concerns about the high attrition rate often seen in matched-sample designs (Klein 2007)[3] while still capturing two-sided perceptions of the constructs. Third, collecting the endogenous variables from both sides allowed us

to evaluate the extent to which the dependent variables are symmetrical, an important procedure for validating dyadic measures (Straub et al. 2004).

Data Collection from Buyers. We first obtained a list of buyers who intended to participate in an upcoming, highly influential national trade fair for each industry.[4] We next randomly selected 100 buyers at each trade fair, resulting in a sample of 400 buyers. Next, a team of 10 carefully trained research assistants approached the selected buyers for interviews, at each of the four trade fairs.

During the interviews, we first asked the informants to describe their job responsibilities to ensure that they were knowledgeable about the overall corporate activities of their firms and their collaborations with channel partners. On the buyer side, we focused on procurement professionals, managers, and executives because they were the most directly involved in interacting with channel partners through IOSs (Saraf et al. 2007) and were knowledgeable about the performance status of the channel dyad they were managing. These informants were then asked whether their firms had deployed IOSs with their suppliers (e.g., EDI, integrated customer relationship management, integrated inventory sharing system, warehouse management system, or any other partner-interfaced systems). Only respondents who answered "Yes" were asked to complete the instrument. Buyers who deployed IOSs via multiple suppliers were asked to base their responses on their relationship with one of their major suppliers. We received 276 valid responses (Executives 29.7%, Procurement Managers 43.5%, and Procurement Professionals 26.8%), for a response rate of 69% (276/400). This is quite respectable, even according to the very high standards articulated by Sivo et al. (2006).

Data Collection from Suppliers. Once they had completed the buyer questionnaire, each buyer respondent was asked to identify their counterpart in the supplier firm. A total of 191 counterparts were referred and successfully reached by telephone. Our research assistants interviewed 156 (81%) of the suppliers who agreed to participate. Suppliers were asked to base their responses on the focal buyer. A total of 141 interviews were completed (Marketing Executives 29.1%, Marketing Managers 42.6%, and Marketing Professionals 26.2%) for a response rate of 74%. This is a very reasonable response rate for a dyadic, interfirm research design, compared to an average response rate of 58% in other studies employing the same strategy (Dyer 1996, Fein and Anderson 1997, Johnson et al. 1996). Our final sample size of 141 dyads is large relative to earlier studies (e.g., 83 dyads in Dyer's 1996 work and 91 in Klein et al. 2007).

Our interviews revealed that dyads tend to use IOSs to share explicit knowledge about products (e.g., product specifications, inventory status, sales orders, sales volumes, and sales forecasts), customers (e.g., customer needs and feedback), and finances (e.g., financial sheets). IOS use varied from very infrequent (e.g., once a month) to very frequent (e.g., in real time). The sample demographics are shown in Appendix B.

To assess nonresponse bias, we first compared the available demographics for the responding and the nonresponding suppliers/buyers in terms of firm size, sales mode, and sales region and found no statistical differences (Armstrong and Overton 1977). We then compared the 132 unmatched responding buyers and the 141 matched respondent buyers in terms of firm size, relationship length, and respondent position. We detected no significant differences in key variables, leading us to infer that nonresponse bias was not a major concern.

Gathering the independent variables (IVs) and dependent variables (DVs) from different and independent sources ensured a large measure of independence from the method effects between our IVs and DVs (Podsakoff et al. 2003). However, we still checked for common methods bias using a direct measure of a latent common method factor (Chang et al. 2010). As predicted, this test indicated that common method bias is not a major concern (see Online Appendix B).

4.4. Data Analysis Technique

We used partial least squares (PLS) to validate the measurement model and to test the structural model. PLS is a suitable component-based approach for estimation because, unlike a covariance-based structural equation model (SEM), it works efficiently with both complex models and, according to several sources, a relatively smaller sample size (Hair et al. 2011). Furthermore, PLS can test complex relationships by avoiding inadmissible solutions and factor indeterminacy (Fornell and Bookstein 1982, Gefen et al. 2000).

5. Analyses and Results

To conduct our data analyses, we first aggregated the data from the matched samples. We then tested the measurement model and the structure model[5] by using Smart PLS 2.0 with the parameter setting of bootstrapping with 400 resamples (Ringle et al. 2012).

5.1. Aggregation of Matched Data

Before aggregating the dyadic data on IOS-enabled knowledge sharing and joint performance, we checked for pair symmetry by using the interrater agreement index *rwg*. This is a frequently used index for interrater agreement on Likert-type scales (Brown and Hauenstein 2005, Dunlap et al. 2003, LeBreton et al. 2003). The average *rwg* for IOS-enabled knowledge sharing and joint performance was 0.89 and 0.93, respectively, passing the threshold of 0.70 (James et al. 1984) and

Table 2. Descriptive Statistics and Construct Correlations

	JP	IA	IKS	RD	ND	CD	MU	SSIZE	BSIZE	RL	LD	IOSS	FRE
JP	**0.82**												
IA	0.39**	**0.70**											
IKS	0.48**	0.59**	**0.67**										
RD	−0.16	−0.29**	−0.22*	**0.79**									
ND	−0.16	−0.43**	−0.38**	0.53**	**0.66**								
CD	−0.19*	−0.38**	−0.35**	0.56**	0.69**	**0.79**							
MU	0.05	−0.06	−0.18*	0.22**	0.23**	0.08	**0.78**						
SSIZE	0.08	0.16	0.19*	0.02	−0.12	−0.11	−0.09	—					
BSIZE	0.24**	−0.00	−0.04	0.09	0.13	−0.05	0.14	0.10	—				
RL	0.13	0.13	0.03	−0.02	0.04	−0.05	0.01	0.10	0.03	—			
LD	−0.05	−0.05	−0.05	0.15	0.11	0.17*	0.00	−0.05	−0.04	−0.05	—		
IOSS	0.05	−0.07	−0.01	−0.23	−0.10	−0.16	0.07	−0.34**	0.17	0.09	−0.24*	—	
FRE	−0.21	−0.23*	−0.13	0.00	−0.12	−0.08	−0.14	0.04	0.05	−0.12	−0.09	0.47**	—
Mean	5.52	5.67	5.79	2.29	1.83	2.20	3.96	1,110.92	783.66	5.30	1.53	2.69	3.65
S.D.	0.72	0.80	0.79	0.86	0.77	0.90	1.40	3,030.68	3,724.17	3.63	0.78	0.87	0.85
Degree of missingness (%)	0.0	2.1	2.1	2.1	2.1	2.8	2.1	2.1	9.2	0.0	2.1	7.8	7.8

Notes. AVEs are in bold. JP, joint performance; IA, IOS adaptability; IKS, IOS-enabled knowledge sharing; RD, regulative distance; ND, normative distance; CD, cognitive distance; MU, market uncertainty; SSIZE, supplier size; BSIZE, buyer size; RL, relational length; LD, location difference; IOSS, IOS size; FRE, IOS frequency. $N = 141$.

*$p < 0.05$; **$p < 0.01$.

suggesting a good symmetry and consensus in the perceptions of the supplier and buyer (Straub et al. 2004). Thus, we averaged the matched buyer and supplier's scores of IOS-enabled knowledge sharing and joint performance for further analysis (Luo 2008).[6,7]

5.2. Measurement Model: Reliability and Construct Validity

Reliability was assessed using composite reliability and average variance extracted (AVE) (Fornell and Larcker 1981). Convergent and discriminant validity were assessed by a confirmatory factor analysis to determine whether the loadings on the corresponding constructs were consistently higher than the loadings on the other constructs,[8] as shown in Online Appendix A. The results showed that all of the items passed the tests, except when the fourth item of IOS-enabled knowledge sharing was removed because of a low loading. Discriminant validity was also assessed by comparing the correlations and the square roots of the AVEs (Table 2) and the resulting statistical comparisons pass the standard tests (Hair et al. 2011).

5.3. Hypothesis Testing via the Structural Model

Table 3 summarizes the PLS results from testing the main and moderating effects and reporting their respective explanatory power, using an econometric stepwise approach.[9] In Model 1, we examined the effects of control variables on IOS-enabled knowledge sharing and joint performance. The hypothesized main effects were added for Model 2. In Model 3, we added the interaction effects of normative, cognitive, and regulative distances, following the product-indicator method (Chin et al. 2003).[10] This approach allows us to check the robustness of the main and interaction effects and to calculate the R-square increment due to the main and interaction effects.

H1A–C state that normative distance, cognitive distance, and regulative distance, negatively affect IOS-enabled knowledge sharing. Model 2 shows that both normative and cognitive distance had a negative and significant effect on IOS-enabled knowledge sharing (normative distance: $b = -0.10$, $p < 0.05$; cognitive distance: $b = -0.17$, $p < 0.01$), supporting H1A and H1B. The effect of regulative distance on IOS-enabled knowledge sharing was not significant ($b = 0.08$, $n.s.$), rejecting H1C.

H2 states that IOS-enabled knowledge sharing is positively related to joint performance. As shown in Model 2, this relationship was positive and significant ($b = 0.47$, $p < 0.001$), supporting H2. H3A–C postulate negative moderating effects of normative distance, cognitive distance, and regulative distance on the relationship between IOS-enabled knowledge sharing and joint performance. Model 3 shows that the interaction effect of cognitive distance and IOS-enabled knowledge sharing on joint performance was negative and significant ($b = -0.12$, $p < 0.05$), supporting H3B. We plotted this interaction effect in Figure 2; the plot indicates a moderating effect and a corroboration of H3B. However, the interaction effect of normative distance was not significant ($b = -0.14$, $n.s.$), rejecting H3A. Regulative distance did not exert a significant moderating effect on joint performance ($b = 0.04$, $n.s.$), rejecting H3C.

As shown in Model 2 of Table 3, the relationship between IOS adaptability and IOS-enabled knowledge sharing was also positive and significant ($b = 0.50$,

Table 3. PLS Analysis Results

Variables		IOS-enabled knowledge sharing			Joint performance		
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Control variables							
Market uncertainty		−0.17**	−0.12**	−0.13**	0.00	0.10*	0.10*
Supplier firm size		0.17**	0.06	0.05	0.05	−0.02	−0.02
Buyer firm size		−0.06	−0.02	−0.01	0.22**	0.23***	0.24***
Relationship length		0.01	−0.03	−0.02	0.14*	0.14**	0.14**
Industry 1 (furniture)		0.11	0.16**	0.13*	0.22**	0.16**	0.16*
Industry 2 (home appliance)		0.01	0.09*	0.10	0.21**	0.21***	0.21**
Industry 3 (automotive)		0.05	0.08	0.05	0.21*	0.20**	0.17*
Location distance		−0.03	−0.02	−0.05	−0.06	−0.02	−0.01
IOS size		0.11	0.04	0.02	0.08	0.01	0.01
IOS use frequency		−0.03	−0.02	−0.16	−0.11	−0.10	−0.06
IOS Type 1 (sales and marketing)		−0.05	−0.03	0.00	−0.08	−0.05	−0.08
IOS Type 2 (order and inventory)		−0.01	0.03	0.04	−0.01	0.00	0.00
IOS Type 3 (finance)		0.05	0.05	0.05	0.00	−0.02	−0.01
IOS Type 4 (others)		0.06	0.00	0.01	0.04	0.01	0.00
Independent variables							
Adaptive IOS	H4	—	0.50***	0.49***	—	—	—
IOS-enabled knowledge sharing (KS)	H2	—	—	—	—	0.47***	0.48***
Normative distance	H1A	—	−0.10*	0.02	—	−0.05	−0.09
Cognitive distance	H1B	—	−0.17**	−0.20**	—	0.02	0.02
Regulative distance	H1C	—	0.08	0.08	—	−0.12	−0.11
Interaction effects							
Adaptive IOS × Normative distance	H5A	—	—	0.04	—	—	—
Adaptive IOS × Cognitive distance	H5B	—	—	0.13*	—	—	—
Adaptive IOS × Regulative distance	H5C	—	—	−0.12	—	—	—
KS × Normative distance	H3A	—	—	—	—	—	−0.14
KS × Cognitive distance	H3B	—	—	—	—	—	−0.12*
KS × Regulative distance	H3C	—	—	—	—	—	0.04
R^2		0.11	0.43	0.46	0.17	0.40	0.44
ΔR^2			0.32	0.03		0.23	0.04
f^2-statistics			0.56	0.06		0.38	0.07

Notes. f^2-statistics = $[R^2$ (full model)-R^2 (partial model)$]/[1 - R^2$ (full model)$]$. Missing values were replaced by using multiple imputation ($m = 5$).

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (one-tailed test for hypothesized effects).

$p < 0.001$), supporting H4. H5A–C postulates the positive moderating effect of IOS adaptability on the relationship between normative, cognitive, and regulative distance, and IOS-enabled knowledge sharing. As seen in Model 3 of Table 3, the interaction effect of an IOS adaptability and cognitive distance was positive and significant ($b = 0.13$, $p < 0.05$), supporting H5B. We plotted this interaction effect in Figure 3. The less negative slope of the line for high IOS adaptability corroborates H5B. The moderating effects of IOS adaptability on normative distance and regulative distance were not significant (normative distance: $b = 0.04$, $n.s.$; regulative distance: $b = -0.12$, $n.s.$), rejecting H5A and H5C.

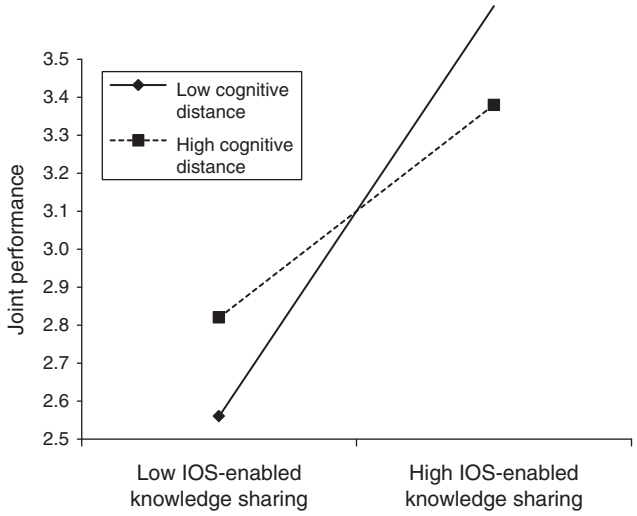
To determine whether the significant hypothesized effects are substantive, we examined R-square changes resulting from the respective effects, following Cohen (1988) and Chin et al. (2003). In Model 1 (see Table 3), the control variables collectively explained 11% of the variance of knowledge sharing and 17% of the variance of joint performance. In Model 2, we added IOS adaptability and the three dimensions of institutional distance to affect knowledge sharing, increasing R^2 from 11% to 43%, up by 32%. This R^2 increase indicates a large effect size ($f^2 = 0.56$). Similarly, including knowledge sharing and the three dimensions of institutional distance to affect joint performance in Model 2, increased the R^2 from 17% to 40%, up by 23%. This R^2 increase also indicates a large effect size ($f^2 = 0.38$).

Including the interaction effect of regulative, normative, and cognitive distances on knowledge sharing in Model 3 increased the R^2 by 3%, indicating a small-to-medium effect size ($f^2 = 0.06$), similar to those in prior studies (Chin et al. 2003). Including the interaction effects of regulative, normative, and cognitive distances on joint performance increased the R^2 by 4%, indicating a small-to-medium effect size ($f^2 = 0.07$).[11]

6. Discussion, Implications, Limitations, and Further Research

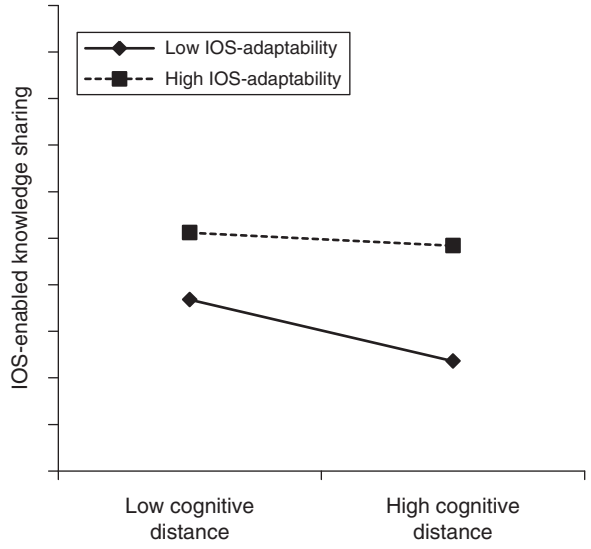
Institutional distance has previously been discussed in the organizational literature and practitioners recognize its relevance to contemporary digitally enabled

Figure 2. Moderating Role of Cognitive Distance on IOS-Enabled Knowledge Sharing and Joint Performance



interorganizational collaboration; however, the existing IOS literature has not accounted for institutional distance. The present study contributes to IOS research by taking the first step toward understanding institutional distance within the context of IOS. Specifically, we build on the institutional theory and boundary object literatures to develop a set of hypotheses to understand how institutional distance affects IOS-enabled knowledge sharing and joint performance. We also explore how IOSs can be designed to overcome the knowledge sharing problem arising from institutional distance. Six of 11 hypotheses are supported (as summarized in Table 4), providing evidence for many of our theoretical arguments. In this section, we reflect on the theoretical implications of our work, consider why some of the hypotheses were not supported, and offer practical recommendations.

Figure 3. Moderating Role of IOS Adaptability on Cognitive Distance and IOS-Enabled Knowledge Sharing



6.1. Theoretical Implications

First and foremost, our study confirms that normative and cognitive distances are negatively related to IOS-enabled knowledge sharing, indicating that these two dimensions of institutional distance reduce knowledge sharing through IOS.[12] This is consistent with our expectations. Furthermore, the results show that cognitive distance weakens the positive relationship between IOS-enabled knowledge sharing and the joint performance of collaborating firms.

To better display this moderating relationship, we present an interaction plot as Figure 2. This chart shows that the two lines cross over, thus indicating a polarized effect of cognitive distance on the performance impact of IOS-enabled knowledge sharing. Specifically, a high level of joint performance was achieved when collaborating firms with low cognitive distance successfully shared knowledge via IOS; however, this performance sharply deteriorated when collaborating firms had a low cognitive distance and were poor at sharing knowledge via IOS.

This result is intriguing. One explanation could be that although narrow cognitive distance can legitimize (and thus lubricate) cooperative actions informed by a high level of shared knowledge, it can also reduce the opportunity to challenge existing practices, which is an important process of mindfully evaluating shared knowledge (Velu et al. 2013). When knowledge sharing is at a low level, this mindful process is particularly important. Firms with weak or scant knowledge sharing, as is the case with narrow cognitive distance, might uncritically execute poorly informed collaborative actions and inadvertently undermine joint performance. Conversely, when cognitive distance is high, the partners may more mindfully consider joint actions based on limited knowledge sharing, thus reducing the risk to performance. The polarizing effect of cognitive distance is likely due to these considerations.

These findings make an important contribution to the IOS literature by advancing our scholarly understanding of IOS-enabled knowledge sharing and its impact on the joint performance of institutionally distant firms. Prior IOS literature has addressed knowledge sharing in general through several theoretical angles, such as the relational view of the firm (Saraf et al. 2007), absorptive capacity (Malhotra et al. 2005), organizational learning (Im and Rai 2008), and boundary spanning (Malhotra et al. 2007). These theoretical perspectives argue that partner misinterpretation is the main barrier to general knowledge sharing. However, knowledge shared through IOS, even by institutionally distant partners, is explicit and not subject to misinterpretation; hence, a commonly held assumption that

Table 4. Results Summary

Hypotheses	Expectation	Support
H1A–C	Normative (a), cognitive (b), and regulative distance (c) are negatively related to IOS-enabled knowledge sharing between two channel partners.	Yes/Yes/No
H2	IOS-enabled knowledge sharing positively affects joint performance between two channel partners.	Yes
H3A–C	Normative (a), cognitive (b), and regulative distance (c) *negatively* moderate the effect of IOS-enabled knowledge sharing on joint performance between two channel partners, such that the effect is stronger when the distance is small.	No/Yes/No
H4	IOS adaptability positively affects IOS-enabled knowledge sharing between channel partners.	Yes
H5A–C	IOS adaptability positively moderates the negative relationship between normative (a), cognitive (b), and regulative distance (c) and IOS-enabled knowledge sharing between channel partners, such that the negative effect is weaker when IOS adaptability is higher.	No/Yes/No

institutional distance does not matter to knowledge sharing via an IOS. Drawing on institutional theory, our study contributes to the IOS literature by explaining why institutional distance (cognitive distance in particular), can still reduce IOS-enabled knowledge sharing and has an indirect weakening effect on joint performance.

Our study also contributes to the IOS literature by extending institutional theory in the IOS area. Institutional theory has been used to predict IOS adoption (Liu et al. 2010, Teo et al. 2003) and postadoption assimilation (Bala and Venkatesh 2007, Sodero et al. 2013) by recognizing IOS technology as the *focus* of the institutional environment. Our study extends this institutional account to explain the business outcomes of IOSs (i.e., IOS-enabled knowledge sharing and performance). This is achieved by introducing a specific business domain (channel management in our case) as the *foci* of the institutional environment in the IOS context. In so doing, we acknowledge the "institutional duality" of IOSs and introduce the construct of institutional distance as a meaningful set of antecedents to IOS-enabled knowledge sharing. This novel perspective represents a theoretical advancement of institutional theory in the IOS context.

Our findings also contribute back to the institutional distance literature in two ways. One, our study extends the applicability of institutional distance from its original context of multinational firms (Kostova 1999, Kostova and Roth 2002, Kostova and Zaheer 1999) to interorganizational relationships. Two, it unveils IOS-enabled knowledge sharing as one plausible mechanism through which institutional distance affects performance. The prior literature has found that institutional distance has a significant effect on intermediate outcomes, such as practice adoption/transfer (Kostova 1999, Kostova and Roth 2002, Kostova and Zaheer 1999), legitimacy pressure/market ambiguity (Yang et al. 2012), and new business development (Xu and Shenkar 2002), but has little effect on direct performance outcomes. Our findings suggest that, despite limited observed direct effect on joint performance, institutional distance does have indirect performance impacts through IOS-enabled knowledge sharing and by the effect of moderating its relationship with joint performance. Thus, our work contributes to the institutional distance literature by understanding one mechanism that connects the otherwise remote, nearly unobservable relationship between institutional distance and joint performance. It also opens avenues for future research to understand other possible mechanisms.

The second major finding of our study is that IOS adaptability positively affects IOS-enabled knowledge sharing. More interestingly, we find that IOS adaptability moderates the relationship between cognitive distance and IOS-enabled knowledge sharing, such that when IOS adaptability is high, the negative effect of cognitive distance on IOS-enabled knowledge sharing is weaker, as illustrated in Figure 3. This finding advances our understanding of how an IOS can be designed as a boundary object to enable knowledge sharing when facing the challenge of institutional distance.

The existing IOS literature has identified standardization from the boundary object perspective as an IOS design characteristic to enable knowledge sharing (Im and Rai 2008; Malhotra et al. 2005, 2007); however, IOS adaptability has been overlooked as another theoretically relevant design characteristic instrumental in knowledge sharing, especially in the context of institutional distance. By introducing the novel construct of IOS adaptability, we contribute to the IOS literature by adding this important design characteristic for improved understanding of knowledge sharing using an IOS. We also extend the use of boundary object theory from the existing organizational or community contexts (Boland and Tenkasi 1995, Carlile 2002, Dougherty 1992, Wenger 1998) to the broader institutional context where the boundary lies in the differences between different institutional environments.

In addition to these theoretical implications, our study also utilizes a stronger empirical design in that it is dyadic research measuring single-supplier/single-buyer dyads from different suppliers and buyers. Most prior IS research employs either a monadic approach with one-sided data (Gosain et al. 2004; Malhotra et al.

2005, 2007) or a dyadic approach that collects single-supplier and multiple-buyer data (e.g., Im and Rai 2008, Klein 2007). Our design captures more complete perceptions from both sides of the dyad, thus alleviating the measurement issue of interdependence between different data points (Im and Rai 2008).

Unexpectedly, we did not find a moderating effect of normative distance between IOS-enabled knowledge sharing and joint performance. Also, as noted earlier, the significant direct effect of normative distance on IOS-enabled knowledge sharing is not completely robust across models. One possible reason may be that, although cognitive and normative institutions are conceptually distinct, in practice they overlap considerably (Kostova and Zaheer 1999). The cognitive and normative domains are created through a process of education and socialization (Murtha and Lenway 1994), compared to the regulative domain, which is shaped by governmental and regulatory bodies. Normative influences, such as social norms and values, may affect a firm's collaborative planning and execution through cognitive categorization (Kostova and Zaheer 1999). Thus, the effects of normative distance might have been partially subsumed in cognitive distance and hence less salient empirically despite its distinctiveness at the conceptual level.

To empirically verify this speculation, we conducted a posthoc PLS analysis in which cognitive distance was excluded from the model. The results show that normative distance turned out to negatively moderate the linkage between knowledge sharing and joint performance ($b = -0.17$, $p < 0.05$). In other words, our hypothesized moderation effect regarding normative distances would have been supported if cognitive distance were not included in the analysis, providing preliminary evidence that cognitive distance may be suppressing the moderating effects of normative distance. Similarly, when cognitive distance is excluded from the model, the moderating effect of IOS-adaptability on the relationship between normative distance and IOS-enabled knowledge sharing turns out to be significant and positive ($b = 0.10$, $p < 0.05$). If this conjecture is true, future research could further extend institutional theory by considering the interdependence of cognitive and normative distance.

Moreover, none of the hypotheses related to regulative distance were supported. This surprising finding may be due to the formal nature of regulative institutions, especially as compared to normative and cognitive institutions. Regulative institutions are explicitly formalized constraints of laws and regulations (North 1990). Therefore, they are the most tangible and easiest for an outsider to observe and mindfully react to. Chances are that regulative differences could have been fully considered at the adoption stage of IOS, making its overall effect at the IOS use stage rather weak, albeit theoretically possible. By contrast, cognitive and normative institutions are informal and intangible (Scott 2001) and much more difficult to cope with because they are part of the "deep structure" (Gersick 1991, p. 14), subconsciously rooted in the cultural and value systems of the institution (Kostova and Zaheer 1999). Thus, they could have enduring effects over time. Indeed, Kostova and Zaheer (1999) state, "The cognitive and normative domains of the institutional environment will present a greater challenge to MNE subunits in establishing their legitimacy, and to MNEs and MNE subunits in maintaining legitimacy, compared to the regulatory domain" (p. 70). This suggests that the legitimacy issue in the regulative domain may be less difficult to overcome than in the normative and cognitive domains (Kostova and Zaheer 1999). In other words, the larger of institutional logic in the regulative domain might be easier to observe and address than in the other two domains, hence the insignificant findings.

Another possible explanation for the lack of effects for normative and regulative distances in comparison to cognitive distance could be that, while the three distances represent the three aspects of the institutional environment, they also manifest themselves at different levels. Regulative distance is more at the regional or even national level. Normative distance is more at the industry or community level. Thus, it can be more difficult for firms to reconcile their impacts. By comparison, the influence of cognitive distance is much easier to reconcile by firms because cognitive distance is more at the organizational level.[13] Future research could investigate this line of reasoning more thoroughly.

6.2. Practical Implications

Our study has practical implications for channel relationship managers. First, managers should not only concentrate on building a standardized IOS for use with partners but also invest in improving the adaptability of their IOS, particularly when they collaborate with institutionally (at least cognitively) distant partners. They can do so by modularizing the system for knowledge sharing while still enhancing system integration and enforcing the use of standardized data formats, wherever possible. Second, as more and more contemporary firms extend their market reach by developing collaborative relationships with institutionally distant partners, managers should try to develop a sound understanding of their partner's institutional profile, particularly the cognitive structures regarding professional channel management knowledge. When the two partners are situated in different cognitive environments, a manager should invest more seriously in building an adaptive IOS because an adaptive IOS can mitigate the negative impact of cognitive distance on knowledge sharing via IOS. Finally, the

manager should also be mindful of the social norms and value orientations of the characteristic channel relationships of their partners (Earley and Ang 2003) because normative distance can undermine knowledge sharing through IOS.

6.3. Limitations and Future Research

The findings of our study should be interpreted with several limitations in mind. First, our empirical findings are based solely on data gathered from Chinese firms. China shares many characteristics with other emerging economies and with emerging industries in developed economies in terms of channel relationships, market conditions, and interfirm networks. However, the country also possesses some idiosyncrasies that may limit the generalizability of our findings. Future research can benefit by extending our study to other national contexts.

Second, the current empirical context has certainly provided us with a theoretically justified and empirically conservative (and therefore more robust) setting within which to test our hypotheses; however, we would expect a more salient role for institutional distance in IOS-enabled knowledge sharing when investigations focus on cross-border interorganizational relationships. Third, for practical reasons, a few constructs in our model were fully measured from only one side of the dyad. We do not expect the research findings to change, given the consistency of the responses obtained from the other key constructs measured from both sides; however, future research could certainly benefit from collecting a full spectrum of data from both sides.

Finally, in our research design, we asked the buyer respondents to answer all of the questions based on their relationship with a major supplier. This particular buyer-supplier relationship was recommended in prior literature (Jap 1999); however, it may have still led to a self-selection bias. Future studies should try other means for specifying the buyer-supplier relationship in the empirical design. Hence, these limitations provide us with opportunities to conduct further research.

6.4. Conclusion

Contemporary firms are increasingly collaborating with institutionally distant partners by using IOS. This study provides a clearer understanding of the challenge that institutional distance imposes on using IOSs to share knowledge for joint business success. It also offers insights into how IOS adaptability can deal with this challenge. Future research and practice can focus more intently on how to make an IOS more adaptable to manage knowledge sharing across collaborating firms that confront sizeable institutional distances.

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Appendix A. Measurement Scales

Regulative Distance (RD)—*Please indicate the magnitude of difference for the following regulative aspects related to channel management between your supplier's local institution and your local institution*: (1 = *not different at all*, 7 = *completely different*)
(RD1) Rules and laws to effectively settle disputes
(RD2) Rules and laws to enforce contracts

Normative Distance (ND)—*For each of the following items concerned with socially accepted norms and values channel professions are expected to hold, please indicate the magnitude of difference between your supplier's local institution and your local institution*: (*response anchor same as above*)
(ND1) Norms of cooperation among channels in general
(ND2) Trust as a society-wide phenomenon
(ND3) Moral obligation for providing quality products/services
(ND4) Expectation for high standards of codes of conduct

Cognitive Distance (CD)—*For each of the following items concerned with shared beliefs, conventions, and taken-for-granted customs related to channel management, please indicate the magnitude of difference between your supplier's local institution and your local institution*: (*response anchor same as above*)
(CD1) Professionals' knowledge pertaining to channel management
(CD2) Companies' implementation of channel management programs
(CD3) Conventions of marketing channel operations

IOS-Enabled Knowledge Sharing (IKS)—*Please indicate your agreement with the following statements about knowledge sharing with your channel partner due to usage of an IOS*.
(IKS1) With the help of the integrated information system, whenever there is a problem or change, we can immediately inform this channel partner how to cope with it.
(IKS2) Using the integrated information system, both this channel partner and we are able to share and apply all useful information.
(IKS3) We established a joint information system to combine the relevant knowledge of both parties.

Appendix A. (Continued)

(IKS4) With the co-developed information system, we can share sensitive information to support this channel partner in any future collaboration.[a]

IOS Adaptability (IA)—*Please indicate your agreement with the following statements about the IOS in use*:
(IA1) Both partners are able to make adjustments in the joint information system to cope with changing economic circumstance or vulnerable customer demands.
(IA2) Together, we have developed processes to increase flexibility in our joint information systems in response to customer requests.
(IA3) We are able to make adjustments in our joint information system to accommodate changing circumstances.

Joint Performance (JP)—*With this buyer/supplier, our firm has*:
(JP1) achieved a high level of joint profits.
(JP2) generated a considerable amount of profit together.
(JP3) increased joint profits shared between us.

Market Uncertainty (MU)
(MU1) It is difficult for us to monitor the trends in our sales area.
(MU2) The industry volume in our sales area is volatile.
(MU3) The sales forecasts in our sales area are quite inaccurate.
(MU4) The market environment in our sales area is unpredictable.

[a]We deleted this item from further analysis because of its low factor loading.

Appendix B. Sample Demographics

		Buyer (%)	Supplier (%)
Firm size (no. of employees)	<100	24.1	58.9
	100–499	29.8	24.1
	500–1,000	11.3	5.7
	≥1,000	25.5	9.2
	Missing	9.2	2.1
Firm location (regions)	East China	54.6	56.0
	South China	14.9	17.7
	North China	14.9	14.9
	West China	13.5	7.1
	None of the above	2.1	4.3
Respondent title	Executive	7.1	29.1
	Midlevel manager	40.4	42.6
	Professional	42.6	26.2
	Missing	9.9	2.1
Industry	Automotive	25.4	25.4
	Furniture	20.4	20.4
	Home appliance	24.6	24.6
	Lighting	29.6	29.6

Endnotes

[1]This was an open-ended question. A dyad might report more than one function. Least-used functions were grouped as "others."

[2]The four omnibus items are (1) the IOS that this buyer and our firm use together is adaptable (IOS adaptability); (2) the regulative aspects related to channel management between our buyer's local institution and our local institution are very different (regulative distance); (3) the normative aspects related to channel management between our buyer's local institution and our local institution are very different (normative distance); and (4) the cognitive aspects related to channel management between our buyer's local institution and our local institution are very different (cognitive distance).

[3]The response rate of the suppliers would otherwise be lower because the suppliers were snowballed through their buyers and were only interviewed by telephone.

[4]The trade fairs we selected were highly influential and attracted many participants. Indeed, 2,974 of a total of 4,255 furniture manufacturers attended the furniture trade fair; 403 of 2,363 home appliance manufacturers attended the appliance trade fair; 63 of 121 automotive manufacturers attended the automotive trade fair; and 207 of 368 lighting manufacturers attended the industrial lighting trade fair. In addition, the average firm size of our sampled exhibitors/manufacturers was comparable to the average firm size in each industry, implying that our samples may not be systematically biased. In the furniture industry, the average firm size of our sample

is 873 and the industry average is 106. In the home appliance industry, the average firm size of our sample is 843 and the industry average is 600. In the automotive industry, the average firm size of our sample is 804 and the industry average is 754. In the industrial lighting industry, the average firm size of our sample is 1,120 and the industry average is 779.

[5] The missing values were replaced using multiple imputation in PLS analysis.

[6] This approach to data aggregation is mathematically consistent with the *degree value* measure proposed by Straub et al. (2004). We also generated the degree-symmetric value by averaging the degree value and the symmetric value of these constructs. Since the dyadic data demonstrated good symmetry, the hypothesis results based on the degree values and the degree-symmetric values should be close if not identical.

[7] We also followed Selnes and Sallis (2003) as an alternative method to merge buyer and supplier data. In this way, each latent construct has two indicators, the buyer's value of this latent construct and the supplier's value. The hypothesis results using this method are similar, thus further corroborating the robustness of our results and the consensus between buyers and suppliers.

[8] As the loading of Item ND1 is only slightly higher than its cross-loadings, we conducted a robustness check by estimating the research model without ND1 as an indicator of normative distance. The results are robust even without ND1.

[9] To check the robustness of PLS results, we also conducted ordinary least squares (OLS) regression to test our research model and doing this, we got consistent results. For the detailed results of the OLS regression, please refer to Online Appendix C.

[10] To account for potential endogeneity, we followed the Durbin–Wu–Hausman method (Davidson and MacKinnon 1993) and found that IOS adaptability is exogenous in our setting. For detailed results of this procedure, please refer to Online Appendix D.

[11] Although the effect sizes of our hypothesized interaction relationships are relatively small, it is important to note, according to Cohen (1988), that these were general guidelines for any effects and not specific to interaction effects. Past studies find that interaction effects are typically smaller in effect size (Chin et al. 2003, Weill and Olson 1989). For instance, an effect size of 0.02 is seen as optimistic by Aguinis (2004). Low effect size is usually due to the low reliability of the product terms (Cohen et al. 2013, Jaccard and Turrisi 2003), not the importance of theoretical relationships (Chin et al. 2003). Indeed, Aguinis et al. (2005) reviewed articles representing great theoretical advancements in the past 30 plus years and found that the median effect size for the interactions effects is about 0.002. Likewise, our search of *Information Systems Research* and *MIS Quarterly* articles reveals that small to moderate effect sizes for moderation effects are not uncommon. For example, Majchrzak et al. (2005) and Angst and Agarwal (2009) reported moderating effects with R^2 changes of about 1%. In sum, the effect sizes of the interaction effects in our study are reasonable.

[12] Overall, our results suggest that normative distance has a significant positive effect on IOS-enabled knowledge sharing (per H1A); however, care needs to be taken when taking this as an affirmative conclusion because this effect turns insignificant in the full model (Model 3, Table 3). Future research should replicate and reaffirm this relationship.

[13] We would like to thank an anonymous reviewer for pointing us to this possible explanation so as to inspire future research.

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