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Developing relationship-specific memory and absorptive capacity in interorganizational relationships

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Abstract Drawing on the studies of relationship-specific memory and absorptive capacity, this study examines whether physical and human IT resources deployed in interorganizational relationships influence the development of a firm's IT-enabled capabilities, namely relationship-specific memory and absorptive capacity. In addition, the study explores whether these capabilities increase firm performance and also examines the relationship between relationship-specific memory and absorptive capacity. To test the hypotheses, we conducted a partial least squares analysis using data collected from 115 firms. The results demonstrate that firms enhanced their relationship-specific memory and absorptive capacity by leveraging their physical and human IT resources invested in interorganizational relationships and that these two capabilities increased their performance. Moreover, our results indicate that relationship-specific memory served as a knowledge base for the development of absorptive capacity. The results offer empirical evidence on how firms could improve their performance by internally managing the relational knowledge obtained through their interorganizational relationships.

Keywords Knowledge management · Interorganizational relationship · Relationship-specific memory · Absorptive capacity · IT-enabled capability · IT resources

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1 Introduction

Given the limitation of IT in providing firms with differential advantages over competitors as they can adopt the same or similar IT systems in the long run, prior studies have sought to uncover the idiosyncratic capabilities that they may develop through IT [34, 42]. That is, IT should be considered as an important tool for developing a firm's capabilities and thus for enhancing firm performance. For example, Tippins and Sohi [42] proposed organizational learning as a capability connecting IT competency to firm performance. In their study, IT competency means a firm's ability to use IT for knowledge management. Pavlou et al. [32] argued that the use of IT leveraging competence, which is increased by the use of project and resource management systems, knowledge management systems (KMSs), and cooperative work systems, leads to the development of dynamic capabilities and functional competencies and thereby leading to competitive advantage in the context of new product development. Therefore, it is problematic to assume that IT itself is equivalent to the advancement of firm performance, although IT can help firms develop their unique capabilities, which directly involve superior performance [30, 42].

Beyond firm boundaries, the same issue raises in the context of interorganizational relationships (IORs): that is, what types of capabilities related to increased relationship performance can firms develop based on IT resources embedded in IORs? Prior studies have sought to find certain capabilities in IORs which can be developed by leveraging IT resources (namely, IT-enabled capabilities), such as expertise exploitation capability [10] and business process capability [34, 35]. In the context of supply chains, Rai et al. [34] underscored a firm's process integration capability as a key variable linking IT to firm performance.

Rai et al. [35] contended that structural IT capabilities (i.e., IT integration and IT reconfiguration) are linked to competitive process capabilities and thus result in competitive performance in IORs. Likewise, researchers have attempted to find certain firm capability that can be developed by the use of IT in the context of IORs. Despite the fact that firms can potentially develop many different types of capabilities embedded in IORs by leveraging IT resources, little has been known about such capabilities. This study advances our understanding by identifying and empirically testing IT-enabled capabilities in IORs.

This study proposes two types of IT-enabled capabilities in IORs, drawing on the studies of the relationship-specific memory and absorptive capacity. First of all, this study introduces the concept of relationship-specific memory to capture the ability of a firm to manage relational knowledge obtained through IORs by leveraging IT resources. Relationship-specific memory is defined "as the amount of knowledge, experience, and familiarity with the supply chain process" [20], pp. 243. In fact, relationship-specific memory is a construct extending organizational memory into the context of IORs [31]. Organizational memory has been applied to measure the levels of knowledge accumulation and distribution across the organization [13, 31, 45]. Relationship-specific memory is regarded as an important mechanism for firms to obtain, accumulate and integrate relationship-specific knowledge, experiences, and best practices obtained in IORs [20, 22, 38]. This study suggests that relationship-specific memory is one of the IT-enabled capabilities that can be enhanced by using IT resources embedded in IORs.

A majority of studies have focused on fostering information sharing in IORs and exploring the impact of information sharing on relationship performance. Nevertheless, there is a lack of understanding as to how firms manage the shared information in IORs and how they apply it for developing further firm capabilities. Although a firm actively engages in information sharing in IORs, it may not effectively manage the shared information inside. Thus, sharing or exchanging information in IORs is a different matter from building relationship-specific memory. Generally, information sharing is considered as a first, basic step triggering a firm's further collaborative activities, such as shared interpretation (i.e., common knowledge) and relationship-specific memory [8, 38]. In this regard, this study attempts to explain how to manage the already shared information by introducing the construct of relationship-specific memory as one of IT-enabled capabilities.

Furthermore, we limit our focus to relationship-specific memory stored in electronic knowledge repositories in that the memory is generally implemented in various electronic forms, including KMSs and computer databases, and contributes to the accumulation and distribution of knowledge across organizations [4, 12]. Although many knowledge acquisition activities occur in IORs, little has been known about how firms internally manage externally sourced relational knowledge through IORs by using electronic knowledge repositories. However, previous studies have considered neither the role of memory in developing firms' capabilities nor the role of IT in building and exploiting the memory, particularly in the context of IORs. In this regard, we examine whether IT resources deployed in IORs enhance relationship-specific memory and thereby increasing relationship performance.

Absorptive capacity, another IT-enabled capability in IORs, is also noteworthy. Absorptive capacity refers to a firm's ability to grasp and acquire new knowledge from outside the firm, assimilate and transform that knowledge with existing organizational knowledge, and ultimately apply the knowledge for achieving the firm's business purposes [11, 36, 43, 48]. By introducing the concept of absorptive capacity, we demonstrate another way in which firms may achieve superior performance by using relational knowledge. That is, the study explores whether IT resources in IORs can increase absorptive capacity and thus, relationship performance. IT resources allow firms to facilitate absorptive capacity [27, 32, 36]. Further, these resources function as a key enabler of a firm's KM processes by supporting the creation, application, transfer, storage and retrieval of knowledge [1]. There are few empirical evidences on the argument that firms with superior IT resources in IORs can enhance their absorptive capacity. Furthermore, we empirically test the relationship between relationship-specific memory and absorptive capacity based on the assertion that the latter relies on the level of a firm's prior knowledge [11, 36, 43, 48].

Finally, we investigate the relationships between IT resources deployed in IORs and IT-enabled capabilities by classifying IT resources into physical and human IT resources. According to the resource-based view (RBV) [2], not all IT resources of a firm are directly related to its core capabilities and/or performance. A firm can gain a competitive advantage only if its IT resources are valuable, rare, imperfectly imitable, and non-substitutable [2, 44]. Therefore, there is a need to investigate how physical IT resources and human IT resources individually influence firm capability. In doing so, we can understand the relative impact of each type of IT resources on developing firm capabilities.

In a nutshell, this study has the following three main objectives: First, the study examines the relationships between a firm's IT resources and its capabilities, namely relationship-specific memory and absorptive capacity. Second, the study examines whether relationship-specific memory and absorptive capacity can increase relationship performance. Finally, the study explores the relationship between relationship-specific memory and absorptive capacity.

2 Literature review

Literature review consists of four sections as follows. The first section develops the conceptual framework underpinning this study's research model by explaining how IT resources, IT-enabled capabilities, and relationship performance are interrelated. The second section provides the detailed explanation of relationship-specific memory considered as one of the IT-enabled capabilities in this study. Further, the third section advances the discussion on relationship-specific memory by describing that building the memory is a different issue from sharing or exchanging information, which draws this study's originality from previous studies. Finally, the comprehensive discussion of absorptive capacity, considered as another IT-enabled capability in this study, is provided.

2.1 Relationship of IT resource, IT capability and relationship performance

Can a firm's IT resources facilitate the development and maintenance of its competitive advantages? Previous studies have employed RBV to address this question and provide meaningful answers [3, 10, 30, 44]. RBV posits that not all resources of a firm are related to the firm's competitive advantages and thus that for a sustained competitive advantage (SCA), IT resources must be valuable, rare, non-imitable, and non-substitutable [2]. Applying RBV, IS researchers have classified IT resources into certain types or certain attributes in order to identify those IT resources which are closely related to SCA. For example, Mata et al. [29] suggested four types of attributes of IT, such as capital requirements, proprietary technology, technical IT skills, and managerial IT skills, and asserted that only managerial IT skills could be a source of SCA by meeting the four criteria suggested by RBV. Ross et al. [37] suggested three types of IT assets, such as human assets (i.e., technical and managerial IT skills of IT staffs), technology assets (i.e., physical IT infrastructure) and relationship asset (i.e., the close relationship between IT and business units). They also emphasized that IT executives should continuously manage the three assets and apply them for developing a firm's strategies. Bharadwaj [3] proposed three types of IT resources, namely, IT infrastructure, human IT resources and IT-enabled intangibles, and argued that IT capability created by the combination of the three resources could increase firm performance. As such, earlier studies applying RBV have attempted to identify certain types of IT resources closely related to SCA and explain how these IT resources directly or indirectly involve firm performance.

Furthermore, IS researchers have employed the concept of a firm's capability to explain how firms can gain an SCA through their IT resources [3, 10, 44]. There is a need to understand that the concept of a resource is different than that of a capability [17]. Resources can be classified into tangible (e.g., factories, facilities, and raw materials), intangible (e.g., reputation, brands, and product quality), and human-based (e.g., know-how, organizational culture, and employee training and loyalty) resources, whereas a capability is the ability of a firm to combine, integrate, and deploy such resources [3, 17]. Wade and Hulland [44] provided a meta-analysis and proposed a conceptual framework explaining how IT resources can be a source of SCA, dividing these resources into assets and capabilities. They summarized that physical IT resources enable firms to obtain temporary performance improvements but that ongoing efforts to develop capabilities based on IT resources are required to achieve long-term performance. In this sense, IT resources can be regarded as a basis for developing a firm's additional capabilities and thus, can facilitate the firm's performance and competitive advantage.

Accordingly, IS researchers have sought to find certain organizational capabilities that a firm can develop by leveraging IT resources, namely, IT-enabled capabilities, in various situations [30, 42, 47]. That is, IT resources play a key role in developing a firm's various business capabilities and thus, contribute to firm performance indirectly. Through a review on IT and organizational performance, Melville et al. [30] proposed that technical and human IT resources can first enhance business processes, thereby increasing firm performance. In addition to IT resources, they also emphasized that complementary resources such as organizational structure and organizational culture are necessary to change business processes. Xu et al. [47] asserted that IT infrastructure contributes to IT project success through the increase of teamwork quality. Tippins and Sohi [42] agreed to the notion that IT competency does not necessarily contribute to increased firm performance. Further, they proposed that organizational learning is needed as a mediator to connect IT competency to firm performance. That is, IT competency composed of IT knowledge, IT operations and IT objects first enhances organizational learning, thereby leading to increased firm performance.

Some researchers have extended the issue of IT-enabled capabilities into IORs beyond the boundaries of the organization. In the context of IORs, Christiaanse and Venkatraman [10] proposed expertise exploitation capability, which refers to a firm's ability to develop its own knowledge and expertise obtained through the use of IT resources in vertical electronic channels and also asserted that the capability enhances electronic integration. In supply chains, Rai et al. [34] found that IT infrastructure integration (i.e., IT integration capability) considerably enhances the supply chain process integration (i.e., process integration capability) and thus, increases firm performance, such as operational excellence and customer relationships. In IORs, Rai and Tang [35] established the process in which structural IT capabilities (IT integration and IT reconfiguration) influence a firm's process capabilities (process alignment, offering flexibility and partnering flexibility) and in turn contribute to competitive performance. In supply chains, Malhotra et al. [27] theorized that standard electronic interfaces (i.e., IT infrastructures enabling real-time information sharing and application integration in supply chains) influence a firm's absorptive capacity, which in turn engenders increased relationship performance, such as operational efficiency and partner-enabled market knowledge creation. In summary, prior studies agree to the notion that a firm's IT resources can serve as a major foundation for developing its further capabilities and thus contribute to firm performance and competitive advantage. Most recently, in the context of buyer–supplier relationships, Wang et al. [46] found that a buyer's IT-enabled planning and control, meaning the use of interorganizational information systems (IOISs) and Internet applications, triggers the supplier's relational response (i.e., relation-specific business process investments and modification flexibility) and thereby leading to positive performance, such as a buyer's manufacturing goal achievement. IOISs-based joint activities, such as market data/forecasts sharing and coordination activities, function as a trigger of developing further capabilities [8, 46]. In line with this idea, we propose that physical and human IT resources deployed in IORs play a key role in developing a firm's capabilities (namely, relationship-specific memory and absorptive capacity) and ultimately influence its relationship performance.

2.2 Relationship-specific memory

An organization's accumulated knowledge is a foundation for the development of additional capabilities [22] as well as a source of competitive advantage [31]. To capture the degree of knowledge accumulation and distribution across the organization, researchers have been employing the construct of organizational memory [13, 31, 45]. Organizational memory is defined as "a repository for collective insights contained within policies, procedures, routines, and rules that can be retrieved when needed" [13], p. 44. More broadly, Walsh and Ungson [45] defined organizational memory as a concept reflecting a memory structure and the process of acquiring and retrieving knowledge as well as an organization's stored knowledge. Organizational memory is the organizational hub for the management of the organization's accumulated knowledge, which enables the organization to acquire, accumulate, and use its knowledge in a timely manner [39]. Organizational memory plays a key role as a knowledge repository not only for accumulating organizational knowledge [31, 39, 45] but also for containing collective organizational thoughts embedded in organizational policies, routines, and rules [13]. Further, organizational memory is strategically employed as a source of competitive advantage and superior performance because the knowledge stored in the memory is difficult for competitors to observe or imitate.

Researchers have applied the concept of organizational memory in the context of IORs [20, 22, 38] and called it relationship-specific memory [38]. By performing various joint-activities and engaging in joint-decision making processes in IORs, firms have various opportunities to obtain new knowledge which they cannot create inside [38]. Therefore, it is necessary for firms to develop how they systematically manage and utilize such relationship-specific knowledge obtained through IORs for achieving their business goals. In this regard, developing relationship-specific memory is an important way for firms to acquire, accumulate and integrate relationship-specific knowledge, experiences and best practices obtained in IORs [20, 22, 38]. In the context of supply chains, Hult et al. [20], pp. 243 called such memory as achieved memory and defined it "as the amount of knowledge, experience, and familiarity with the supply chain process," following the definition of Moorman and Miner [31]. Selnes and Sallis [38] considered that relationship-specific memory is one of the sub-dimensions of relational learning along with information sharing and shared meaning development. Further, they asserted that information sharing leads to shared meaning development, which in turn increase the development of the memory. As such, building relationship-specific memory is a different issue from sharing information in IORs. That is, information sharing in itself does not assure the development of relationship-specific memory. Hence, this study concentrates on relationship-specific memory rather than information sharing in IORs.

It has been reported that relationship-specific memory is positively related to relationship performance [20, 22, 38]. Relationship-specific memory functions as an important repository for the systematic management and integration of relationship-specific knowledge created through IORs [22], thus enabling firms to augment the mutual understandings in IORs by providing a common frame of Ref. [20]. Johnson et al. [22] found that relational knowledge repositories for IORs directly enhanced product development, creativity and relationship quality. For strategic supply chains, Hult et al. [20] highlighted that firms should establish relationship-specific memory in order to systematically manage the relational knowledge developed through their IORs, thereby enhancing their performance. That is, relationship-specific memory positively influences knowledge acquisition activities and information distribution activities that are directly related to a firm's relationship performance. In supply chains, Malhotra et al. [27] suggested that relationship-specific memory enables a firm to develop the absorptive capacity that is directly related to relationship performance. In this sense, more studies are required to offer a better understanding on how relationship-specific memory involves a firm's relationship performance either directly or indirectly. Otherwise, certain activities or capabilities based on such memory are needed to create superior relationship performance.

From the organizational learning perspective, relationship-specific memory has been considered as a key component of organizational learning [38, 42]. Selnes and Sallis [38] regarded relationship-specific memory as one of three components of relationship learning along with information sharing and interpretation of shared information (i.e., knowledge development). Furthermore, Tippins and Sohi [42] elaborated organizational learning as a concept composed of five elements, namely, information acquisition, information dissemination, shared interpretation, declarative memory and procedural memory. That is, the first two components refer to information sharing, whereas the last two components refer to organizational memory. In supply chains, Malhotra et al. [27] considered the three components, such as information exchange, shared interpretation and organizational memory, although they did not consider organizational learning in their study.

Prior researchers of memory asserted that relationship-specific memory is obvious in various physical artifacts, such as documents and computer databases [38], and is embedded in behavioral routines and organizational beliefs [31, 45]. Although relationship-specific memory can be represented in various forms, we focus on the memory that is accumulated in only electronic knowledge repository systems, such as KMSs and computer databases, in order to examine whether IT resources play a key role in developing the memory. Moreover, prior studies of memory have not considered the role of IT in developing relationship-specific memory. However, because IT facilitates a firm's ability to transfer, store, retrieve, develop and apply knowledge [1], the role of IT in building organizational memory should be considered. Nowadays, firms utilize electronic knowledge repositories to acquire, store and maintain useful organizational knowledge [1]. Thus, organizational memory or relationship-specific memory is frequently represented in electronic knowledge repositories such as computer databases [12], online computers [4], and organizational memory information systems [39]. Bock et al. [4] used the term "knowledge repository systems" to describe those systems storing an organization's knowledge, expertise, and experience as electronic documents. As such, firms have digitalized organizational memory, which enable organizational knowledge to be shared across the organization and be available when needed [39]. Therefore, we focus on relationship-specific memory accumulated in electronic knowledge repositories.

2.3 Information management in IORs

As we discussed above, sharing or exchanging information in IORs is a different matter from building relationship-specific memory. Generally, information sharing is considered as a first, basic step triggering a firm's further collaborative activities, such as shared interpretation (i.e., common knowledge development) and relationship-specific memory [8, 38]. Although a firm has shared information in IORs, the firms may not effectively manage the shared information inside. A majority of studies have focused on fostering information sharing in IORs and exploring the relationship of information sharing and relationship performance. Dyer and Singh [14] suggested that the greater the firm facilitates knowledge exchanges in IORs, the greater the relational rents will be increased. In supply chains, Chengalur-Smith et al. [49] confirmed the positive effect between information sharing and business benefits, and further asserted that information sharing is determined by a relational concurrence, implying shared business interests. Malhotra et al. [27] suggested that high levels of relational benefits depends on the facets of information exchanged, such as the breadth of information, the quality of information, privileged information and coordination information exchanged in supply chains. Klein and Rai [24] argued that the strategic information flow directly involved with the relationship performance depends on trusting the buyer and supplier beliefs in each other, buyer dependence on supplier and buyer IT customization. Likewise, beyond sharing simple information, such as order status, firms can achieve better performance when they share more strategic, exclusive information in IORs.

IS researchers have emphasized the role of IT in facilitating information sharing or managing information flows in IORs. For example, Rai and Tang [35] contended that IT integration influences a firm's competitive process capabilities (i.e., process alignment and process flexibility) by enabling the firm to exchange idiosyncratic information timely with partners. Rai et al. [34] considered information flows as one of the major components of the supply chain process integration capability together with physical and financial flow integration; further, they verified that this capability is enhanced by IT capabilities. Malhotra et al.

[28] asserted that standard electronic business interfaces increase the collaborative information exchange composed of breadth, quality and privileged information exchange in supply chains. They not only have a considerable direct effect on mutual adaptation, but also have an indirect effect on it through a collaborative information exchange. In contrast, there is a lack of understanding on how to manage the shared information and how to apply it for creating further activities and capabilities. Thus, applying the studies of relationship-specific memory, we propose that the ability of a firm to systematically manage relational knowledge created in IORs by using electronic repositories (i.e., KMS or online databases) leads to develop further capabilities (i.e., absorptive capacity), thereby increasing relationship performance.

2.4 Absorptive capacity

Since Cohen and Levinthal [11] coined the term absorptive capacity of a firm based view of strategic management in order to explain how the ability of the firm to utilize external knowledge is relevant to the development of innovative capabilities, numerous studies have empirically examined and extended absorptive capacity in various settings. Through a review of absorptive capacity, Zahra and George [48] provided a reconceptualization of absorptive capacity as a dynamic capability regarding knowledge creation and utilization, and argued that absorptive capacity enables a firm to obtain and sustain competitive advantage. Further, they suggested that absorptive capacity consists of two subsets: potential and realized absorptive capacity. Potential absorptive capacity refers to the capability of knowledge acquisition and assimilation whereas realized absorptive capacity refers to that of knowledge transformation and exploitation. Roberts et al. [36] conducted another review of absorptive capacity in the IS field and provided a comprehensive overview of how absorptive capacity is associated with knowledge transfer, IT assimilation, and IT business value.

Absorptive capacity has been applied to capture the ability of a firm to manage external knowledge generated outside the firm. Dyer and Singh [14] extended the construct of absorptive capacity of a firm into the context of IORs and named it relationship-specific absorptive capacity, which means the dynamic capability of the firm to recognize valuable knowledge created in IORs, assimilate it into its unique internal business processes, and utilize it for increasing relational advantages. Christiaanse and Venkatraman [10] proposed the construct of expertise exploitation capability based on absorptive capacity and defined it as the ability of a firm to combine external data created in IORs with internal data generated within the firm. Likewise, absorptive capacity can be considered as a useful construct to examine a firm's ability to manage external knowledge created in IORs.

Following Cohen and Levinthal [11], previous studies have asserted that absorptive capacity is primarily dependent on a firm's prior knowledge base [14, 48]. In other words, when a firm has a lack of knowledge base in certain areas, it is difficult for the firm to grasp the value of the knowledge, assimilate it with internal knowledge, and exploit it for its business purposes. Roberts et al. [36] asserted that business-IT knowledge functions as a firm's overall knowledge base. Zahra and George [48] contended that internal knowledge sources (e.g., related prior knowledge) and external knowledge sources (e.g., IORs) contribute to the development of absorptive capacity. That is, when a firm has high exposure to various external knowledge sources including IORs, it has more opportunities to enhance absorptive capacity. On the other hand, there is another argument that the frequent exposure to external knowledge does not always bring about increased absorptive capacity [48]. It is required that external knowledge should have knowledge relatedness and complementarity to enhance absorptive capacity [48].

Previous studies have also examined that absorptive capacity plays a key role in developing various firm capabilities and enhancing firm performance [11, 14, 36, 43, 48]. Cohen and Levinthal [11] verified the positive effect of a firm's absorptive capacity on its innovative capability. Christiaanse and Venkatraman [10] argued that expertise exploitation capability generates a distinctive capability which directly involves differential advantages. Malhotra et al. [27] reported the positive impact of absorptive capacity on relationship performance including operational efficiency and market knowledge creation. Joshi et al. [21] found that realized absorptive capacity increased by potential absorptive capacity is positively associated with ideated commercialized innovation. Pavlou and El Sawy [32] verified that absorptive capacity considered as one of the dimensions of dynamic capabilities enhance functional competencies and thus enhances competitive advantages in the context of new product development. As such, a firm's absorptive capacity is positively associated with firm capability and performance.

3 Research model and hypotheses

3.1 Research model

The model explains that IT resources deployed in its IORs influence the development of a firm's IT-enabled capabilities. Considering that IT-enabled capabilities are distinct from IT resources, there is a need to examine the IT-enabled capabilities that can be developed by leveraging IT

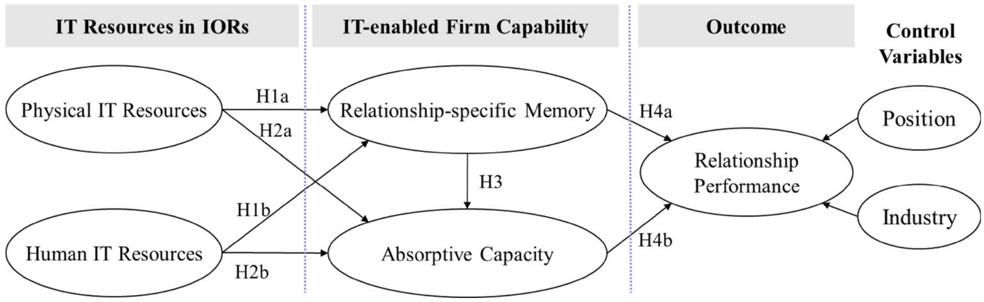


Fig. 1 Research model

resources. This study classifies IT resources into two types—physical and human IT resources—by following Broadbent et al. [5] and Melville et al. [30]. Physical IT resources include tangible IT resources (i.e., hardware and software) and applications necessary for interorganizational transactions whereas human IT resources refer to the extent to which a firm's IT personnel have relevant business knowledge and expertise as well as IT knowledge. IT personnel can make strategic use of IT resources for the firm's business objectives. By distinguishing physical IT resources from human ones, this study suggests that the latter, together with the deployment of the former, are an important part of IT management. Figure 1 shows the hypothesized relationships.

3.2 IT resources and relationship-specific memory

Previous studies have asserted that the implementation and use of organizational memory are enabled by IT resources [1, 18, 23]. Organizational memory is regarded as one of the key aspects of KM [18, 23]. IT resources enable a firm to easily codify, share, store and retrieve knowledge and are particularly effective in integrating the explicit knowledge across the firm [18]. IT can actualize the argument of Moorman and Miner [31] that organizational memory enables firms not only to retain a large amount of knowledge, but also to share and use it in a timely manner among all members. This indicates that physical and human IT resources in IORs may be positively related to relationship-specific memory. Physical IT resources offer electronic repositories for obtaining and accumulating relationship-specific knowledge developed through IORs. Besides, they provide convenient access to memory and facilitate knowledge sharing across the organization. In addition to physical IT resources, firms need human IT resources to achieve a firm's business objectives based on physical ones [9]. Human IT resources can play a key role in grasping and acquiring valuable knowledge from IORs, integrating that knowledge into relationship-specific memory, and helping to develop common relational knowledge based on the memory. That is, when a firm has IT personnel with high levels of knowledge and expertise in their business domain, the firm's relationship-specific memory may be enhanced. In this regard, we propose the following hypotheses:

H1a Physical IT resources enhance relationship-specific memory.

H1b Human IT resources enhance relationship-specific memory.

3.3 IT resources and absorptive capacity

Physical IT resources may be positively related to absorptive capacity. Physical IT resources are regarded as a key enabler of a firm's capability development [6] and a facilitator of KM processes such as the creation, storage/retrieval, transfer, and application of knowledge [1]. Alavi and Leidner [1] suggested the following three roles of IT in the KM process: the codification and sharing of best practices, the creation of organizational knowledge directories, and the construction of knowledge networks (p. 114). That is, KMSs enable KM initiatives. Rai et al. [29] established that the IT infrastructure allows firms to develop their ability to integrate supply chain processes (i.e., supply chain integration capability). Joshi et al. [21] asserted that IT resources enable firms to facilitate absorptive capacity. Pavlou and El Sawy [32] asserted that a team's ability to effectively use IT functionalities enhances the absorptive capacity, thereby increasing the firm's competitive advantage in new product development. Malhotra et al. [27] suggested that IT infrastructures increase a firm's absorptive capacity by allowing the firm to process information obtained in the supply chains, thus leading to increased relationship performance (i.e., operational efficiency and partner-enabled market knowledge creation). Roberts et al.'s [36] review supported the positive effect of IT on absorptive capacity, suggesting that IT offers a platform for knowledge sharing within and across organizations. Therefore, when firms make effective use of physical IT resources, their absorptive capacity is likely to increase.

Human IT resources may also increase absorptive capacity. IT personnel are required not only to understand business opportunities and solve business problems but also to have technical knowledge of the use of IT resources [9, 30, 37]. Melville et al. [30] highlighted that IT personnel should have managerial skills to solve business problems as well as technical skills to deal with IT. When firms have superior human IT resources, they have more opportunities to recognize, assimilate, and use the value of knowledge created from IORs. In this regard, a firm's absorptive capacity is dependent on its IT personnel namely, human IT resources. In this regard, we propose the following hypotheses:

H2a Physical IT resources enhance absorptive capacity.

H2b Human IT resources enhance absorptive capacity.

3.4 Relationship-specific memory and absorptive capacity

Knowledge is regarded as one of the most important strategic resources of a firm for creating its further capabilities and competitive advantage [2, 18]. Previous studies have generally asserted that absorptive capacity relies on the level of a firm's knowledge base [11, 14, 43, 48]. Cohen and Levinthal [11] coined and defined the construct of absorptive capacity as "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (p. 128). Moreover, they argued that absorptive capacity is "largely a function of the level of prior related knowledge" (p. 128). The prior knowledge in a certain domain offers firms a fundamental framework (or knowledge structure) needed to grasp the value of new external knowledge, assimilate it with existing knowledge and apply it for achieving their goals [11]. Review papers on absorptive capacity [36, 48] have supported the assertion that prior related knowledge is a source of developing a firm's absorptive capacity and thereby leading to outcomes, such as innovation, flexibility and performance. If firms do not have prior related knowledge, it is hard for them to accurately evaluate the value of new external knowledge, which could lead them to miss the opportunity to acquire the valuable knowledge [36, 40]. Liang et al. [26] asserted that when a firm has in-depth related knowledge, the firm easily acquires new knowledge related to the focal innovation. Thus, the level of a firm's existing knowledge determines its absorptive capacity.

A firm can obtain knowledge from various sources both within and outside the firm [48]. Absorptive capacity is an important issue in IORs because IORs can function as new sources of knowledge that a firm does not possess inside [11, 27]. Following Cohen and Levinthal [11], Dyer and Singh [14] argued that firms can develop their partner-specific absorptive capacity through IORs, which is based on common knowledge bases and interorganizational interactions. By expanding knowledge sources through IORs, firms can enhance their absorptive capacity. Thus, we propose that a firm's relationship-specific memory is positively related to absorptive capacity.

H3 Relationship-specific memory has a positive effect on absorptive capacity.

3.5 IT-enabled firm capability and relationship performance

Relationship-specific memory is positively related to relationship performance, such as relationship quality and relationship portfolio effectiveness [22]. A firm's knowledge and experience accumulated in its memory influences its performance [42]. This suggests that a firm's relationship-specific knowledge and expertise drawn from IORs enhance its competitive advantage [10, 34]. Christiaanse and Venkatraman [10] suggested that a firm's capability to develop IT-enabled expertise serves as a crucial source of its competitive advantage by enabling the firm to exploit knowledge assets in vertical IORs. Lai et al. [25] found that organizational memory increases employee service performance. Moorman and Miner [31] argued that firms are better able to develop new products when they have greater organizational memory. Johnson et al. [22] asserted that a firm's accumulated relational knowledge can bring about relational effectiveness and quality in its IORs. This indicates that relationship-specific memory may enhance relationship performance.

H4a Relationship-specific memory has a positive effect on relationship performance.

Previous studies have also reported that a firm's absorptive capacity is positively related its strategic flexibility, adaptation to turbulent environment, innovation, and performance [11, 43, 48]. Malhotra et al. [27] revealed that a firm's absorptive capacity influences its efficiency and the development of market knowledge. This indicates that absorptive capacity may enhance relationship performance. In this regard, we propose the following hypotheses:

H4b Absorptive capacity has a positive effect on relationship performance.

4 Methodology

4.1 Data collection

For the data, we conducted an online survey of the members of the Korean Call Center Industry Resources Center. We requested their participation in the survey by emailing them a newsletter with a link to the survey. A total of 483 members opened the newsletter and among these, 130 participated in the survey (a 26.9 % response rate). We eliminated 15 responses because of missing data and had a total of 115 responses for the analysis.

Among the 115 respondents, 41 (36.7 %) were managers; 28 (24.3 %), staff members; 23 (20 %), general managers; 15 (13 %), CEOs; and 8 (7 %), others. By industry, 30 (26.1 %) were in the petroleum and chemical industry; 30 (26.1 %), in the computer/IT industry; 28 (24.3 %), in the service industry; and 27 (23.5 %), others. The respondents used a wide range of ISs in IORs: 27.5 % used the electronic data interchange; 25.4 %, internet-based systems; 16.9 %, dedicated supply chain systems; and 14.3 % e-marketplaces. The average transaction period for major trading partners (i.e., those accounting for a majority of total sales) was approximately 10 years (SD = 10.1). On average, the respondents used ISs for transactions with their trading partners for approximately 5 years (SD = 3.5).

4.2 Measures

To measure the items, we used a seven-point Likert-type scale ranging from "very strongly disagree" (1) to "very strongly agree" (7). We employed those measures validated in previous research. The details of measures used for this study are given in the Appendix.

We divided IT resources into physical and human IT resources based on Broadbent et al. [5] and Melville et al. [30]. We defined physical IT resources as the extent to which a firm has a tangible IT infrastructure and application functionality and measured them by using six items drawn from Byrd and Turner [6] and Ross et al. [37]. In the present study, a firm's tangible IT infrastructure refers to a technical, tangible IT resources such as hardware, software, and communication technologies, whereas its application functionality refers to a tangible infrastructure supporting its business objectives. On the other hand, we defined human IT resources as the extent to which a firm has IT personnel with relevant technical and managerial knowledge and measured them by using six items drawn from Byrd and Turner [6] and Ross et al. [37].

In terms of IT-enabled capabilities, we defined relationship-specific memory as the extent to which a firm builds and exploits its digitalized memory for effectively managing relational knowledge developed through IORs. The construct of relationship-specific memory is based on Hult et al. [20] and Selnes and Sallis [38], whose construct of memory was based on previous studies of organizational memory (e.g., [13, 31, 45]). We measured relationship-specific memory by using six items from Choi and Ko [8], Malhotra et al. [27], and Selnes and Sallis [38].

We defined a firm's absorptive capacity as its ability to grasp, assimilate/transform (with respect to existing knowledge) based on Cohen and Levinthal [11], and exploit new knowledge for its business purposes and measured it using four items from Ettlie and Pavlou [15] and Zahra and George [48]. We defined relationship performance as the extent to which a firm obtains benefits from IORs and measured it by using five items from Choi and Ko [8] and Subramani [40].

4.3 Measurement model assessment, common method bias and multicollinearity

We employed the partial least squares (PLS) method with Smart PLS 2.0 to assess the measurement structural models. This method is widely used in IS research for theory testing and can be used to test the relationship between a latent variable and its indicators as well as the structural model. The PLS method imposes minimal constraints on measurement scales, sample sizes, and residual distributions [7]. Therefore, we employed this method because of this study's small sample size.

Tables 1 and 4 show the results for the measurement model. In terms of internal consistency, Cronbach's α exceeded the recommended threshold of 0.7 for all constructs. Moreover, the composite reliability was above 0.8, exceeding the recommended threshold of 0.7 [16]. These results demonstrate sufficient reliability. Concerning construct validity, all factor loadings exceeded 0.7 and every item showed the highest loading for its proposed factor, supporting the satisfactory convergent validity. In addition, the AVE (average variance extracted) value exceeded the recommended threshold of 0.5. Regarding discriminant validity, as shown in Table 4, all the items have higher loadings on their corresponding constructs than any cross-loadings on any other constructs. Moreover, as shown in Table 2, the square root of the AVE exceeded all other cross-correlations, thus supporting the discriminant validity [7, 16].

We checked for the possibility of common method bias (CMB) because we measured independent and dependent variables from one source. To test CMB, we conducted the Harman's one-factor test by using confirmatory factor analysis. For this, we compared the five-factor model with a single-factor model (i.e., Harman's one-factor model) in which all indicators loaded on a single factor [33]. According to Podsakoff et al. [33], if CMB is substantial, than the single-factor model provides a good fit. The single factor model did not provide a good fit ($\chi 2 = 2{,}016.65$, $df = 324$, the goodness-of-fit index (GFI) = 0.43, the comparative fit index (CFI) = 0.86, and the root mean square error of approximation (RMSEA) = 0.214) in comparison with that of the five-factor model

Table 1 Measurement model assessment

Constructs	AVE	Cronbach α	Composite reliability
Physical IT resources	0.771	0.9404	0.9528
Human IT resources	0.771	0.9401	0.9527
RM	0.815	0.9546	0.9635
Absorptive capacity	0.859	0.9450	0.9604
Relationship performance	0.635	0.8595	0.8967

NA Not Applicable, *RM* relationship-specific memory

($\chi2 = 613.19$, $df = 314$, GFI = 0.72, CFI = 0.96, and RMSEA = 0.091). The results demonstrate that CMB is not a serious problem in our study. Additionally, we tested CMB by using a marker variable that was theoretically unrelated to this study's constructs [33]: the number of employees. We included the marker variable in the model and assessed any changes in partial correlations between the constructs. The results indicate that the marker variable had no significant effect on construct correlations, indicating that CMB was not a serious problem. Generally, evidence of common method bias results in very high correlations ($r > 0.90$) [52]. In our survey, we collected data by ensuring anonymity of the respondents and by requesting that they answer each question as honestly as possible.

Finally, as shown in Table 2, the constructs showed high correlations. Therefore, we checked for the possibility of multicollinearity by employing the variance inflation factor (VIF), which is a widely used method [19], and verified no issue on multicollinearity. The results indicate that all constructs had a VIF less than 10 (Human IT Resources had the highest value: 2.68), implying that multicollinearity was not a serious problem with the data.

4.4 Structural model assessment and hypothesis testing

To estimate the statistical significance of path coefficients, we employed a bootstrap re-sampling procedure with 500 subsamples to estimate *t*-statistics. Fig. 2 and Table 3 show the results for the structural model. Concerning the criteria for assessing the structural model, previous studies have typically employed R^2 values for endogenous constructs. According to Chin [7], an R^2 value of 0.15 indicates only weak explanatory power, whereas 0.35 and 0.67 are considered to be moderate and substantial, respectively. Therefore, this study's model showed moderate explanatory power: That is, the R^2 values were 0.498 for relationship-specific memory, 0.396 for absorptive capacity, and 0.250 for relationship performance. Previous studies have employed Tenenhaus et al.'s [41] global goodness-of-fit (GoF) criterion as an index for assessing the PLS model globally. The GoF is computed as the geometric mean of average communality and R^2 values. For this study's model, the GoF was 0.542, indicating that the model provided a good fit to the data.

Previous studies have used Stone-Geisser Q^2 for endogenous constructs to examine their predictive relevance to the structural model [7]. The Q^2 value is a measure of how well some observed values are reconstructed by the model and its parameter estimates and is estimated using a "blindfolding" technique that omits some part of the data for a particular block of indicators during the parameter estimation [7]. There are two types of Q^2 values that can be estimated through the PLS: cross-validated communality and redundancy Q^2 values. Here $Q^2 > 0$ implies the predictive relevance of the model, whereas $Q^2 < 0$, a lack of its predictive relevance [7]. The Q^2 results (omission distance = 7) indicate that this study's structural model showed a high degree of predictive

Table 2 Descriptive statistics, inter-construct correlations and discriminant validity

	Construct	Mean	SD	A	B	C	D	E	F	G
A	Physical IT resources	5.16	1.06	0.878						
B	Human IT resources	5.13	1.03	0.747**	0.878					
C	RM	4.99	1.18	0.638**	0.651**	0.903				
D	Absorptive capacity	5.23	1.03	0.504**	0.542**	0.515**	0.927			
E	Position[a]	1.62	0.62	−0.203*	−0.157	−0.250**	−0.224**	1.000		
F	Industry[b]	1.51	1.10	−0.035	−0.028	−0.067	0.023	0.098	1.000	
G	Relationship performance	4.77	0.87	0.424**	0.385**	0.400**	0.360**	−0.154	0.056	0.797

Values along the diagonal indicate the square root of the AVE

RM relationship-specific memory

[a] categorical variable (0 = others, 1 = staff members, 2 = CEOs/managers). [b] categorical variable (0 = others, 1 = petroleum and chemical industry, 2 = computer/IT industry, 3 = service industry)

* $p < 0.05$, ** $p < 0.01$

Table 3 Structure model assessment

Construct	R^2	Cross-validated communality	Cross-validated redundancy
Physical IT resources	NA	0.672	NA
Human IT resources	NA	0.672	NA
RM	0.498	0.731	0.395
Absorptive capacity	0.396	0.741	0.322
Relationship performance	0.228	0.454	0.124

NA Not Applicable, *RM* relationship-specific memory

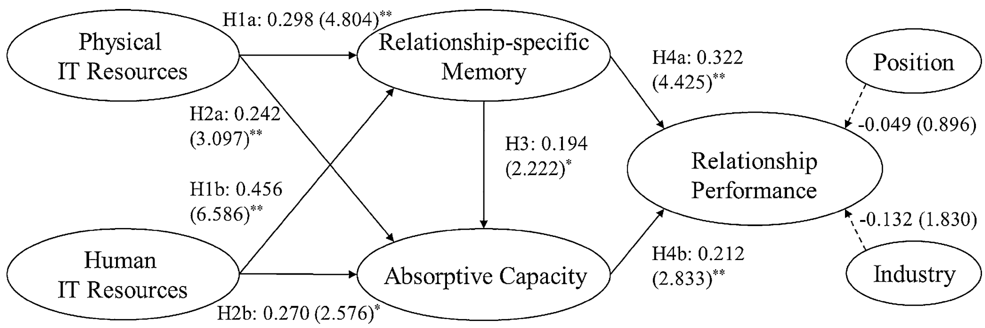


Fig. 2 Results for the structure model. *Note* $^*p < 0.05$, $^{**}p < 0.01$

relevance (Table 4). All the hypothesized relationships were significant at the 0.05 level (Fig. 2).

4.5 Additional mediation analysis

The research model includes two types of IT-enabled capabilities (i.e., relationship-specific memory and absorptive capacity) between physical/human IT resources and relationship performance. To assess the mediating effect of IT-enabled capabilities, a pseudo F-test technique is performed. We compared R^2 in a mediated model (i.e., our research model) with R^2 in a full model (i.e., a partially mediated model including a direct path from independent variable and dependent variable); the two models are compared statistically using PLS results [40, 50]. The *effect size* (f^2) is calculated based on difference in R^2 and the significant of the f^2 is assessed based on a *pseudo F* test [50]. The f^2 statistic is estimated as $(R^2_{\text{full}} - R^2_{\text{excluded}})/(1 - R^2_{\text{full}})$ [51]. According to Cohen [51], f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. The *pseudo F* statistic is calculated as multiplying f^2 by (n−k−1), with 1 and n−k degrees of freedom, where n is the sample size and k is the number of constructs in the model. The results are summarized in Table 5: the results showed that the f^2 value of each direct path was between medium and large (0.190–0.349). Moreover, it has been found that each direct path itself was significant at the significant level of 0.001 and the explanatory power of each direct path was significant at the significant level of 0.001. Therefore, the results lead to the conclusion that the effects of IT resources on relationship performance are partially mediated through relationship-specific memory and absorptive capacity. Also, the effect of relationship-specific memory on relationship performance is partially mediated through absorptive capacity.

5 Discussion and conclusion

Because of the widespread use of IT resources in IORs, firms should develop their own capabilities based on their IT resources to create competitive advantage. Drawing on the studies of relationship-specific memory and absorptive capacity, this study suggests that IT-enabled capabilities that are developed by leveraging IT resources deployed in IORs (namely relationship-specific memory and absorptive capacity) are needed to obtain better relationship performance. The results offered empirical evidence on how firms could improve their performance by internally managing the relational knowledge obtained through their IORs. The major results are summarized as follows:

Concerning the effects of IT resources on IT-enabled capabilities, the results indicate that physical IT resources served as a basic means for enhancing both relationship-specific memory and absorptive capacity. This suggests that physical IT resources can provide firms with a foundation for developing additional capabilities by enabling relationship-specific knowledge management and

Table 4 Item loadings and cross-factor loadings

	Physical IT resources	Human IT resources	RM	Absorptive capacity	Position	Industry	Relationship performance
PIR1	0.851	0.646	0.520	0.586	−0.159	−0.080	0.405
PIR2	0.907	0.676	0.577	0.583	−0.174	0.001	0.476
PIR3	0.868	0.648	0.509	0.469	−0.185	0.068	0.440
PIR4	0.894	0.646	0.580	0.417	−0.205	0.000	0.448
PIR5	0.901	0.650	0.590	0.436	−0.204	0.008	0.412
PIR6	0.844	0.617	0.565	0.462	−0.141	0.013	0.426
HIR1	0.691	0.922	0.607	0.482	−0.123	−0.085	0.356
HIR2	0.691	0.922	0.600	0.490	−0.117	−0.102	0.361
HIR3	0.650	0.876	0.588	0.488	−0.125	−0.131	0.432
HIR4	0.624	0.863	0.604	0.578	−0.115	−0.058	0.509
HIR5	0.628	0.881	0.626	0.545	−0.039	−0.092	0.427
HIR6	0.603	0.798	0.527	0.457	−0.099	0.014	0.344
RM1	0.616	0.649	0.901	0.542	−0.089	−0.001	0.406
RM2	0.634	0.629	0.904	0.431	−0.092	−0.007	0.405
RM3	0.572	0.613	0.896	0.488	−0.022	−0.174	0.430
RM4	0.526	0.625	0.917	0.442	0.017	−0.026	0.396
RM5	0.494	0.555	0.891	0.485	−0.014	0.001	0.315
RM6	0.582	0.582	0.907	0.478	−0.056	0.056	0.427
AC1	0.509	0.506	0.471	0.892	−0.199	0.012	0.333
AC2	0.484	0.497	0.473	0.945	−0.195	0.019	0.368
AC3	0.521	0.537	0.459	0.929	−0.116	−0.006	0.326
AC4	0.569	0.598	0.551	0.939	−0.115	−0.032	0.416
Position	−0.202	−0.117	−0.049	−0.166	1.000	0.098	−0.113
Industry	0.000	−0.088	−0.029	−0.003	0.098	1.000	−0.147
PER1	0.472	0.397	0.364	0.274	−0.225	−0.212	0.744
PER2	0.410	0.424	0.335	0.307	−0.071	−0.148	0.828
PER3	0.426	0.467	0.450	0.469	−0.067	−0.094	0.877
PER4	0.296	0.228	0.247	0.189	−0.025	0.001	0.774
PER5	0.311	0.224	0.287	0.216	−0.018	−0.084	0.755

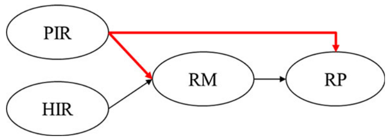
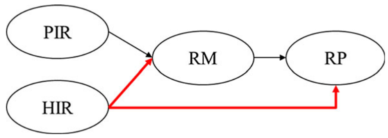
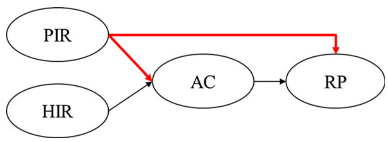
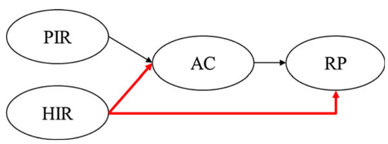
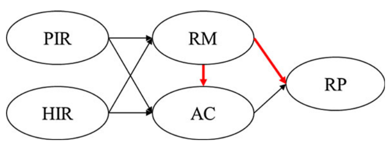
RM relationship-specific memory

enhancing absorptive capacity in the context of IORs. That is, firms may consider physical IT resources as an important tool for developing additional capabilities. Although the importance of physical IT resources has been decreasing [10], the results suggest that they may still play a major role as a key infrastructure in helping firms to develop other capabilities.

The results indicate that human IT resources had positive effects on both relationship-specific memory and absorptive capacity. This suggests that a firm is more likely to develop additional capabilities if it has IT personnel who have not only superior technical knowledge of IT resources but also business knowledge of areas to which they can apply these resources. In particular, the results indicate that human IT resources had considerable influence on relationship-specific memory. This suggests that IT personnel can understand and acquire valuable knowledge through IORs and thus can facilitate their firms' relationship-specific memory. Therefore, human IT resources as well as physical ones may play key roles in developing firms' IT-enabled capabilities. In general, the results indicate that physical and human IT resources deployed in IORs were positively and significantly related to relationship-specific memory and absorptive capacity and thus have important implications for future research on firms' IT-enabled capabilities. Particularly, relationship-specific memory is deeply embedded in IORs so that it is difficult to be observed, imitated, and transferred, which satisfy the criterion for firms to create sustainable competitive advantages as RBV suggests.

In addition, the study extends relationship-specific memory research by introducing the role of IT in the memory for accumulating knowledge created through IORs. That is, physical and human IT resources in IORs

Table 5 Mediation test—full versus nested model comparison

Direct path	Graphical model	R^2 in mediated model (no direct path)	R^2 in full model	f^2 value	Psuedo $F_{(1,\ 108)}$
PIR → RP (B = 0.367, t = 4.606)		0.718	0.791	0.349	37.373
HIR → RP (B = 0.289, t = 3.509)		0.718	0.763	0.190	20.316
PIR → RP (B = 0.414, t = 5.147)		0.563	0.665	0.304	32.579
PIR → RP (B = 0.354, t = 3.988)		0.563	0.643	0.224	23.978
RM → RP (B = 0.322, t = 4.425)		0.577	0.646	0.195	20.856

PIR physical IT resources, *HIR* human IT resources, *RM* relationship-specific memory, *AC* absorptive capacity, *RP* relationship performance

can be used to systematically manage the relational knowledge created through IORs. Further, the study contributes to the literature by demonstrating how firms can enhance their absorptive capacity through physical and human IT resources deployed in IORs. Although many firms use IT resources to manage their organizational and relational knowledge, the role of IT resources has generally been overlooked in previous research on organizational or relationship-specific memory as well as on absorptive capacity. The results suggest that both physical and human IT resources deployed in IORs can provide firms a key foundation of developing their relationship-specific memory and absorptive capacity. The results provide support for the assertion that IT still contributes to the further development of firms' capabilities [30, 34, 42]. In this regard, this study contributes to the literature by demonstrating how firms can use IT resources deployed in IORs to develop additional capabilities.

The results indicate that relationship-specific memory had a positive effect on absorptive capacity. This suggests that firms can enhance their absorptive capacity by employing the knowledge stored in their relationship-specific memory. That is, a firm's absorptive capacity relies on its relationship-specific memory. This result provides empirical support for the assertion that absorptive capacity depends on a firm's existing knowledge base [11]. When a firm has a lack of knowledge in certain domains, it is difficult to grasp the potential value of the new knowledge created in IORs. Thus, relationship-specific memory containing knowledge and experience related to IORs can function as a knowledge base for grasping and acquiring new knowledge and assimilating the knowledge with the existing knowledge. Our results indicate that firms can expand their source of knowledge by developing their relationship-specific memory through IORs. Therefore, firms should employ their relationship-specific memory to further develop their capabilities, particularly absorptive capacity.

The results indicate that both relationship-specific memory and absorptive capacity directly and positively influenced relationship performance. Besides, relationship-specific memory had an indirect effect on relationship performance through the enhancement of absorptive capacity. These results provide support for the argument that IT-enabled capabilities, which are developed based on IT resources, are directly related to improved relationship performance [3, 10, 30]. Therefore, firms should further develop their capabilities based on physical and human IT resources to enhance their performance beyond the deployment of those resources in IORs. The results verify that relationship-specific memory and absorptive capacity are important variables connecting IT resources deployed in IORs to relationship performance. In particular, managing relationship-specific knowledge and expertise from IORs is crucial for developing additional capabilities as well as for enhancing relationship performance. Previous studies have viewed the relationship-specific knowledge embedded in collaborative IORs as a core source of relational rents directly related to SCA [14]. In this regard, the knowledge stored in a firm's relationship-specific memory and the firm's ability to use that knowledge can serve as a source of SCA for the firm. The results provide an explanation for why many firms fail to achieve superior performance even when they invest heavily in the implementation of IT resources for IORs. That is, this failure may be due to a lack of a firm's ability to leverage IT resources for developing additional capabilities. In this regard, the results suggest that firms should make continuous efforts to develop their idiosyncratic IT-enabled capabilities based on their cooperation with trading partners to achieve better performance by going beyond the deployment of IT resources in IORs.

Finally, the additional analysis provides evidence that two types of IT-enabled capabilities function as mediators on the relationships between physical/human IT resources and relationship performance. The findings support the process proposed in our model, IT resources—IT-enabled capabilities—relationship performance. Besides, the analysis confirms that it is appropriate to consider absorptive capacity as a mediator on the relationship between relationship-specific memory and relationship performance. Thus, relationship-specific memory contributes to increased relationship performance directly or indirectly via absorptive capacity.

In conclusion, the results demonstrate the importance of systematically managing the relationship-specific knowledge gained through IORs for firms in terms of developing additional capabilities and thus enhancing performance. As expected, physical and human IT resources deployed in IORs can have positive effects on relationship-specific memory and absorptive capacity and thus can enhance relationship performance. Finally, the results provide evidence that relationship-specific memory functions as a knowledge source of a firm to enhance absorptive capacity.

6 Limitation and future research

This study has some limitations. First, given the importance of managing the relationship-specific knowledge developed through IORs, we attempted to measure relationship-specific memory in IORs by extending the construct of organizational memory. However, relationship-specific memory is a relatively new variable in IS research and thus requires further research for its conceptual elaboration. Moreover, research on organizational or relationship-specific memory can be approached from various perspectives, such as organizational or interorganizational learning and knowledge management. For example, Selnes and Sallis [38] considered relationship-specific memory as a key dimension of interorganizational learning.

Second, we measured relationship performance as a unidimensional construct encompassing operational and strategic performance, focusing on the relationships between IT-enabled capabilities and relationship performance. However, previous research has also conceptualized relationship performance as a multi-dimensional construct. For example, Subramani (2004) measured relationship performance with two dimensions: operational performance and strategic performance. Similarly, Malhotra et al. (2005) measured relationship performance with two dimensions: operational efficiency and partner-enabled market knowledge creation (i.e., more strategic performance). In this regard, by conceptualizing relationship performance as a multi-dimensional construct, future research could develop a better understanding of how IT-enabled capabilities are associated with different types of relationship performance.

Third, although this study argues that relationship-specific memory influences absorptive capacity, there could be the possibility of reverse causality. Considering that absorptive capacity refers to "the ability of to recognize the value of new, external information, assimilate it, and apply it to commercial end", if a firm has a lack of such ability to recognize the value of new knowledge, it is unlikely to make that information part of its knowledge store. Thus, future research may examine the reverse relationship between relationship-specific memory and absorptive capacity.

Forth, since we used a single source of data, our study is vulnerable to CMB. There could be the possibility that respondents answered the questions with certain tendency to avoid inconsistency or in socially desirable ways. Recognizing CMB, we collected data by ensuring anonymity of the respondents and by requesting that they answer each question as honestly as possible. Furthermore, we assessed the Harman's one-factor model and tested CMB by using a marker variable. The results demonstrated that CMB was not a serious issue in this study.

Finally, a majority of sample were collected from four industries (petroleum and chemical industry, the computer/IT industry, and the service industry) within one country. Thus, there is a need to include other industries to increase the generalizability of our findings.

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Appendix: Measurement items

Physical IT resources

1. The degree to which IT and IS are available in IORs.
2. The degree of having hardware and software for IORs.
3. The degree of electronic linkage via network in IORs.
4. The degree to which IOIS supports a variety of business functions.
5. The degree to which IOIS can adjust to support new business functions.
6. The degree to which IOIS adjusts to meet a user's needs.

Human IT resources

1. IT personnel understand business environments.
2. IT personnel understand business domains.
3. IT personnel understand the production and logistics of their firms.
4. IT personnel have the business knowledge to predict and understand problems in IORs.
5. IT personnel have the ability to solve the technical problems occurring in IORs.
6. IT personnel have the ability to develop software and programming.

Absorptive capacity

1. Our company has the ability to identify the value of new information from IORs.
2. Our company has the ability to assimilate information coming from IORs into its internal operation.
3. Our company has the ability to transform information coming from IORs for the decision-making on internal operation of it.
4. Our company has the ability to exploit the new integrated knowledge for its business purpose.

Relationship-specific memory

1. We store information about IORs into electronic relationship-specific repositories (e.g., knowledge management systems or online databases).
2. We frequently update information about IORs in electronic relationship-specific repositories.
3. We can search and retrieve information about IORs from electronic relationship-specific repositories.
4. We have electronic relationship-specific repositories to acquire and store common information gained from IORs.
5. We accumulate best practices and success/failure experiences in electronic relationship-specific repositories.
6. We have a variety of information and knowledge in electronic relationship-specific repositories.

Relationship performance

1. Overall business process is enhanced due to improving or adjusting preset business processes.
2. Profitability is increased.
3. Learning about product/service, trading partners, and markets is increased.
4. Improvement of current products and development of new products are increased.
5. Opportunities for new business are increased.

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