Alignments between the depth and breadth of inter-organizational systems deployment and their impact on firm performance

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A R T I C L E   I N F O

A B S T R A C T

This paper explores the performance impact of alternative deployment alignment strategies for inter-organizational systems (IOS) in supply chains. Based on the asset orchestration perspective, we consider two deployment alignment strategies, namely, balanced alignment and reinforcing alignment, which represent strategic choices made by firms in relation to the emphases placed on depth and breadth of IT deployment in supply chain operations. The results of our empirical study show that the depth and breadth of IOS deployment enhance a firm's competitive performance through operational improvement, and the balanced alignment between IOS depth and breadth enhances the firm's competitive performance.

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1. Introduction

Many innovative practices in supply chain (SC) management have been developed based on the intensive usage of IT [61,17,53], such as IT-based collaborative planning, forecasting and replenishment (CPFR) [52]; standards-based vertical information systems [39]; supply chain partnerships management based on electronic business interactions [37]; and digitized inter-organizational business process standards such as Rosettanet [2]. In addition, firms are increasingly deploying IT to broaden the scope and strengthen the extent of collaboration with supply chain partners to sense and respond to market demands quickly [31]. A key feature of IT-based supply chain coordination is the shift from the connection of physical processes to the electronic integration of inter-firm processes and information with supply chain partners [80]. Firms invest in various inter-organizational systems (IOSs), such as electronic data interchange (EDI), Rosettanet-based systems, and business-to-business electronic exchanges, to realize such electronic integration in supply chain management [83,6]. Accordingly, recent studies have considered

supply chain management a digitally enabled inter-organizational capability and viewed IOS as typical modern supply chain management systems [54].

Despite the general arguments regarding the benefits of IOS (for achieving SC integration), both academia and industry observers have long been concerned about the continued slow, painful process and many cases of failure to realize the performance value of IOS [58,60,5,54]. Although industry observers are usually concerned with the overall impact of IOS on performance [43,32], academia has recognized the need to adopt a more in-depth configuration analysis to consider the alignment between interdependent strategies of IOS adoption [60,35]. A recent stream of literature has also suggested that IOS success is dependent on the contingent fit among various deployment strategies, structures and contexts rather than on their separate effects [51,29]. This key idea is consistent with views in other literature on how the joint effects of multiple asset configuration and deployment dimensions contribute to the firm's performance and competitive advantage [65,66,21]. Industry reports have also revealed the increasing differentiation of breadth and depth of firms' IOS deployment and foreseen firms' future competitive advantage from better leveraging both dimensions for strategic use [78].

In line with the logic presented in these streams of literature, in this study, we consider how the alignment between different dimensions of IOS deployment contribute to firm performance in

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the supply chain context. We first examine the effects of specific IOS deployment dimensions, i.e., depth and breadth, on firm performance. In addition, we explore the performance impact of the alignment between these two IOS deployment dimensions. The consideration of the alignment between these two dimensions is nontrivial because research in supply chain integration suggests that managers may focus differently on these dimensions in different stages of building supply chain relationship [69]. However, the extent to which the alignment between these two dimensions contributes to performance remains inconclusive. We propose that firms can better leverage IOSs by not simply pursuing IOS deployment along each individual dimension but selectively aligning these IOS deployment dimensions in alternative way, such as in balanced or reinforcing ways that prioritize depth versus breadth functionality differently. Our attempt to better understand the effect of such alternative alignment mechanisms of IOS deployment on firm performance is relevant to the consideration of net-enabled business value [5] and IT-enabled business value – a central issue in IS research [31,1]. Although we expect that both the depth and breadth of IOS deployment are beneficial to the firm in operational improvement, an in-depth investigation of the alignment between these two dimensions should provide more insight into how firms gain performance improvement from the deployment of IOS, especially long-term performance improvement. This investigation should also generate hold managerial implications with respect to how firms achieve competitive advantage by appropriately configuring various aspects of IOS deployment in supply chains.

We conducted an empirical investigation to test our hypotheses using a sample of Chinese firms. Our study generated important findings regarding how IOS depth and breadth separately as well as jointly contribute to firm performance. First, our results suggest that IOS depth and breadth both contribute to the firm's operational improvement and enhance the firm's competitive performance through operational improvement. However, our results also indicate that the direct effects of IOS depth and IOS breadth on the competitive performance of the firm are limited. Second, our findings suggest that the balanced alignment between IOS depth and IOS breadth contributes to the firm's competitive performance, which implies that the firm gains long-term competitive advantage by maintaining balanced development in IOS depth and IOS breadth. However, the reinforcing alignment between IOS depth and IOS breadth does not appear to significantly enhance the firm's competitive performance, which implies that the intensive development in either individual dimension of IOS deployment does not necessarily enhance the marginal effect of the other dimension on the firm's competitive performance. Therefore, the potential disproportional development in individual dimensions of IOS deployment may not be justified. Furthermore, we do not find that the alignment between IOS depth and IOS breadth significantly contributes to the firm's operational improvement, which further suggests that alignment of IOS deployment dimensions is more of a strategic concern about long-term resource commitment than a tactical concern about operational improvement.

The rest of this paper is organized as the follows. In Section 2, we present the theoretical foundation of this study and develop hypotheses. Section 3 explains the data and methodology used in the empirical analysis. Section 4 presents the results of the empirical analysis. Finally, Section 5 discusses the theoretical and managerial implications of the study and concludes the paper.

2. Theoretical background and hypothesis development

We draw on insights from the asset orchestration perspective, e.g., [26], to investigate alternative configurative approaches that relate to how firms deploy IOS assets in the context of the supply chain. The asset orchestration perspective suggests that firms can make more effective use of limited resources and assets by configuring resource deployment mechanisms [26]. Resource deployment mechanisms include managerial actions and processes concerning the search, selection, configuration and deployment of a firm's assets; they can serve as mediators between firms' resources and performance [66,25]. The effect of a resource deployment mechanism is therefore a function of the firms' managerial abilities to coordinate specialized assets, provide vision and nurture innovation [67].

Supply chain management (SCM) is widely accepted as an important value-creation approach to improving supply chain operational performance [33,47]. Concepts such as value-added chain [34] and value network [62] in the SCM literature consider supply chains as a set of sequential organized inter-firm processes that add value to material assets or products in a successive way [64]. Because business environments have become more turbulent, firms that can leverage their assets, information and knowledge more effectively are more likely to capitalize on emerging opportunities, as well as attain superior performance [18]. However, asset management and optimization processes are complex because suppliers are external to the firm and leveraging resources to link with partners through IOS is challenging.

Information systems that are forged through relationships between IT assets and organizational resources, such as IOSs for supply chain management, are firms' valuable resources and assets that can positively affect firms' performance [7,74]. System utilization and deployment can realize systems' value in improving firms' new capabilities and performance [82,68,44]. It is important to note that even though an IT system has the potential to improve firm performance, its value cannot be realized without an appropriate deployment mechanism. From a process-oriented perspective [68], specific IT applications in supply chain management, such as B2B e-commerce, can improve operational performance only when they are used appropriately in business processes (e.g., to enable better decision making, improve operational efficiency, and increase coordination flexibility). Barua et al. (1995) analyze an intermediate process of usage-linked IT and demonstrate how it improves firm performance. Following this logic, Zhu and Xu (2004) further develop a technology usage depth model to link IT usage to value realization. In this paper, we focus on firm-level IOS deployment configuration to consider the deployment–performance relationship.

The utilization of innovation and knowledge assets can be characterized primarily along two dimensions: depth and breadth [21,50]. The former concerns the intensity and scale of asset utilization, and the latter concerns the diversity and scope of asset utilization. Based on this logic, we consider the depth and breadth of IOS usage as two underlying building blocks for deployment strategies. Depth of IOS refers to the scale of a firm's IOS usage that complements other organizational practices to integrate with its supply chain partners, and breadth of IOS refers to the scope of a firm's IOS usage. Firms with in-depth IOS usage often integrate and collaborate with partners tightly, whereas firms with broad IOS usage often cultivate more inter-firm relationships. These two dimensions of system usage also have been examined in other studies of various IT systems, such as EDI [40,56], e-business [82] and IT standards [83].

When firms engage in IT-enabled supply chain management, both operational and strategic competitive performance can be improved [16,41]. IT-enabled operational performance reflects in improvements in business process efficiency, such as better inventory control, improved customer service, reduced cost, or reduced response time, whereas strategic competitive performance reflects in improvement in the firm's overall competitive