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Leveraging e-business process for business value: A layered structure perspective

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ABSTRACT

Few studies have examined how e-business processes can be leveraged to create business value. By examining the technical, relational and business components of an e-business process, we propose a three-layer structure to identify the source of e-business value in procurement, channel management, and customer service processes. We tested research model using structural equation modeling with data collected from 196 manufacturing firms in China. Our results provide support for the following: (1) platform capability and relational governance integrated to enhance e-business process capabilities (EBPCs) and (2) EBPCs, as process enablers, facilitate digital operations activities across organizational interfaces to improve process performance.

1. Introduction

Over the last two decades, the rapid advancement and wide adoption of information technology (IT) has become the engine for management innovation and IT-enabled organizational transformation [6]. With more and more firms relying on web-based e-business technologies to manage inter-firm business processes [35,52], the impact of IT has crossed firm boundaries to affect inter-firm relationships and business networks. However, many firms fail to realize the benefits of such IT-enabled transformations due to a lack of effective e-business process design capabilities and operations [3]. For example, in the US retail industry, about $40 billion is lost annually due to inadequate or a lack of digitized inter-firm business process operations [73]. Therefore, it is important to understand the value creation mechanisms of these IT-enabled business processes. This knowledge can help managers make effective decisions in promoting e-business technologies and obtain business value from their investment in these technologies.

From a practical perspective, the e-business process represents a collection of business rules that can be applied, using the Internet, on any recurrent request (input) to coordinate interactions (processes/additional input) and to deliver unique value (output) to customers [40]. When e-business technologies are applied to supply chain management, a firm executes IT-enabled processes across organizational interfaces together with supply chain partners according to their business rules [2]. E-business processes, therefore, provide great opportunities to establish a business-IS linkage to enhance collaboration between supply chain partners and to promote knowledge management inside and across the firm boundaries, all of which help to achieve supply chain agility and to improve process performance [44,77].

From a theoretical perspective, prior IS research mainly examines the value creation mechanisms of IT from two points of view: business process redesign (BPR) [15,59] and the resource-based view (RBV) [62]. Business process re-design suggests that business value can be generated from IT-enabled process innovations [15,59]. Technological innovations like the Internet, ubiquitous computing, social networks, and business analytics provide unprecedented methods and procedures that offer new processes and/or redesign existing ones [59]. Such new and/or improved business processes help firms achieve competitive performance in a dynamic, information-intensive, and global marketplace. Similarly, RBV indicates that firms obtain value by developing IT-enabled organizational capabilities to acquire, integrate, and reconfigure IT-related resources that are embedded in the firm's structural, cultural and process contexts [6,43,57]. Both views acknowledge that IT resources may not generate business value

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directly, but they can enable intermediate transformational processes and generate higher order organizational capabilities that are sources of firm performance [37,57,66]. Although prior research has identified relationships among IT, business process, and performance [2,13,62,75], few studies have examined how to leverage the e-business process to create business value in the information systems and operations management disciplines.

Due to the proliferation of e-business practices, there has been a recent call to further understand *how* embedding IT in e-business processes can generate business value [43]. In response to this call, we intend to address the following research questions in this study:

1. *What key components define e-business processes between a focal firm and its partners?*
2. *How does a focal firm leverage e-business process capabilities to create business value?*
3. *How do e-business process capabilities affect performance at the process level for a focal firm?*

Specifically, we use the component analysis of processes suggested by Crowston and Osborn [18] to decompose an e-business process into technical, relational and business components and further develop a three-layer research framework (i.e., *organizational assets layer*, *process capabilities layer* and *outcome layer*) to investigate how a focal firm leverages e-business processes to create business value. Drawing on interrelated IS and strategic management literature streams, we focus on platform capability (technical components), relational governance (relational components), and e-business process capabilities (business components) to examine how they work together to improve process performance. We test the research model using data collected from 196 Chinese firms through a large-scale survey.

The rest of the paper is organized as follows. We first define and decompose e-business processes in Section 2, followed by the research model and hypotheses in Section 3. Section 4 describes the operationalization of constructs and the process of data collection, followed by the data analysis in Section 5. Research findings are discussed in Section 6. We then discuss the theoretical contributions and management implications of this study and outline potential directions for future research.

2. Theory development

2.1. Definition of e-business processes and components analysis

Business processes are usually considered "the business actions that firms engage in to accomplish some business purpose or objective" [62, p. 24]. In this paper, we define e-business processes as *a form of process that represents Internet-enabled information flows across organizational boundaries and links supply chain partners to support digital operation activities including procurement, channel management and customer service*.

Business processes depend on a component structure to integrate organizational resources, link supply chain partners, and execute certain business activities to accomplish a firm's business objective [18]. Drawing on the process component literature [17,18], we decompose an e-business process into technical, relational and business components. The technical component enables business process digitalization that links supply chain partners and supports information sharing in a timely manner. The relational component can develop the governance structure to effectively gain and manage its relational assets. With support from the technical and relational components, the business component creates new digital operations activities to achieve business goals. The relationships among these three components are depicted in Fig. 1.

Technical component: A digital platform supports a focal firm to link supply chain partners, representing the technical component of an e-business process [18]. When connected through digital platforms, a firm and its partners can achieve real-time transactional information sharing across distributed applications [57] and promote strategic and operational information sharing to establish business routines and operating procedures [14,43].

Relational component: Managing and refining relationships with a firm's supply chain partners represents the relational component of the e-business process. A focal firm should strengthen bonds with supply chain partners through effective relational governance [24] to implement e-business processes operation.

Business component: Digital operations activities represent the business component of e-business processes that enable a firm to launch various supply chain activities and achieve business goals [66]. Digital operations activities allow a focal firm to use a digital platform that helps the focal firm achieve integration with suppliers and distributors so that it can procure direct or indirect materials, respond rapidly to customer demands, and deliver value-added services over the Internet.

2.2. Three-layer structure in e-business value creation

We examine the value creation mechanisms of the e-business process using the component analysis lens, which allows us to track the route of business activities across organizational interfaces and to analyze the intermediate steps that transform process operations [41].

Extending the resource-based view of the firm [4], the IS business value literature suggests that IT-related resources and capabilities often serve as the basis for higher-order organizational

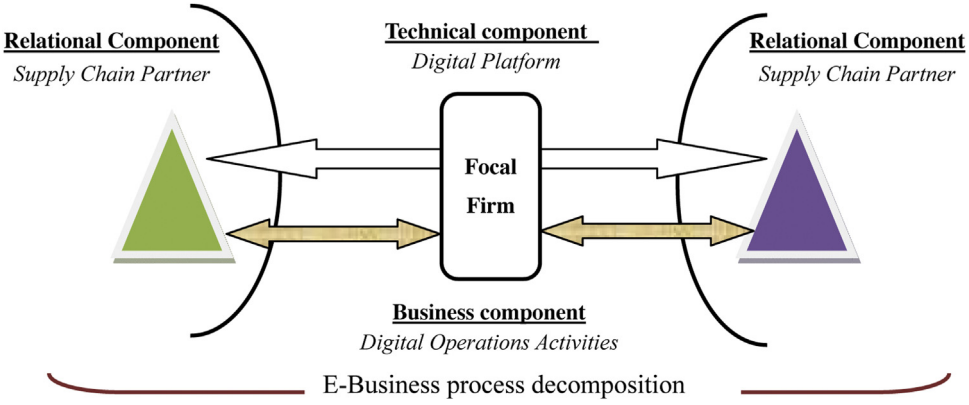

Fig. 1. Three key components of e-business processes.

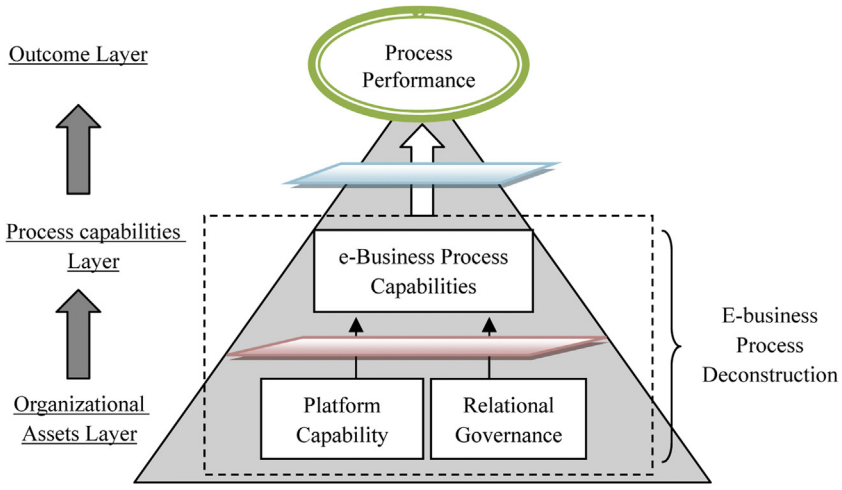

Fig. 2. Three-layer structure framework.

capabilities, which in turn lead to firm performance [46,65,66,81]. With the ability to integrate IT-related resources and capabilities with organizational processes and structural resources [6], a firm can develop higher-order organizational capabilities to support digital operations activities for improved process and firm performance [44]. Following the same logic, we developed a three-layer research framework to investigate how a focal firm leverages e-business processes to create business value (Fig. 2). Table 1 presents how the constructs in the research framework map to the three key components of e-business processes.

2.2.1. Organizational assets layer

The organizational assets layer involves specialized platform capability and relational governance, two first-order abilities that focus on managing the technical and relational components of e-business processes. These two capabilities form the basis for developing e-business process capabilities, which are higher-order organizational capabilities.

As important technical assets, the digital platform integrates back-end ERP systems with front-end web-based systems as well as across partners to support e-business initiatives [32]. By effectively managing interactions with a firm's partners and gaining shared key information/knowledge to facilitate e-business operations activities across organizational boundaries [21], an integrated digital platform lays the basis for developing a firm's higher-order capabilities for procurement, channel management, and customer service. Therefore, we defined *platform capability* as the technical ability of a digital platform to support inter-firm process coupling, data integration and employee participation for e-business processes.

Close and long-term relationships with external partners, including supplier and distributors, represent the "relational assets" of the focal firm [54,76]. Due to the rising importance of such relationships, a focal firm should design and develop a governance structure to effectively maintain and manage its relational assets [24]. We define *relational governance* as the use of relational norms and joint actions to maintain supply chain partner relationships based on common goals [80]. This sets up a social control structure among supply chain partners that encourages partners to make investments in collaboration activities and mitigates uncertainty by discouraging opportunistic behavior in e-business initiatives [28,31].

2.2.2. Process capability layer

The process capability layer involves the business component of e-business processes and includes e-business process capabilities (EBPCs) that facilitate value creation [66]. E-business process capabilities (EBPCs) are defined as the digital operation abilities of a focal firm to conduct supply chain activities in an online setting. E-business process capabilities are higher-order organizational capabilities that build on platform capability and relational governance to conduct e-business process activities for value creation.

Based on the interactions between a focal firm and its supply chain partners, we follow the framework of Johnston and Whang [38] to divide e-business processes into three categories: online procurement, online channel management, and online customer service, all of which require collaboration with supply chain partners. Table 2 compares the characteristics of the three e-business processes. Therefore, we focus on three key process capabilities in this study: (1) online procurement capability (OPC),

Table 1
Mapping to the key components of e-business processes.

E-business process components	Constructs	Effects	Capabilities hierarchy
Technical component	• *Platform capability*	• IT Infrastructure support • Inter-firm interactions based on information/knowledge • Boundary spanning and process linking	First-order technical capability
Relational component	• *Relational governance*	• Incentivizes partner engagement • Combines partner resources and capabilities • Discourages opportunistic behavior	First-order relational capability
Business component	• *Online procurement* • *Online channel management* • *Online service*	• Leverages technical and relational task capability • Executes e-business process for transactions, collaboration, and service • Incentives new value creation	Higher-order process capability

Table 2
Characteristics of Three E-business Processes.

E-business process	Partner	Focus of operations activities	References
Online procurement	Suppliers	• Supplier selection • Joint design • Optimized inventory management • Materials procurement	[7] [20]
Online channel management	Distributors	• Market demand forecasts • Unified pricing, promotion and sales • Sales channel integration	[7] [74]
Online customer service	Suppliers and distributors	• Rapid response for customer demand • Improved customer satisfaction	[74] [25]

(2) online channel management capability (OCMC), and (3) online service capability (OSC).

2.2.3. Outcome layer

The outcome layer is process performance that originates from the previous two layers. Although financial performance is often used to measure e-business value at a *firm* level, many researchers have identified business processes as the more relevant basic unit in IT business value research [36,62]. Davamanirajan et al. [19] note three benefits of conducting research at the business process level: (1) process-level analysis does not involve aggregation across multiple processes where IT investment may result in different levels of effectiveness; (2) it allows researchers to trace the effect of IT on specific processes and tasks and provides effective tools for assessing process-level IT business value; and (3) IT evaluation at the process level is important because investment decisions are often made at this level. Consistent with this research stream, we define *process performance* as the level of improvement on operations productivity and quality at an *e-business process* level. The three processes' performance in corresponding e-business processes are measured in this study: (1) procurement performance (PF), (2) channel management performance (CMF), and (3) customer service performance (CSF).

Table 3 summarizes the definitions of the constructs used in this study.

3. Research model and hypothesis development

According to the above theoretical analysis, we propose the research model below (Fig. 3).

3.1. Platform capability and e-business process capabilities

Platform capability allows a firm to integrate its back-end systems with front-end applications to support core e-business functionality across firm boundaries. This technological ability supports inter-firm process coupling, data transmission and integration, which lays the bases for the focal firm to access and combine supply chain partners' resources and knowledge to improve EBPCs. The digital platform enables seamless integration of activities between a focal firm and its supply chain partners [68,82] such that they can collectively accomplish business activities [66,68]. Firms with a high level of platform capability are able to improve the efficiency of transmission, integration and processing of data collected from business partners and customers [6,58]. By promoting smooth information flows inside the focal firm and across the supply chain partners, platform capability makes it easy for the focal firm and its partners to identify bottlenecks in the supply chain and collaboratively find solutions to optimize business processes.

Specifically, by supporting seamless integration between a focal firm and its suppliers, a digital platform provides the firm the ability to establish online procurement procedures [6]. In addition, this technological capability supports joint coordination of production plans and procurement schedules with suppliers. Thus, it enables the focal firm to optimize business processes and improve collaboration activities in the procurement process. Furthermore, with real-time information sharing across firm boundaries, firms can sense changes in the material markets and identify potential problems in the supply chain, which allows them to adjust or develop new supplier management mechanisms as needed [22].

Table 3
Definitions of constructs.

Constructs	Definition	References
Platform Capability (PC)	• The technology ability of a digital platform to support inter-firm process coupling, data integration and employee participation in e-business operations	[6,68]
Relational Governance (RG)	• The use of relational norms and joint actions to maintain supply chain partner relationships based on common goals	[42,80]
E-business Process Capabilities (EBPCs)	• The digital operation abilities of a focal firm to conduct supply chain activities in an online setting.	[37]
• *Online Procurement Capability* (*OPC*)	• A firm's digital operation ability to conduct procurement activities to realize negotiation and transactions, schedule, and materials demand management	[10,48]
• *Online Channel Management Capability (OCMC)*	• A firm's digital operation ability to conduct channel management to realize unified promotion, product launches, pricing, and order fulfillment	[53,68]
• *Online Service Capability* (*OSC*)	• A firm's digital operation ability to conduct online services to realize customer demand tracking, relationship management, and renewal	[25,68]
Process Performance (PF)	• The extent of improvement in operation productivity and quality at the process level	[47,63]
• *Procurement Performance (PF)*	• The level of improvement in operation productivity and quality of the procurement process	[49,71]
• *Channel Management Performance* (*CMF*)	• The level of improvement in the operation productivity and quality of the channel management process	[84]
• *Customer Service Performance* (*CSF*)	• The level of improvement in the operation productivity and quality of the customer service process	[36,63]

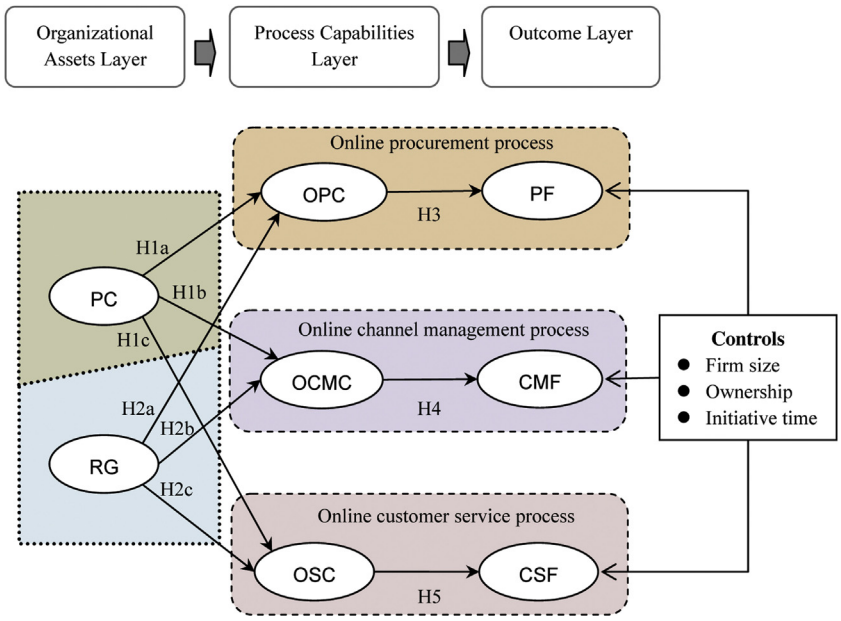

Fig. 3. Research model. *Note*: PC: platform capability; RG: relational governance; OPC: online procurement capability; OCMC: online channel management capability; OSC: online service capability; PF: procurement performance; CMF: channel management performance; CSF: customer service performance.

A digital platform also provides new opportunities for IT-enabled online and offline channel management. Platform capability improves the efficiency of channel management by allowing the focal firm to integrate channel resources from different distributors and coordinate operations in its marketing delivery system [53]. For example, a digital platform helps the focal firm distribute unified promotion information through different channels, increasing the awareness and effectiveness of advertising in public markets. By supporting joint planning of promotion, transaction management, and order fulfillment across different functional channels, platform capability enhances the efficiency of the focal firm's marketing strategy and creates opportunities for process innovation [60].

Moreover, a digital platform improves online service capability through operational optimization, customer analysis, and collaborative management [34]. Firms with a high level of platform capability are not only able to improve the efficiency of customer service support and sales automation [39] but also to provide a better work platform that allows the focal firm to collaborate with its suppliers and distributors to provide better customer service [67,85]. For example, a digital platform allows the focal firm to work together with the suppliers to accommodate emerging requests from the customers and to collaboratively find the optimal solutions. It also helps the focal firm work with distributors to rapidly detect market changes and respond to customer problems [8,56]. Thus, we posit:

H1. Platform capability has a positive impact on (a) online procurement capability, (b) online channel management capability, and (c) online service capability.

3.2. Relational governance and e-business process capabilities

Effective digital operations need supply chain partners to make investments in corresponding technologies and capabilities [12]. Such investments normally involve uncertainty and risk that cannot be completely specified in a formal contract. Relational governance has been considered an effective means of gaining support from business partners for inter-firm operations [83,86]. Acting as an incomplete contract, relational governance contributes to the expectation of long-term relationships and mutual trust among supply chain partners [30,86]. Mutual trust and the commitment to long-term relationships make supply chain partners willing to forgo short-term benefits and invest in complementary technology and process capabilities to support e-business operations [80].

Mutual trust can reduce relationship uncertainty and provide a good collaborative mechanism to encourage suppliers and distributors to increase investments in critical tangible and intangible resources to support online transactions and collaboration activities [80]. In the presence of mutual trust, the focal firm is able to optimize procurement activities through joint process designs and information sharing [7,72] to achieve integrated promotion and transaction processes in different channels [83], effectively detect customer preferences, and address customer needs in customer service processes [9].

Commitment to a long-term relationship encourages supply chain partners to invest in new technologies and operations that may not bring immediate returns. Thus, this commitment mechanism enables a focal firm to collaborate with its supply chain partners to promote its online procurement capability [80] to better sense and respond to market changes [64] and to address customer requests and meet the needs of customization in a timely manner [11,85].

Therefore, we propose the following:

H2. Relational governance has a positive impact on (a) online procurement capability, (b) online channel management capability, and (c) online service capability.

3.3. E-business process capabilities and process performance

When embedded in a business process, IT can affect process performance due to improved information sharing and collaboration activities and quick response to customer needs [61]. Similarly, by sharing key planning and schedule information across supply chain partners, EBPCs can optimize inventory management, coordinate order fulfillment, and provide high quality customer service, which improves process performance [20,29,78].

An online procurement capability reduces procurement and inventory costs as the strategic collaboration with suppliers increases the effectiveness and efficiency of procurement

[50,71]. This capability increases the reach of the focal firm so that it can search across a broader range to find the right suppliers. Supported by this digital operations capability, firms can develop efficient processes and improve the electronic exchange of tactical and strategic information [22,49]. Such linked processes and detailed information sharing enables the focal firm and its partners to coordinate product design, production plans and shipping schedules in an effective manner, which lowers uncertainty and reduces inventory and obsolescence [22,49]. Therefore, we propose the following:

H3. Online procurement capability has a positive impact on procurement performance.

Online channel management capability integrates a firm's cross-functional channel resources and operations. E-business supported channel management provides the organizational capability to achieve unified product launches, pricing, promotion and transaction activities through an automated process of operations management and decision support [53]. These e-business activities can increase operations efficiency by reducing the cost of transactions such as record keeping, ordering, invoicing, and information exchange. Another benefit to cross-channel (e.g., online and offline channels) marketing is the ability to use digital operations methods to manage inventory more effectively and facilitate faster turnover of products [84]. This capability also allows distributors or retailers to share inventory among themselves. With the ability to pool inventory across channels, the focal firm is better positioned to fulfill orders and reduce inventory costs [1]. Therefore, we propose:

H4. Online channel management capability has a positive impact on channel management performance.

Developing online service capabilities for customers provides new opportunities to rapidly respond to customer demands and increase customer satisfaction [51]. For example, the automated service technology of customer relationship management (CRM) is supported by integrating a company's offerings, its website and processes, and knowledge of customer experience [25]. Such IT-enabled operations capabilities have a positive impact on customer service performance. For example, Setia et al. find that two customer service capabilities, customer orientation and customer response, are positively related to process performance [69]. Thus, developing online service capabilities allows the focal firm to quickly respond to customer grievances or complaints, which may enhance the overall experience of customers and improve service performance [25]. Therefore, we posit.

H5. Online service capability has a positive impact on customer service performance.

4. Research design and data collection

With support from the central Chinese government and the widespread use of Internet and related technology in the country, e-business has become a critical part of the Chinese economy. In 2013, the GMV (gross merchandize volume) of e-business represented by B2B and B2C transactions in China reached approximately 10 trillion RMB [33]. As the largest manufacturing base in the world, China plays an indispensable role in the international supply chain [45]. Chinese manufacturing firms adopt e-business initiatives to enhance their collaboration with transnational partners. The widespread presence of e-business in China provides a strong research setting to investigate our research model. In addition, most existing research on IT-enabled business value has been conducted in developed countries. Testing our research model using data collected from Chinese firms provides an opportunity to compare and contrast the results from existing research and reveal nuances in IT value creation mechanisms.

4.1. Data collection and research sample

Survey data was collected from manufacturing firms that interact with suppliers and distributors using Web-based technologies. A list of approximately 1500 qualified manufacturing firms in the food, textiles and leather, chemicals and medicine, computer, electronic equipment, telecommunications equipment, and automobile sectors was obtained from the Chinese Electronic Commerce Association[1] and the Commission of the Economy and Information Technology.[2] The seven above-mentioned manufacturing sectors are focal industries supported by the central government for IT investment. We selected an industry stratified random sample of 600 firms from the list.

We followed the key informant approach to collect data from one senior manager or IS manager in each firm who was highly knowledgeable about e-business operations [88]. Email invitations stating the purpose of the study were sent to these managers to determine their willingness to participate. Questionnaires were then emailed to those managers who expressed an interest in the study. Of the 600 firms that we contacted, 233 surveys were returned, representing a response rate of 38.8%. After deleting 37 incomplete questionnaires, we had a sample of 196 firms that could be used for empirical testing. We tested for non-response bias using analysis of variance techniques. Using the last group of respondents as the proxy for non-respondents, we compared the first and last 25 percent of respondents on key research variables and firm characteristics. No significant difference was detected between the early and late respondents, which indicates response bias may not be a concern in this study. Table 4 presents the demographic profile of the respondents.

4.2. Measurement development

All measurement items were adapted from the prior literature and modified to suit the study context to enhance validity and reliability. The initial English version of the questionnaire was translated into Chinese by a bilingual research associate and then verified and refined for translation accuracy by two MIS professors and two PhD students. We refined the questionnaire sequentially through two-stage Q-sorting conducted by the researchers and face-to-face interviews with six senior managers. The questionnaire was then pilot tested in ten firms to solicit feedback and assess the construct variances. The final questionnaire was modified and improved based on the feedback received from these steps. As summarized in Appendix A, all key constructs in the study are reflective[3] and measured using multi-item, five-point Likert and semantic scales.

Platform capability is used to assess the technical ability of the digital platform employed by the focal firm for online activities. The scale was measured by four items (support seamless connection, data transmission and integration, employee participation in operations processes, and manager participation in management activities) adopted from Barua et al. [6] and Dong et al. [23].

[1] The Chinese Electronic Commerce Association is the premier association of e-business professionals with more than 60,000 members in China (http://www.ec.org.cn/Index.htm).

[2] The Commission of the Economy and Information Technology is the government agency that advances e-business and IT industry development.

[3] Appendix B provides the analysis approach for reflective vs. formative measurement for each multi-item latent variable.

Table 4
Demographic profile of responding firms.

Employees	Number	Percentage	Sales (million RMB)	Number	Percentage
<100	40	20.4	<10	34	17.3
101–1000	63	32.2	10–100	39	20.0
1001–5000	37	18.9	101–1000	42	21.4
>5000	52	26.5	>1000	70	35.7
Unknown	4	2.0	Unknown	11	5.6
Manufacturing industry			E-business initiative		
Food	13	6.6	<1 year	37	18.9
Textiles and leather	5	2.5	2–3 years	59	30.1
Chemicals and medicine	54	27.6	4–5 years	39	19.9
Computer	39	19.9	>5–6 years	55	28
Electronic equipment	22	11.2	Unknown	6	3.1
Telecommunications equipment	34	17.3			
Automobile and components	24	12.2			
Unknown	5	2.7			

Relational governance refers to the ability of a focal firm to build a social control structure for supply chain management. Four items were adopted and developed from Wang and Wei [80] to measure trust and cooperative commitment between the focal firm and its suppliers and distributors.

We assessed EBPCs in terms of the information sharing and collaboration activities in e-business processes [87]. The scale to measure *online procurement capability* (*OPC*) was adapted from Mishra et al. [48] and Soto-Acosta and Merono-Cerdan [71] to measure the main operations activities of negotiation-transaction processes, procurement scheduling, and product and demand management. Four items for *online channel management capability* (*OCMC*) were adapted from Oh et al. [53] to capture the promotion policies, transaction process, pricing, and order fulfillment with distributors. As suggested by Eng [25], *online service capability* (*OSC*) was operationalized as three items related to the capability of providing online service, value-added information about products, and after-sale service. These items reflect service orientation, customer orientation, and market orientation, which are critical components of online service capability.

Performance is assessed separately for the three processes of procurement, channel management, and service. Three items emphasizing lead time reduction, control capability of materials improvement and the level of overstock reduction were adapted from Mishra et al. [48] to measure *procurement performance* (*PF*). *Channel management performance* (*CMF*) was measured by improvements in inventory costs, the speed of fulfilling orders, and partner relationships [16,21,41]. *Customer service performance* (*CSF*) was measured by improvements in product and service satisfaction, customer loyalty, and service quality [16,21,41].

To control for firm-specific effects, we included three control variables to account for performance impacts from *firm size*, e-business *initiative time*, and *ownership*. Large firms may obtain better process performance due to higher potential for product and resource synergy and scale economy [88]. Number of employees was used to measure *firm size* using a categorical variable. E-business *initiative time* may affect process performance because such initiatives need time to assimilate in a firm and its supply chain. Thus, early adopters may enjoy first mover advantages. In this paper, *initiative time* was captured by the number of years since e-business technologies were first used in supply chain operations. Furthermore, *ownership* may affect process performance due to organizational and institutional restrictions for IT investment and management [87]. We specify ownership as state-owned and non-state-owned firms using dummy variables.

4.3. Common methods variance assessment

To safeguard against common method variance (CMV), we incorporated the following procedural safeguards when designing the questionnaire: (a) developing concise and clear items and (b) using separate scale formats for independent and dependent variables. After data collection, we assessed the threat of common method bias using a latent single common method factor (CMF) test and Lindell and Whitney's marker variable test.

A structural equation model (SEM)-based latent single common method factor (CMF) test was executed [55]. We compared a base CFA model with a CFA model that extended the base model with a single latent method factor that is uncorrelated with all the other latent variables following Wagner and Bode's method [79]. The inclusion of the CMF only marginally improved the model fit (base model: $\chi^2/df = 1.88$ ($\chi^2_{(311)} = 584.19$, $p < 0.01$), RMSEA = 0.059, CFI = 0.99, NFI = 0.97, GFI = 0.90; CMF model: $\chi^2/df = 1.88$ ($\chi^2_{(310)} = 582.77$, $p < 0.01$), RMSEA = 0.058, CFI = 0.99, NFI = 0.97, GFI = 0.90). The comparison test reveals that the two models are not significantly different ($\Delta\chi^2_{(1)} = 1.42$, $p > 0.05$).

In addition, a marker variable that was theoretically unrelated to the other study variables was included in the research instrument. Post hoc CMV was then assessed by calculating and comparing the adjusted correlations after controlling for the lowest correlations (0.015) in the correlation matrix. The correlations remained significant in all CMV adjusted correlations. The results from these two tests suggest that CMV may not be a problem in this study.

5. Data analysis and results

The proposed research model is assessed using a covariance-based SEM analysis. The analysis consists of two parts – the measurement model and the structural model. The measurement model assesses the adequacy of the measures used for theoretical constructs employed in the study. The structural model specifies the relationship between constructs. Both parts were analyzed using LISREL 8.72.

5.1. The measurement model

Confirmatory factor analysis (CFA) was used to evaluate the validity and reliability of the instrument. Overall, the measurement model fits the data well ($\chi^2/df = 1.88$ RMSEA = 0.059, CFI = 0.99, NFI = 0.97, GFI = 0.90). Convergent validity and discriminant validity were assessed for the measurement model. One way to test for convergent validity is to evaluate whether an individual item's standardized coefficient from the measurement model is

Table 5
Descriptive statistics, correlation matrix and AVE test.

	1	2	3	4	5	6	7	8	9	10	11
1. Platform capability	**0.735**										
2. Relational governance	0.109	**0.739**									
3. Online procurement capability	0.619	0.127	**0.853**								
4. Online channel management capability	0.553	0.264	0.696	**0.810**							
5. Online service capability	0.600	0.329	0.664	0.692	**0.752**						
6. Procurement performance	0.491	0.016	0.604	0.563	0.626	**0.870**					
7. Channel management performance	0.504	0.053	0.691	0.522	0.413	0.629	**0.877**				
8. Customer service performance	0.508	0.098	0.622	0.655	0.675	0.661	0.617	**0.883**			
9. Firm size[a]	0.128	−0.152	0.080	0.090	0.060	0.110	0.147	−0.035	NA		
10. Initiative time[b]	0.288	−0.131	0.251	0.215	0.200	0.197	0.251	0.136	0.459	NA	
11. Ownership[c]	−0.26	0.190	0.015	0.042	0.038	0.034	−0.021	0.053	−0.381	−0.199	NA
Mean	3.526	3.385	3.175	3.176	3.374	3.415	3.408	3.403	3.28	2.76	0.36
SD	0.832	0.810	0.995	1.011	0.886	0.846	0.915	0.871	1.71	1.44	0.48

The shaded diagonal values are the square root of the AVE for each construct.
[a] Number of employees is measured in six categories (≤100, 101–500, 501–1000, 1001–5000, 5001–10,000, and >10,000).
[b] Initiation time is measured in five categories (≤1 year, 1–2 years, 3–4 years, 5–6 years, and >6 years).
[c] Dummy variables (state-owned or non-state-owned).

significant [27]. As shown in Appendix A, all estimated standard loadings are significant ($p < 0.001$), suggesting good convergent validity. Discriminant validity is established when the square root of the average variance extracted (AVE) of each construct is larger than the inter-construct correlations. As shown in Table 5, all square roots of AVEs were above 0.7, and they are much larger than all cross-correlations. Such results suggest that the items share more common variance with their respective constructs than with other constructs. All our constructs meet this criterion.

Construct reliability was measured using Cronbach's alpha and composite reliability (Appendix A). The results range from 0.79 to 0.92 for the eight constructs, indicating high internal consistency. Further, composite reliability was evaluated and the results are similar to Cronbach's alpha, indicating good reliability of these constructs [26].

5.2. The structural model

We estimated a structural model to assess the relationships proposed in the research model. The overall model provided a good fit to the data (χ^2/df = 2.0, RMSEA = 0.061, CFI = 0.96, NFI = 0.92, GFI = 0.90). Fig. 4 presents the testing results.

For control variables, initiation time ($\beta = 0.18$, $p < 0.05$) positively impacts channel management performance. This result suggests that it takes time for the focal firm to obtain business value from its e-business investments. Firm size ($\beta = 0.21$, $p < 0.05$) also has a positive impact on procurement performance, which suggests that larger firms normally have better performance because they are able to achieve economies of scale.

Fig. 4 shows that platform capability has a positive effect on online procurement capabilities ($\beta = 0.64$, $p < 0.001$), online channel management capability ($\beta = 0.61$, $p < 0.001$), and online service capability ($\beta = 0.67$, $p < 0.001$). Thus, we found strong evidence for hypotheses H1a, H1b, and H1c, suggesting that firms that have a high degree of platform capability have enhanced e-business process capabilities.

We also found that relational governance has a positive effect on online procurement capabilities ($\beta = 0.21$, $p < 0.001$) and online service capability ($\beta = 0.17$, $p < 0.05$), but it does not have a significant impact on online procurement capabilities ($\beta = 0.12$, $p > 0.05$). Thus, only H2b and H2c are supported.

Hypotheses H3, H4, and H5 are all strongly supported at a 0.001 significance level, demonstrating that EBPC involvement in procurement ($\beta = 0.58$, $p < 0.001$), channel management ($\beta = 0.68$, $p < 0.001$), and the customer service process ($\beta = 0.67$, $p < 0.001$) leads to improved individual process performance. The R^2 showed that this model accounts for 33 percent of the variance in

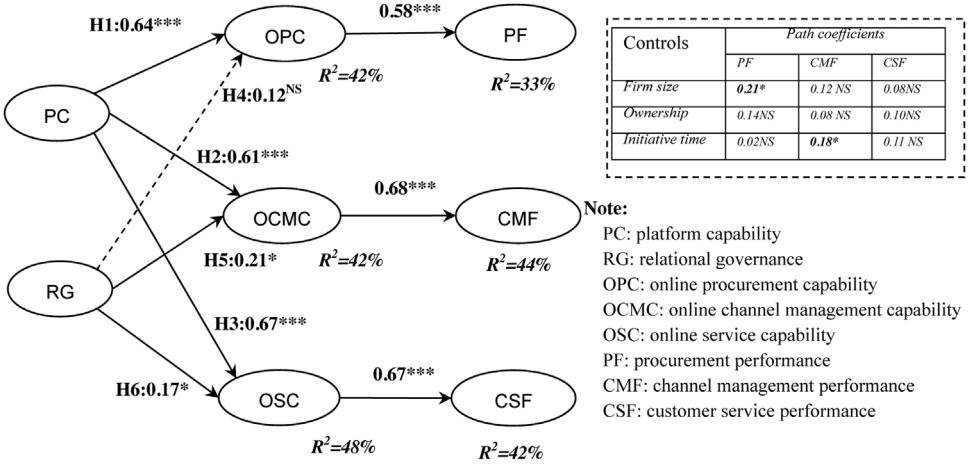

Fig. 4. SEM structural model results.

Table 6
Sobel mediation test.

IV	MV	DV	IV → MV(a)	MV → DV(b)	IV → DV (c')	Sobel test	Mediation role
PC	OPC	PF	0.64^{***}	0.58^{***}	0.10^{NS}	3.94^{*}	Full
	OCMC	CMF	0.61^{***}	0.68^{***}	0.12^{NS}	4.17^{*}	Full
	OSC	CSF	0.67^{***}	0.67^{***}	0.10^{NS}	4.08^{*}	Full
RG	OPC	PF	0.12^{NS}	0.58^{***}	0.1^{NS}	0.8^{NS}	No mediation
	OCMC	CMF	0.21^{**}	0.68^{***}	0.09^{NS}	5.38^{*}	Full
	OSC	CSF	0.17^{*}	0.67^{***}	0.06^{NS}	4.12^{*}	Full

Note: IV, independent variable; MV, mediation variable; DV, dependent variable. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$; NS, not significant.
Sobel test, $z=\hat{a}\hat{b}/s_{ab}$, Stat.>0.97. $^{*}p<0.05$; $^{NS}p>0.05$.

procurement performance, 44 percent in channel management performance, and 42 percent in customer service performance.

5.3. Post hoc analysis

To further test the research model and check the robustness of our research results, we conducted a mediation test and a performance impact test using archival data.

While we did not propose mediation effects in the hypotheses, the effects of platform capability and relational governance on process performance are mediated by EBPCs in the research model. Thus, we used the procedure suggested by Baron and Kenny to test for implicit mediation effects [5]. We first ran separate models between independent variables and mediators, between mediators and dependent variables, and between independent variables and dependent variables. We then ran a full model to test for the effects between independent variables and dependent variables after controlling for the mediation variables. The level of significance was assessed using a Sobel test [70]. The test results are presented in Table 6.

As shown in Table 6, we observed e-business process capabilities fully mediate five out of six of the relationships. The only exception is that the relationship between relational governance and procurement performance is not mediated by online procurement capability. Observing the results, we see that relational governance does not have a significant impact on procurement performance either, which indicates that relational governance does not play an important role in improving procurement performance. Therefore, except for the path of RG → OPC → PF, our results provide evidence that EBPCs mediate the relationships between first-order capabilities and process performance in our model.

To examine whether e-business process capabilities can create competitive performance impacts at the firm level, we further tested the performance impact of EPBCs using objective performance data collected from archival records. In our sample, we have 46 public firms that can be identified in the Oriana Asia-Pacific company information database.[4] We collected performance data on return on equity (ROE) and net profit margin (NPM) for these 46 firms on both the survey year (year t) and the next year after the survey (year $t+1$). To mitigate the performance variation across industries, we also collected average industry performance data on year t and $t+1$ to construct a comparative ratio for each of the following two items:

1. Comparative ratio of *return on equity* (CRROE) = [(firm ROE − industry average ROE)/industry average ROE].
2. Comparative ratio of *net profit margin* (CRNPM) = [(firm NPM − industry average NPM)/industry average NPM].

We then ran OLS-regressions to test the relationship between e-business process capabilities and CRROE and CRNPM at both the *year t* and *year t* + 1. Overall, Table 7 shows that e-business process capabilities have an important positive effect on CRROE and CRNPM in both years at the 0.05 significance level, indicating that the e-business process can generate competitive performance at the firm level.

Table 7
Post Hoc results of competitive performance from e-business process capabilities.

	CRROE		CRNPM	
	Year t	Year $t+1$	Year t	Year $t+1$
OPC	0.124^{*}	0.141^{*}	0.09^{NS}	0.103^{*}
OCMC	0.10^{NS}	0.162^{*}	0.127^{*}	0.142^{**}
OSC	0.171^{*}	0.153^{*}	0.152^{**}	0.164^{**}
R^2	17%	21%	19%	20%
VIF	<2.5	<2.5	<2.5	<2.5

* $p<0.05$.
** $p<0.01$.
NS, not significant.

6. Discussion

6.1. Limitations and future research

While we developed our research model on a sound theoretical base and conducted the empirical study following the best practices in the field, our study is still subject to certain limitations that may be worth examining in future research. First, we took a focal firm perspective to examine the value creation mechanism of e-business processes. If a paired data set can be collected from both the focal firm and its upstream or downstream supply chain partners, we could both improve the reliability of the findings and examine how the collaboration and joint decision making between partners affect e-business process capabilities and process performance. Second, we used cross-sectional data, which provides a snapshot of e-business activities in the focal firm. A longitudinal design would be desirable to further examine how firms develop EBPCs over time and delineate the causal dynamics between EBPCs and process performance. Third, this paper did not consider possible moderating factors in the value creation process of EBPCs. Despite these potential limitations, we believe our study offers important theoretical and practical implications to understand the nature of e-business processes that enable firms to create business value.

6.2. Theoretical implications

In this research, we examined the value creation mechanism of e-business at the process level, which allows us to delineate the intermediate steps that transform process operations. Despite some research on IT value creation in businesses from the BPR and the RBV perspectives [15,59,62], little empirical work has been performed to examine the components of e-business process operations. Drawing from interrelated IS and strategic management literature, our research suggests that e-business process

[4] Oriana is provided by Bureau van Dijk (BvD) (http://www.bvdinfo.com), which is a European financial information vendor. This database contains comprehensive information on companies across the Asia-Pacific region, such as company financials, detailed corporate structure, market research and business news.

components (i.e., technical, relational and business components) form the basis to obtain business value from investment in e-business technologies. We then developed a three-layer research framework (i.e., organizational assets layer, process capabilities layer and outcome layer) to investigate the source of e-business value at the process level. Our results confirm the potential relationship among these layers, which indicates that EBPCs serve as the critical intermediate layer to transform platform capability and relational governance into process performance. These results not only echo recent research that has recognized business processes as the most direct source of business performance gains [43,49,63] but also represent a new step toward understanding the underlying mechanisms of e-business value creation. Specifically, we contribute to the IT business value literature in the following three ways.

First, this study identifies the importance of both technical capabilities and relational management capabilities to develop e-business process capabilities. The extant research on IT business value has primarily focused on internal capabilities, such as technical capabilities and human resources, that a firm can control [23,48], but few have taken into account the issues of inter-firm relational governance for e-business value at the process level. In today's business world, firms cannot compete alone. Instead, they have to draw on resources and capabilities from their supply chain partners for competitive performance [58]. Similarly, to develop the e-business process capabilities, the focal firm has to obtain support from its supply chain partners. Our results provide evidence that relational governance is an effective way to involve supply chain partners in developing online channel management and online service capabilities. The lack of effect from relational governance on online procurement capability may indicate that the procurement process is a more structured routine process, which can be effectively handled by the digital platform and is less dependent on relational governance for collaboration. Our results also show that the effects of platform capability are much stronger than those of relational governance on EBPCs, which suggest that Chinese firms rely more on technology support to achieve improved communication and information sharing for coordinating e-business processes.

Second, our study indicates that a firm's EBPCs are an important source for improved process performance; thus, e-business process capabilities allow us to track the route of e-business activities across organizational interfaces for business value creation. Acting as higher-order capabilities, EBPCs enable a firm to acquire, integrate, reconfigure, and release internal and external resources/capabilities that are embedded in business processes to improve process performance. These inter-firm process capabilities require substantial investment in IT support, partnership management, and business process management in specific supply chain domains. Therefore, EBPCs are firm-specific and deeply embedded within an organization and inter-firm collaborative processes that are not easily transferable or quickly imitable [87]. Because causal ambiguity arose from internal and external resources/capability interconnectedness and indivisibility, EBPCs can also be the source of competitive performance as confirmed in the post hoc analysis that is drilled into the performance impacts at the firm level.

Third, our mediation test reveals that a firm's EBPCs act as key process enablers that transform platform capability and relational governance into business value. These critical causal relationships expand our understanding of the net-enabled organizational transformation at the process level [6]. Based on the interactions among supply chain partners [38], we divide EBPCs into three categories – online procurement capability, online channel management capability and online service capability in supply chain operations. Prior research has focused either on the supply side (upstream) or on the demand side (downstream) of integration [78]. We argue EBPCs can be embedded into the entire supply chain processes to improve IT-enabled partner coordination and customer responsiveness.

6.3. Practical implications

Our study provides guidance for IS and business managers to develop e-business process capabilities and to obtain business value from their investments in e-business technology at the process level. First, our study provides a framework for firms to understand the e-business process and then design their e-business process applications to create business value. Through decomposing an e-business process into technical, relational and business components, IS and business managers can delineate the effects of technology, partnership, and digital operations on process performance. The proposed three-layer research model (i.e., organizational assets layer, process capabilities layer and outcome layer) can be used to design and develop e-business process capabilities to improve process performance.

Second, business managers in firms should consider how to leverage platform capability and partnership management to develop appropriate e-business process capabilities. While relational governance may not have as strong effects on EBPCs as that of platform capability, it is an indispensable part in the value creation mechanism of e-business. With partners' investments in complementary technology and process capabilities, the focal firm can enhance its e-business operations and obtain improved process performance.

Third, IS managers and business managers also need to understand the pivotal role of EBPCs in transforming e-business technology investments into business value. Our results indicate that firms have to develop EBPCs from their investments in e-business technology and partnership management to accrue business value. Thus, they should carefully evaluate their EBPCs across different processes to identify issues that may prevent them from obtaining value from their investments. Our set of 11 items grouped under three e-business processes provides managers with an instrument to assess the status of EBPCs, which can be used as a diagnostic benchmark for a follow-up assessment of e-business operations.

7. Conclusions

While e-business technologies bring the promise of improved process performance, there is a need to understand their mechanisms to leverage e-business processes for business value creation. In this paper, we decompose an e-business process into three key components and develop a three-layer research model to explain the source of business value in three major e-business processes. Our results support the proposed research model and reveal the pivotal role of EBPCs in obtaining business value from investments in platform technology and partnership management. This paper represents an important step in understanding e-business value creation at the process level and contributes to promoting net-enabled organizational transformation and process innovation.

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Appendix A

Table A1
Survey instrument, statistics of the measurement model and reliability analysis.

		Standard loadings
PC: Platform capability (Cronbach's alpha = 0.81; composite reliability = 0.82, AVE = 0.54)		
PTS 1	Our digital platform provides seamless connection between partners' systems and our systems to support e-business process coupling.	0.74*
PTS 2	Our digital platform can easily transmit, integrate and process data from suppliers and retailers.	0.74*
PTS 3	Our digital platform supports employee participation in e-business operations activities (e.g., collecting market information) with their knowledge.	0.76*
PTS 4	Our digital platform supports manager participation in e-business management activities (e.g., procurement decision making) with their knowledge.	0.68*
RG: Relational governance (Cronbach's alpha = 0.85; composite reliability = 0.83, AVE = 0.55)		
RG1	Our firm has established trusting partner relationships with our suppliers.	0.66*
RG2	Our firm has established a cooperative commitment that encourages suppliers to join in our procurement network.	0.66*
RG3	Our firm has established trusting partner relationships with our distributors.	0.79*
RG4	Our firm has established a cooperative commitment that encourages distributors to join in our channel.	0.83*
OPC: Online procurement capability(Cronbach's alpha = 0.92; composite reliability = 0.91, AVE = 0.73)		
OPC1	The online procurement operations process is reengineered to realize online procurement negotiation-transaction management	0.84*
OPC2	Production schedules are shared online with suppliers to realize procurement schedule management.	0.84*
OPC3	Procurement order catalogs are shared online with suppliers to realize procurement product management.	0.87*
OPC4	Material demand information is shared online with suppliers to realize procurement demand management.	0.76*
OCMC: Online channel management capability (Cronbach's alpha = 0.88; composite reliability = 0.88, AVE = 0.66)		
OCMC1	The online transaction process is reengineered to support ordering management.	0.88*
OCMC2	Marketing policies are shared online with retailers to realize promotion policy management.	0.82*
OCMC3	Ordering catalogs are shared online with retailers to realize product and pricing management.	0.82*
OCMC4	Production schedules are shared online with retailers to realize order fulfillment management.	0.71*
OSC: Online service capability (Cronbach's alpha = 0.80; composite reliability = 0.80, AVE = 0.57)		
OSC1	Our firm provides online customer service (e.g., e-mail, online communication software) in the website.	0.68*
OSC2	Our firm provides value-added services (e.g., product quality comments) on the website for potential customers.	0.75*
OSC3	Our firm provides online customer service to address customer feedback and suggestions.	0.82*
PF: procurement performance (Cronbach's alpha = 0.90; composite reliability = 0.90, AVE = 0.76)		
PF1	Lead time reduced	0.87*
PF2	Control capacity of materials improved	0.85*
PF3	The level of overstock reduced	0.89*
CMF: Channel management performance (Cronbach's alpha = 0.90; composite reliability = 0.91, AVE = 0.77)		
CMF1	Reduction in inventory costs	0.88*
CMF2	The increase in speed of fulfilling orders	0.85*
CMF3	Improvement in partner relationships with retailers	0.90*
CSF: Customer service performance (Cronbach's alpha = 0.92; composite reliability = 0.91, AVE = 0.78)		
CSF1	The increase in the level of products and service satisfaction	0.90*
CSF2	The increase in the number of loyal customer	0.86*
CPF3	Improvement in quality of service	0.89*

Overall fits of the measurement models: $\chi^2/df = 1.88$, RMSEA = 0.059, CFI = 0.99, NFI = 0.97, GFI = 0.90.
* $p < 0.001$.

Appendix B

Table B1
Formative vs reflective constructs analysis approach.

Construct	Are the indicators defining characteristics of the construct?	Do changes in indicators cause changes in the construct?	Do changes in the construct cause changes in the indicators?	Do the indicators necessarily share a common theme?	Does eliminating an indicator alter the conceptual domain of the construct?	Is a change in one of the indicators necessarily associated with a change in all the other indicators?	Do the indicators have the same antecedents and consequences?	Scale type
Platform capability	No	No	Yes	Yes	No	Yes	No	Reflective
Relational governance[a]	No	No	Yes	Yes	No	Yes	No	Reflective
Online procurement capability	No	No	Yes	Yes	No	Yes	No	Reflective
Online channel management capability	No	No	Yes	Yes	No	Yes	No	Reflective
Online service capability	No	No	Yes	Yes	No	Yes	No	Reflective

Table B1 (*Continued*)

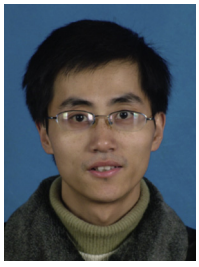
Construct	Are the indicators defining characteristics of the construct?	Do changes in indicators cause changes in the construct?	Do changes in the construct cause changes in the indicators?	Do the indicators necessarily share a common theme?	Does eliminating an indicator alter the conceptual domain of the construct?	Is a change in one of the indicators necessarily associated with a change in all the other indicators?	Do the indicators have the same antecedents and consequences?	Scale type
Procurement performance	No	No	Yes	Yes	No	Yes	No	Reflective
Channel management performance	No	No	Yes	Yes	No	Yes	No	Reflective
Customer service performance	No	No	Yes	Yes	No	Yes	No	Reflective

[a] Relational governance can be viewed as an index of the levels of relational mechanisms used, and these levels are not necessarily similar, so it was operationalized as a formative construct with four dimensions[80]. In this paper, we defined relational governance as the ability of a focal firm to build a social control structure for supply chain management, which can be consistent across suppliers and distributors. Thus, this construct should be classified as reflective.

References

[1] N.A.H. Agatz, M. Fleischmann, J.A.E.E. Van Nunen, E-fulfillment and multi-channel distribution: a review, Eur. J. Oper. Res. 187 (2), 2008, pp. 339–356.
[2] H. Bala, The effects of IT-enabled supply chain process change on job and process outcomes: a longitudinal investigation, J. Oper. Manage. 31 (6), 2013, pp. 450–473.
[3] H. Bala, V. Venkatesh, Assimilation of interorganizational business process standards, Inf. Syst. Res. 18, 2007, pp. 340–362.
[4] J. Barney, Firm resources and sustained competitive advantage, J. Manage. 17 (1), 1991, pp. 99–120.
[5] R.M. Baron, D.A. Kenney, The moderate or mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations, J. Pers. Soc. Psychol. 1, 1986, pp. 1173–1182.
[6] A. Barua, P. Konana, A.B. Whinston, et al., An empirical investigation of net-enabled business value, MIS Q. 28 (4), 2004, pp. 585–620.
[7] T. Boone, R. Ganeshan, The frontiers of eBusiness technology and supply chains, J. Oper. Manage. 25 (6), 2007, pp. 1195–1198.
[8] K.K. Boyer, G.T.M. Hult, Customer behavioral intentions for online purchases: an examination of fulfillment method and customer experience level, J. Oper. Manage. 24 (2), 2006, pp. 124–147.
[9] S.H. Cai, M. Jun, Z.L. Yang, Implementing supply chain information integration in China: the role of institutional forces and trust, J. Oper. Manage. 28 (3), 2010, pp. 257–268.
[10] H.-H. Chang, Y.-C. Tsai, C.-H. Hsu, E-procurement and supply chain performance, Supply Chain Manage. Int. J. 18 (1), 2013, pp. 34–51.
[11] H.H. Chang, K.H. Wong, P.W. Fang, The effects of customer relationship management relational information processes on customer-based performance, Decis. Support Syst. 66, 2014, pp. 146–159.
[12] D. Chatterjee, T. Ravichandran, Governance of interorganizational information systems: a resource dependence perspective, Inf. Syst. Res. 24 (2), 2013, pp. 261–278.
[13] J.V. Chen, Y. Chen, E.P.S. Capistrano, Process quality and collaboration quality on B2B e-commerce, Ind. Manage. Data Syst. 113 (6), 2013, pp. 908–926.
[14] I. Chengalur-Smith, P. Duchessi, J.R. Gil-Garcia, Information sharing and business systems leveraging in supply chains: an empirical investigation of one web-based application, Inf. Manage. 49 (1), 2012, pp. 58–67.
[15] T.H. Clark, B. Donna, Interorganizational business process redesign: merging technological and process innovation, J. Manage. Inf. Syst. 13 (2), 1996, pp. 9–28.
[16] T. Coltman, T.M. Devinney, D.F. Midgley, Customer relationship management and firm performance, J. Inf. Technol. 26 (3), 2011, pp. 205–219.
[17] K. Crowston, A coordination theory approach to organizational process design, Org. Sci. 8 (2), 1997, pp. 157–175.
[18] K. Crowston, C.S. Osborn, A coordination theory approach to process description and redesign, in: K.C.T.W. Malone, G.A. Herman (Eds.), Organizing Business Knowledge: The MIT Process Handbook, The MIT Press, Cambridge, MA, 2003.
[19] P. Davamanirajan, R.J. Kauffman, C.H. Kriebel, et al., Systems design, process performance, and economic outcomes in international banking, J. Manage. Inf. Syst. 23 (2), 2006, pp. 65–90.
[20] B. Dehning, V.J. Richardson, R.W. Zmud, The financial performance effects of IT-based supply chain management systems in manufacturing firms, J. Oper. Manage. 25 (4), 2007, pp. 806–824.
[21] S. Devaraj, L. Krajewski, J.C. Wei, Impact of eBusiness technologies on operational performance: the role of production information integration in the supply chain, J. Oper. Manage. 25 (6), 2007, pp. 1199–1216.
[22] S. Devaraj, G. Vaidyanathan, A.N. Mishra, Effect of purchase volume flexibility and purchase mix flexibility on e-procurement performance: an analysis of two perspectives, J. Oper. Manage. 30 (7–8), 2012, pp. 509–520.
[23] S.T. Dong, S.X. Xu, K.X.G. Zhu, Information technology in supply chains: the value of IT-enabled resources under competition, Inf. Syst. Res. 20 (1), 2009, pp. 18–32.
[24] J.H. Dyer, H. Singh, The relational view: cooperative strategy and sources of interorganizational competitive advantage, Acad. Manage. Rev. 23 (4), 1998, pp. 660–679.
[25] T.Y. Eng, E-customer service capability and value creation, Serv. Ind. J. 28 (9), 2008, pp. 1293–1306.
[26] D. Gefen, E.E. Rigdon, D. Straub, An update and extension to SEM guidelines for administrative and social science research, MIS Q. 35 (2), 2011, pp. III–XIV.
[27] D. Gefen, D. Straub, M. Boudreau, Structural equation modeling techniques and regression: guidelines for research practice, Commun. AIS 1 (7), 2000, pp. 1–78.
[28] V. Grover, R. Kohli, Cocreating IT value: new capabilities and metrics for multifirm environments, MIS Q. 36 (1), 2012, pp. 225–232.
[29] A. Gunasekaran, E.W.T. Ngai, Information systems in supply chain integration and management, Eur. J. Oper. Res. 159 (2), 2004, pp. 269–295.
[30] P. Hadaya, L. Cassivi, Joint collaborative planning as a governance mechanism to strengthen the chain of IT value co-creation, J. Strateg. Inf. Syst. 21 (3), 2012, pp. 182–200.
[31] P. Hart, C. Saunders, Power and trust. Critical factors in the adoption and use of electronic data interchange, Org. Sci. 8 (1), 1997, pp. 23–42.
[32] P.-F. Hsu, Integrating ERP and e-business. Resource complementarity in business value creation, Decis. Support Syst. 56, 2013, pp. 334–347.
[33] iResearch, iResearch Releases China E-commerce Forecast, 2014 Available from: http://www.iresearchchina.com/views/5584.html.
[34] R. Iriana, F. Buttle, Strategic, operational, and analytical customer relationship management, J. Relatsh. Mark. 5 (4), 2007, pp. 23–42.
[35] R.J. Jean, R.R. Sinkovics, D. Kim, The impact of technological, organizational and environmental characteristics on electronic collaboration and relationship performance in international customer–supplier relationships, Inf. Manage. 51 (7), 2014, pp. 854–864.
[36] P.I. Jeffers, W.A. Muhanna, B.R. Nault, Information technology and process performance: an empirical investigation of the interaction between IT and non-IT resources, Decis. Sci. 39 (4), 2008, pp. 703–735.
[37] Y. Jiang, J. Zhao, Co-creating business value of information technology, Ind. Manage. Data Syst. 114 (1), 2014, pp. 53–69.
[38] E.M. Johnson, S. Whang, e-Business and supply chain management: an overview and framework, Prod. Oper. Manage. Sci. 11 (4), 2002, pp. 413–423.
[39] F. Khodakarami, Y.E. Chan, Exploring the role of customer relationship management (CRM) systems in customer knowledge creation, Inf. Manage. 51 (1), 2014, pp. 27–42.
[40] H.M. Kim, R. Ramkaran, Best practices in e-Business process management: extending a re-engineering framework, Bus. Process Manage. J. 10 (1), 2004, pp. 27–44.
[41] R. Klein, Customization and real time information access in integrated eBusiness supply chain relationships, J. Oper. Manage. 25 (6), 2007, pp. 1366–1381.
[42] R. Klein, A. Rai, Interfirm strategic information flows in logistics supply chain relationships, MIS Q. 33 (4), 2009, pp. 735–762.
[43] R. Kohli, V. Grover, Business value of IT: an essay on expanding research directions to keep up with the times, J. Assoc. Inf. Syst. 9 (1), 2008, pp. 23–39.
[44] H. Liu, W. Ke, K.K. Wei, et al., The impact of IT capabilities on firm performance: the mediating roles of absorptive capacity and supply chain agility, Decis. Support Syst. 54 (3), 2013, pp. 1452–1462.
[45] X.H. Lu, L.H. Huang, M.S.H. Heng, Critical success factors of inter-organizational information systems – a case study of Cisco and Xiao Tong in China, Inf. Manage. 43 (3), 2006, pp. 395–408.
[46] J.F. Luo, M. Fan, H. Zhang, Information technology and organizational capabilities: a longitudinal study of the apparel industry, Decis. Support Syst. 53 (1), 2012, pp. 186–194.
[47] N. Melville, K. Kraemer, V. Gurbaxani, Review: information technology and organizational performance: an integrative model of IT business value, MIS Q. 28 (2), 2004, pp. 283–322.
[48] A. Mishra, P. Konana, A. Barua, Antecedents and consequences of Internet use in procurement: an empirical investigation of U.S. manufacturing firms, Inf. Syst. Res. 18 (1), 2007, pp. 103–120.

[49] A.N. Mishra, S. Devaraj, G. Vaidyanathan, Capability hierarchy in electronic procurement and procurement process performance: an empirical analysis, J. Oper. Manage. 31 (6), 2013, pp. 376–390.
[50] S. Mishra, S.B. Modi, A. Animesh, The relationship between information technology capability, inventory efficiency, and shareholder wealth: a firm-level empirical analysis, J. Oper. Manage. 31 (6), 2013, pp. 298–312.
[51] M.M. Montoya, A.P. Massey, V. Khatri, Connecting IT services operations to services marketing practices, J. Manage. Inf. Syst. 26 (4), 2010, pp. 65–85.
[52] S. Muylle, A. Basu, Online support for business processes by electronic intermediaries, Decis. Support Syst. 45 (4), 2008, pp. 845–857.
[53] L.B. Oh, H.H. Teo, V. Sambamurthy, The effects of retail channel integration through the use of information technologies on firm performance, J. Oper. Manage. 30 (5), 2012, pp. 368–381.
[54] A. Paulraj, A.A. Lado, I.J. Chen, Inter-organizational communication as a relational competency: antecedents and performance outcomes in collaborative buyer–supplier relationships, J. Oper. Manage. 26 (1), 2008, pp. 45–64.
[55] P.M. Podsakoff, S.B. MacKenzie, J.Y. Lee, et al., Common method biases in behavioral research: a critical review of the literature and recommended remedies, J. Appl. Psychol. 88 (5), 2003, pp. 879–903.
[56] E. Rabinovich, Linking e-service quality and markups: the role of imperfect information in the supply chain, J. Oper. Manage. 25 (1), 2007, pp. 14–41.
[57] A. Rai, R. Patnayakuni, N. Seth, Firm performance impacts of digitally enabled supply chain integration capabilities, MIS Q. 30 (2), 2006, pp. 225–246.
[58] A. Rai, X.L. Tang, Leveraging IT capabilities and competitive process capabilities for the management of IR portfolios, Inf. Syst. Res. 21 (3), 2010, pp. 516–542.
[59] R. Ramirez, N. Melville, E. Lawler, Information technology infrastructure, organizational process redesign, and business value: an empirical analysis, Decis. Support Syst. 49 (4), 2010, pp. 417–429.
[60] A. Rangaswamy, G.H. Van Bruggen, Opportunities and challenges in multichannel marketing: an introduction to the special issue, J. Interact. Mark. 19 (2), 2005, pp. 5–11.
[61] T. Ravichandran, C. Lertwongsatien, Effect of information systems resources and capabilities on firm performance: a resource-based perspective, J. Manage. Inf. Syst. 21 (4), 2005, pp. 237–276.
[62] G. Ray, J.B. Barney, W.A. Muhanna, Capabilities, business processes, and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view, Strateg. Manage. J. 25 (1), 2004, pp. 23–37.
[63] G. Ray, W.A. Muhanna, J.B. Barney, Information technology and the performance of the customer service process: a resource-based analysis, MIS Q. 29 (4), 2005, pp. 625–652.
[64] E.D. Rosenzweig, A.V. Roth, B2B seller competence: construct development and measurement using a supply chain strategy lens, J. Oper. Manage. 25 (6), 2007, pp. 1311–1331.
[65] V. Sambamurthy, A. Bharadwaj, V. Grover, Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms, MIS Q. 27 (2), 2003, pp. 237–263.
[66] N.R. Sanders, An empirical study of the impact of e-business technologies on organizational collaboration and performance, J. Oper. Manage. 25 (6), 2007, pp. 1332–1347.
[67] N.R. Sanders, Pattern of information technology use: the impact on buyer-suppler coordination and performance, J. Oper. Manage. 26 (3), 2008, pp. 349–367.
[68] N. Saraf, C.S. Langdon, S. Gosain, IS application capabilities and relational value in interfirm partnerships, Inf. Syst. Res. 18 (3), 2007, pp. 320–339.
[69] P. Setia, V. Venkatesh, S. Joglekar, Leveraging digital technologies: how information quality leads to localized capabilities and customer service performance, MIS Q. 37 (2), 2013, pp. 565–590.
[70] M.E. Sobel, Asymptotic confidence intervals for indirect effects in structural equation models, Sociol. Methodol. 13, 1982, pp. 290–312.
[71] P. Soto-Acosta, A.L. Merono-Cerdan, Analyzing e-business value creation from a resource-based perspective, Int. J. Inf. Manage. 28 (1), 2008, pp. 49–60.
[72] M. Subramani, How do suppliers benefit from information technology use in supply chain relationships? MIS Q. 28 (1), 2004, pp. 45–73.
[73] L. Sullivan, Supply-chain inefficiencies exact huge toll, Inf. Week 12 (July), 2004.
[74] J.M. Swaminathan, S.R. Tayur, Models for supply chains in E-Business, Manage. Sci. 19 (10), 2003, pp. 1387–1406.
[75] P.P. Tallon, Value chain linkages and the spillover effects of strategic information technology alignment: a process-level view, J. Manage. Inf. Syst. 28 (3), 2011, pp. 9–44.
[76] X.L. Tang, A. Rai, The moderating effects of supplier portfolio characteristics on the competitive performance impacts of supplier-facing process capabilities, J. Oper. Manage. 30 (1–2), 2012, pp. 85–98.
[77] M. Tarafdar, S.R. Gordon, Understanding the influence of information systems competencies on process innovation: a resource-based view, J. Strateg. Inf. Syst. 16 (4), 2007, pp. 353–392.
[78] S.K. Vickery, J. Jayaram, C. Droge, et al., The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships, J. Oper. Manage. 21 (5), 2003, pp. 523–539.
[79] S.M. Wagnera, C. Bodeba, Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing, J. Oper. Manage. 32 (3), 2014, pp. 65–78.
[80] E.T.G. Wang, H.L. Wei, Interorganizational governance value creation: coordinating for information visibility and flexibility in supply chains, Decis. Sci. 38 (4), 2007, pp. 647–674.
[81] N.X. Wang, H.G. Liang, W.J. Zhong, et al., Resource structuring or capability building? An empirical study of the business value of information technology J. Manage. Inf. Syst. 29 (2), 2012, pp. 325–367.
[82] S. Wang, L. Li, K.L. Wang, et al., e-Business systems integration: a systems perspective, Inf. Technol. Manage. 13 (4), 2012, pp. 233–249.
[83] K.H. Wathne, J.B. Heide, Relationship governance in a supply chain network, J. Mark. 68 (1), 2004, pp. 73–89.
[84] Y.S. Xia, G.P. Zhang, The impact of the online channel on retailers' performances: an empirical evaluation, Decis. Sci. 41 (3), 2010, pp. 517–546.
[85] L. Xue, G. Ray, V. Sambamurthy, The impact of supply-side electronic integration on customer service performance, J. Oper. Manage. 31 (6), 2013, pp. 363–375.
[86] A. Zaheer, N. Venkatraman, Relational governance as an interorganizational strategy: an empirical test of the role of trust in economic exchange, Strateg. Manage. J. 16 (5), 1995, pp. 373–393.
[87] J. Zhao, V.W. Huang, Z. Zhu, An empirical study of e-business implementation process in China, IEEE Trans. Eng. Manage. 55 (1), 2008, pp. 134–147.
[88] K. Zhu, K.L. Kraemer, e-Commerce metrics for net-enhanced organizations: assessing the value of e-commerce to firm performance in the manufacturing sector, Inf. Syst. Res. 13 (3), 2002, pp. 275–295.



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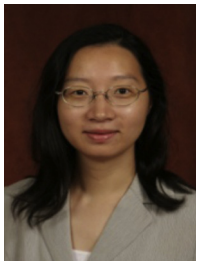

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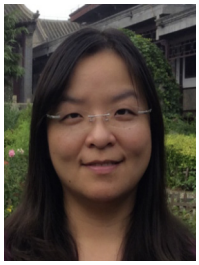

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