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Cross-border e-commerce firms as supply chain integrators: The management of three flows

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ABSTRACT

Cross-border e-commerce is becoming increasingly popular around the world. With the development of technology, competition has gradually shifted from commodity-based attributes, such as cost and quality, to a supply chain's service capacity for e-commerce. Within this context, the present paper delineates how cross-border e-commerce firms can generate supply chain service capabilities that yield improvements in supply chain relationship quality to e-tailors and other platform users. Insights are derived through data collected via a multiple case study approach based on four Chinese cross-border e-commerce enterprises (OSell, Zongteng, BizArk and Linca); data were collected from 41 semi-structured interviews, field visits and secondary data. Relying on the service-dominant logic as the theoretical foundation, we identify three supply chain resources (flows related to information, logistics and finance) and their interplay as being critical for the development of supply chain service capabilities, which in turn lead to an improvement in the quality of supply chain relationships (assessed by the dimensions of trust improvement/commitment, risk mitigation, and customer satisfaction). The results offer important insights into how to best manage supply chain resources in relation to the three flows by cross-border e-commerce firms in order to foster relationship quality, an attribute that has become so critical today for competitive differentiation.

1. Introduction

With the accessibility and popularity of the Internet, as well as the advancement of information technology (IT), e-commerce has been gaining momentum in the global marketplace. While China was late in making inroads in this area, compared to developed countries, it has been catching up quickly (Johnson-Page & Thatcher, 2001). As such, over the last few years, China's cross-border e-commerce sales have increased at an exponential rate, thanks to an improved Internet infrastructure, mounting Internet users and a better e-commerce environment. According to the Chinese Ministry of Commerce (2018), the total amount of imports and exports of cross-border e-commerce commodities inspected and released by customs was 90.24 billion RMB in 2017, which reflected an increase of 80.6% year-over-year; the average annual rate of increase during the years 2010–2017 was approximately 20%.

As of 2016, according to Xinhuanet (2016), there are over 200,000 cross-border e-commerce enterprises and more than 5000 e-commerce platforms in China. With the strong support of national policies, e-commerce firms are driving the development of cross-border supply chain activities. The consulting firm iResearch (2018) estimates that cross-border e-commerce will continue on the current trajectory in the coming years, taking over an increasingly larger share of total international trade. Similarly, Van Heel, Lukic, and Leeuwis (2011) predict that by 2025, annual global cross-border e-commerce revenues will be between 250 and 350 billion US dollars, with China and other Asia countries accounting for 40% of this total amount.

Despite the prosperity of cross-border e-commerce worldwide, there are still obstacles that constrain market growth, such as unreliable and lengthy transit times, complex and ambiguous return processes, bottlenecks at customs, limited transparency on delivery, price opacity, and limited ability to alter delivery times and locations (Van Heel et al., 2011). Specific obstacles in the Chinese context include data collection and processing difficulties, customs clearance, logistics challenges, as

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well as the efficiency associated with electronic payment refunding, a preferential policy issued by the Chinese government (Inama & Sim, 2015). According to China's Ministry of Commerce (2015), China's cross-border e-commerce development had been severely impeded by the unreasonable overall system complexity, inefficient customs clearance and imperfect infrastructure.

Since services, rather than products, have become the foundations of e-marketplace success and differentiation (Standing & Standing, 2015), many Chinese cross-border e-commerce enterprises are transitioning from a product-dominant logic to a service-dominant (S-D) logic (Xie, Wu, Xiao, & Hu, 2016; Ayala, Gerstlberger, & Frank, 2019; Gang, 2019). While the former emphasizes the physical exchange of the product, with limited interaction between buyer and seller; the latter stresses the integration of product offerings with services, to enhance the value and experience of the customer. As such, enterprises are building on their existing business infrastructure to construct services supply chains, with the objective of providing better services accompanying the physical product before, during and after the sale.

The consideration of services in cross-border e-commerce is especially critical. As such, cross-border e-commerce is, in itself, a complex system, integrating multiple types of service offerings, such as cross-border trade services, electronic payment and logistics services, customs declaration and inspection services, and legal advice services (Baruca & Zolfagharian, 2012). E-commerce service supply chains constitute a network, which means that breakdowns in any particular link do not influence the operations of any single physical entity due to the inherent redundancy (Sanchez-Rodrigues, Potter, & Naim, 2010). This is in contrast to the traditional service supply chain, which consists of a one-way flow of information starting with suppliers and ending with consumers; such a setup reduces flexibility and makes the system prone to any single part affecting the entire supply chain.

To meet the requirements of today's scrutinizing customers, cross-border e-commerce enterprises need to cooperate with both goods suppliers and service providers, such as logistics services companies and third-party payment platforms. The physical entities of the service supply chain include domestic customers, overseas businesses, cross-border e-commerce websites, and logistics enterprises, both at home and abroad (Hameri & Hintsa, 2009). Within this context, cross-border e-commerce platforms are the core of the supply chain, connecting businesses, customers, logistics enterprises and other service providers, offering supply chain management services in an integrated fashion.

Within this context, supply chain management (SCM) refers to the integration of upstream and downstream organizations, and the management of information, logistics and financial flows, with the objective to efficiently and effectively manage the whole (Christopher, 2016; Coyle, Langley, Novack, & Gibbson, 2017; Mentzer et al., 2001). While the three inherent flows are considered as essential (Lee & Ng, 1997; Singhal & Singhal, 2012), where insight is still missing is how to manage the three flows given the intrinsic relationships between them (Lambert, Cooper, & Pagh, 1998; Lambert & Enz, 2017; Rai, Patnayakuni, & Seth, 2006). The service supply chains of cross-border e-commerce companies present an intriguing context to examine this phenomenon, since they provide services to manufacturing firms and overseas customers using advanced technologies as a core competence.

Amazon provides a vivid example of how an e-commerce company adopts the S-D logic along the three flows. It has been disturbing the traditional retail market by launching online platforms with advanced IT architecture and strong data analysis capabilities to provide better customer services, for example in the form of enhanced product reviews and recommendations. It also moved into warehousing at the early stages in order to provide rapid delivery services to customers and storage/transportation services for its online platform sellers. In addition, it provides a one click process for customers to provide smooth financial transactions (Wells, Danskin, & Ellsworth, 2018).

Nevertheless, how these services are provided within this context, and how the three flows interact and are combined to provide these services, is not clear to practitioners and academics. The S-D logic thus seems to be promising to utilize as a theoretical lens to explore cross-border e-commerce platforms (Lusch, 2011; Lusch, Vargo, & Malter, 2006; Lusch, Vargo, & O'Brien, 2007; Vargo & Lusch, 2004; Vural, Wang, Navaratnam, & Tafazolli, 2017). Specifically, within this context, we aim to answer the following research questions:

- *What services do cross-border e-commerce firms provide, and how can they be mapped against the three-flow framework?*
- *How can cross-border e-commerce firms improve supply chain relationship quality through the management of the three flows?*

This paper proceeds as follows. The next section reviews the theoretical background of the S-D logic and research in services supply chain management, with a specific focus on the three flows in e-commerce SCM. We then outline our multiple case study research methodology, which is followed by the case description and the cross case analysis and its discussion. We conclude with highlighting our contributions, acknowledge limitations and offer future research directions.

2. Literature review

2.1. S-D logic and service supply chain management

The shift from a functional focus, where each department pursued its own objectives independent of other departments' objectives, to a more integrated focus on both internal and external relationships, aiming to deliver a consistent value proposition to the end customer, also taking a network perspective, has been taking place over the last two decades (Bovet & Martha, 2000; Gunasekaran & Ngai, 2004; Lambert & Enz, 2017; Sampson & Spring, 2012). This transition had been trigged by constant changes in consumption patterns and customer demands, necessitating firms to adapt their operational thinking based on a product-dominant logic to a service-dominant one. Research into services supply chain management thus represents a promising avenue (Giannakis, 2011), being reflected in the field of service sciences (Sampson & Spring, 2012).

Service supply chains can be complex value networks that contain one or more suppliers that engage with one or more downstream customers through service platforms or service intermediaries (Breidbach, Reefke, & Wood, 2015). The service supply chain is distinct from goods-centric supply chains (Ellram, Tate, & Billington, 2004), and is increasingly becoming more strategic, leveraging interdisciplinary thinking as part of the service-dominant (S-D) logic (Lusch, 2011; Lusch et al., 2006, 2007; Vargo & Lusch, 2004; Vural et al., 2017). S-D logic views goods as transmitters of embedded knowledge and skill, just as one would think of stand-alone services, being indicative of services as a higher-order concept (Maas, Hartmann, & Herb, 2014).

A service supply chain can be defined as “the network of suppliers, service providers, consumers and other supporting units that performs the functions of transaction of resources required to produce services; transformation of these resources into supporting and core services; and the delivery of these services to customers” (Baltacioglu, Ada, Kaplan, Yurt, & Cem Kaplan, 2007, p. 112). We adopt this definition in the current study. This is also in line with Lusch, Vargo, and Tanniru (2010) and Sampson and Spring (2012), who define service supply chains as institutionalized configurations of one or more service intermediaries working with one or more service customers within a single supply chain.

S-D logic classifies resources into two types: operand resources and operant resources (Lusch et al., 2007). Operand resources are tangible and static, and only become of value if an action is performed upon them; raw materials serve as an example. In contrast, operant resources are intangible and dynamic, and can be used to act on operand resources; examples include knowledge and skills (Lusch, 2011; Tokman

& Beitelspacher, 2011). Within this context, S-D logic argues that supply chains are value co-creation networks, and that different actors need to apply and integrate different types of resources (Lambert & Enz, 2017; Vargo & Lusch, 2011).

Relying on S-D logic, Richey et al. (2011) identify four basic organizational operant resources in the global marketplace, including two internal resources of customer orientation and service culture, as well as two external resources of collaborative communication with service suppliers and effective governance mechanisms; the authors find collaborative communication to have a positive relationship with global market performance. Along similar lines, Madhavaram and Hunt (2008) propose that operant resources are at the heart of competitive advantage and performance, and follow a hierarchy of basic, composite, and interconnected types. As one moves higher in the hierarchy, the resources become increasingly interconnected and more difficult for competitors to acquire or develop, thus leading to increased sustainable competitive advantages (Madhavaram & Hunt, 2008).

2.2. Three flows in e-commerce supply chain management

Mentzer et al. (2001, p.4) define a supply chain as consisting of "all the upstream and downstream flows of products, services, finances and information from the ultimate supplier to the ultimate customer." As such, the management of flows related to information, logistics and finance can be considered as the basic component of e-commerce supply chain management activities (Kim, Sting, & Loch, 2014).

Along similar lines, Rai et al. (2006) suggest that supply chain integration encompasses the integration of information flows, which require supply chain partners to share information and develop globally optimal plans. Requirements for the integration of logistics flows include the optimization of staging and material flows, while the integration of financial flows, which are interdependent with the other activities, rely on optimal ordering policies and ensuing deliveries.

Information flow integration can be defined as the extent to which operational, tactical, and strategic information is shared between a focal firm and its supply chain partners (Rokonuzzaman, 2018). The biggest advantage of e-commerce activities over traditional business activities is that in the e-commerce environment, enterprises use modern information technology to make the flow of information more efficient. Through communication with customers, establishing customer profiles and cooperating with customers, companies can obtain targeted, content-specific and valuable market information, which can represent an important basis for various business decisions of the company (Nguyen & Sidorova, 2018).

Logistics flows refer to the physical distribution activities of goods from the origin of the raw material to the final consumers. It also includes the reverse flows of goods returns from consumers to the e-commerce platform. Given the criticality and complexity of this type of flow, the presence of third-party logistics providers constitutes a sound prerequisite for the development of effective e-commerce.

Financial fluidity is "the degree to which financial flows between a focal firm and its supply chain partners is driven by workflow events" (Rai et al., 2006, p. 231). It is an indispensable means to realize e-commerce transaction activities. In e-commerce, banks enable the financial flows between manufacturing companies, commercial enterprises and consumers, and thus play a pivotal role. Whether banks can effectively implement electronic payment or refunds has become key to the success of e-commerce (Kabango & Asa, 2015).

Among the three flows, information flows form the basis for both logistics and financial flows (Shaw, 2000). Without information flows, logistics and financial flows cannot operate effectively. Integration between the three flows can be accomplished via information technology. As such, Rai et al. (2006) propose that IT infrastructure integration for SCM is a lower-order capability that can be leveraged to develop a higher-order process capability for the integration of supply chain processes (e.g., information and logistics flows), which can then lead to significant and sustained gains in firm performance. This idea is similar to the notion reflected in operand and operant resources as part of the S-D logic (Lusch, 2011).

Although the three flows have been mentioned frequently by traditional SCM scholars (Christopher, 2016; Coyle et al., 2017; Mentzer et al., 2001), either separately or in a combined manner, the intrinsic links between the three flows and how they are best combined to provide SCM services within the context of e-commerce, has been neglected. This is despite the fact that the coordination of the three flows has been described as imperative (Lee & Ng, 1997; Singhal & Singhal, 2012), also from the perspective of material flow theory (Hou, Chaudhry, Chen, & Hu, 2017). Scholars also lack an understanding of the financial flows in particular, an observation made by Maas et al. (2014), who find that existing research tends to put emphasis on information and logistics flows, with less attention being paid to the financial flows. Furthermore, Paredes, Barrutia, and Echebarria (2014) carry out a literature review on the application of S-D logic in an e-commerce context, and conclude that research in this domain is scarce. This observation, coupled with the limited research into the three flows, especially within an e-commerce context, makes this area ripe for further investigation. Overall, the gaps among the research streams are obvious: there is limited research on the relationships of the three flows, and there is limited researches on the S-D logic within the context of e-commerce.

3. Research methodology

Given the limited research on S-D logic in e-commerce SCM, as well as the relatively few explorations on the integration of the three flows in SCM, a multiple case study method was adopted in this research. We follow commonly accepted standards for conducing case studies in the operations management literature to ensure rigor (Eisenhardt, 1989; Stuart, McCutcheon, Handfield, McLachlin, & Samson, 2002; Voss, Tsikriktsis, & Frohlich, 2002).

3.1. Case selection

We approached 12 cross border e-commerce enterprises after participating in a cross-border e-commerce industry conference, and finally selected four companies as our case companies: OSell, Zongteng, BizArk and Linca. These companies were chosen based on a theoretical sampling approach, which had as its objective that the four firms are at different levels of supply chain service capabilities and supply chain relationship quality, as shown in Fig. 1. The detailed measurements for these two constructs are provided in Section 5.4. All four companies are leading e-commerce firms in China that operate across borders. The

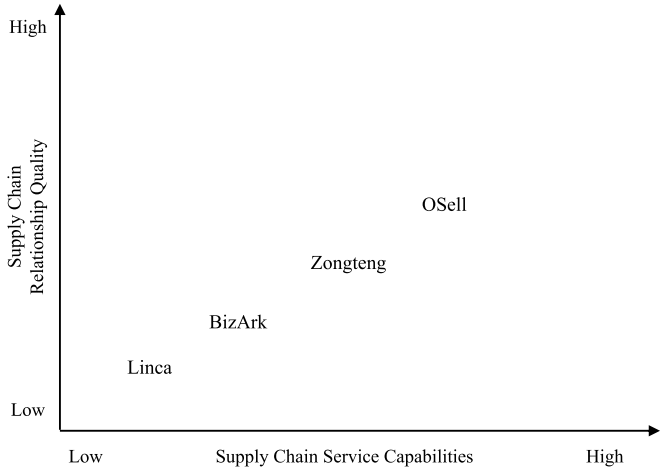

Fig. 1. Sampling logic based on two dimensions.

Table 1
Basic information of the cases.

Company	Location	Establish Date	Main Business Type	No. of Employee	Proactive Project
OSell	Chongqing	2010	B2B Export business	2000+	OSell APP and Connect cross-border B2B online/offline sharing platform
Zongteng	Fuzhou	2007	B2C Export business	1000+	Global supply chain service platform with B2C customer business as core
BizArk	Nanjing	2009	B2B Export business	300+	Tailored overall solutions for overseas marketing of Chinese enterprises
Linca	Fuzhou	2014	B2B Import business	200+	Full channel service e-commerce platform

firms provide end-to-end cross border e-commerce services, making them good exemplars for this research. Table 1 provides some basic information about the four companies.

3.2. Data collection

Data were collected via multiple means, including semi-structured interviews with the four companies' managers (both senior and mid-level management), site visits, internal corporate documents, official public reports and other Internet resources. These multiple sources of data enabled triangulation (Eisenhardt, 1989).

The research team interviewed five managers during the visit at Osell; five managers during two visits at Zongteng; six managers during the visit at BizArk; and five managers during two visits at Linca (details are provided in Table 2). The majority of interviewees were interviewed more than once to obtain additional information, and to ensure clarity and understanding; in total, we carried out 41 interviews. The interviews were conducted in Chinese Mandarin and the average length was about 1 hour. The interviewees' job titles ranged from vice present and director to mid-level managers. During the process of investigation and interview, the researchers managed to acquire information concerning the historical development, ties with suppliers and customers, as well as the firm's overall operations and business models.

Table 2
List of interviewees, their job titles and organizations.

Number	Company	Title	Interview method	Number of Interviews
1	Zongteng	Deputy General Manager	Face to Face	2
2	Zongteng	Chief Operating Officer	Face to Face Telephone	2
3	Zongteng	Chief HR Officer	Telephone	1
4	Zongteng	HR Manger	Face to Face	1
5	Zongteng	Administration Manger	Face to Face	3
6	OSell	Co-Founder and Vice President	Face to Face Telephone	1
7	OSell	Overseas Executive President	Face to Face Telephone	2
8	OSell	Vice President	Face to Face	2
9	OSell	Founder	Telephone	3
10	OSell	National Investment Vice President	Telephone	3
11	Linca	Executive President of Linca e-Commerce Business School	Telephone	2
12	Linca	Director of Overseas Business Unit	Face to Face	2
13	Linca	Logistics Division Director	Telephone	3
14	Linca	Technical Director	Face to Face	2
15	Linca	Director of Cross-Border Business	Face to Face Telephone	3
16	BizArk	Founder & CEO	Telephone	1
17	BizArk	Business Development Manager	Face to Face	1
18	BizArk	National Executive Director	Face to Face	2
19	BizArk	General Manager of South China	Face to Face Telephone	2
20	BizArk	Director of Marketing Promotion	Face to Face	2
21	BizArk	Project Manager	Face to Face	1
Total				41

The interview protocol consisted of four parts: basic information of the case companies; resources for providing SCM services; SCM service capabilities; and supply chain relationship quality. A list of interview questions is shown in the Appendix A.

3.3. Data analysis

After the data collection, the data were coded and analyzed. Within-case analysis was first conducted via axial coding, followed by cross-case analysis to compare the four cases. Coding was done in an iterative fashion, leveraging both the interview transcripts and secondary data. This process led to clarification and, on occasion, redefinition of the constructs and discussion of the evidence. We reached consensus on all constructs before calling the process stationary. Microsoft Excel was utilized to analyze both the semi-structured interview data and the secondary data (Miles, Huberman, Huberman, & Huberman, 1994) for data reduction and coding. Specifically, each case was coded in Excel, with the codes then being further extracted and compared across the cases in a separate Excel sheet.

According to the procedure delineated by Miles et al. (1994), we commenced with the within-case analysis for each of the four companies. First, we traced the history and development of the companies, as well as their lines of business (Li, Sun, Li, & Yan, 2012). Second, we developed a broader understanding of supply chain operand and operant resources, being reflected in information, logistics and financial flows at the four companies (Maas et al., 2014). Third, we identified supply chain service capabilities (Madhavaram & Hunt, 2008) generated by the three flow of resources through the application of S-D logic. And fourth, we captured the outcome generated by service capabilities and reflected in supply chain relationship quality.

Cross-case analyses were then carried out in order to identify patterns in different settings, and to increase the external validity of the findings. As such, we first employed “clustering” data analysis for the supply chain service capabilities at the case level. Second, we compared the four cases and linked the findings to the literature. And third, we validated our results by performing Yin's (2013) four tests (see details in Table 3).

4. Case description

4.1. Osell

Osell was founded in July 2009, and began to set up an end-to-end service for cross-border e-commerce, such as the “Fulfillment by Osell (FBO) service”, which includes product certification, storage, shipment declaration, inspection and quarantine, international logistics, customs declaration, taxation, overseas logistics, sorting and loading, and unloading activities. Osell has developed into the largest cross-border e-commerce trading platform in China. Osell set up their online sales channels as dinodirect.com, 18985.com and Osell APP, providing product data processing, global marketing, order management, multinational online customer service, global warehousing and logistics, cross-border trade settlement, and business social media services. In December 2017, the company launched the blockchain project to explore the potentials of the new technology in its cross-border e-

Table 3
Reliability and validity in case research (Source: adopted from Yin, 2008).

Tests	Application in this Study
Construct validity	• Multiple sources of evidence including semi-structured interviews, various forms of secondary data and observations • A chain of evidence: multiple informants in focal companies • Review of findings by uninvolved senior academics • Senior managers of each focal company reviewed the draft case analysis and provided feedback
Internal validity	• Structured data coding and analysis • Development of propositions based on a chain of evidence
External validity	• Theoretical sampling approach • Thick descriptive data
Reliability	• Utilization of a case study protocol to guide field research and analysis • Development of a case study database including recordings, transcripts, field notes, sustainability reports, internal documents, academic case studies, news coverage and field photos • Iterative discussions with uninvolved senior academics

commerce operations for enhancing traceability and improving trust. Osell built overseas warehouses in Europe and the Americas in 2009, and in April 2016 the first overseas cross-border e-commerce industrial park was launched in Dubai. Overall, Osell operates more than 20 overseas warehouses and has about 1000 employees worldwide.

Osell has more than ten branches around the world, located in Russia, the United States, Canada, Australia, India, and Brazil, among other countries; its businesses cover more than 200 countries and regions. It serves nearly 190 thousand small- and medium-sized enterprises (SMEs) around the world, with an annual import and export value of 3 billion US dollars.

4.2. Zongteng

Zongteng was founded in November 2007. The company's office and storage area exceeds 100,000 square meters, and the number of daily orders processed amounts to about 50,000; the company employs over 1700 individuals. In 2016, the total sales volume of the company was more than 17 billion RMB (over 2.4 billion US dollars at the average exchange rate in 2016). Zongteng has developed diversified and integrated operation patterns with a focus on cross-border e-commerce, integrating product research and development (R&D), purchase, sales, storage, logistics, client service and system R&D. The company has invested equal effort in both third-party e-commerce platforms (e.g., eBay, Amazon and Alibaba) and self-constructed business-to-consumer (B2C) platforms (www.tmart.com). In addition, it stepped up their development in export businesses as well as their professional logistics services. By the end of 2017, Zongteng had built procurement bases in Shenzhen, Guangzhou, Yiwu and Hong Kong. It further established 14 warehouses, including five in the United States, three in the United Kingdom, two in Germany, two in Japan, one in Australia, and one in Taiwan.

4.3. BizArk

BizArk was established in 2006, offering a complete set of overseas marketing solutions customized for Chinese enterprises, including overseas marketing analysis, e-commerce platform services, multi-channel marketing and operational support. The company set up e-stores on popular e-commerce platforms, such as Amazon, Newegg, Rakuten, eBay, Houzz, Sears, Wish, and Overstock, among others. In 2009, BizArk elevated its investment in technology and, since then, has developed a state of the art IT system. From 2015 to 2017, BizArk carried out overseas warehouse operations in the United States, Germany, Japan and Spain.

BizArk operates two businesses models. The first business model consists of joint operational support, which involves running the brand and collecting commissions from customers. In this model, BizArk helps factories build brands and channels abroad by relying on the infrastructure of Amazon, eBay and other foreign channels. In 2016, about 60 brands were operating in Amazon Europe and Amazon United States, with an annual sales volume of about 10 million US dollars. The second business model is consulting, providing staff training, building cross-border e-commerce business teams, and business system services for traditional international trading enterprises that want to enter into cross border e-commerce.

4.4. Linca

Linca was established in October 2014. Linca's businesses include marketing, cross-border B2B, B2C, incubation and support. Linca set up the online sales channels of Nitago.com, Nitago app, Taipingou app, and Nitabang app. It mainly focuses on maternal and infant health care, computer, communication, consumer electronics, daily use cosmetics, and fresh food products. In 2015, the total transaction volume exceeded 476 million US dollars. The monthly transaction volume has exceeded 400 million RMB and over 5000 businesses have joined as online/offline distribution partners. In September 2015, Linca began to build logistics parks, bonded warehouses (for imports), and overseas warehouses (for exports). Linca has nearly 3 million square meters of warehouses, including 350,000 square meters of free trade zone bonded warehouses, and cross-border commodity exhibition and trading centers, serving more than 2000 global high-quality brands marketed in more than 60 countries.

The milestones of each firm in terms of their activities related to the three flows are shown in Table 4. In the following, we summarize key information relevant for the development of the four companies.

5. Cross case analysis and discussion

This section discusses the findings of the cross-case analysis through a comparison with the literature. In order to answer the research questions posed above, a framework is proposed in Fig. 2 and four sets of propositions are developed. We find that the interaction of the operand and operant resources from the three flows can generate enhanced service capabilities, which in turn contribute to supply chain relationship quality in terms of trust improvement/commitment, risk mitigation, and consumer satisfaction. Our findings support the argument that capabilities of a company are enabled by processes and resources (Martin & Eisenhardt, 2010), with operant resources being able to be used to act on operand resources to co-create customer-driven supply chain networks (Lusch, 2011; Vargo & Lusch, 2011).

We first discuss the capabilities generated by information flow related resources, followed by the services capabilities generated by combining the three flows (in pairs or in unison). We then discuss the relationships among the three flows, and finally delineate the relationship between supply chain service capabilities and relationship quality. Our overall research framework is depicted in Fig. 3.

Table 4
Business milestones for the four firms.

Company	Activities on Information Flows	Activities on Logistics Flows	Activities on Financial Flows
Osell	• In July 2009, dinodirect.com was formally launched, which set up a one-stop service for cross-border e-commerce. • In March 2014, the 18985.com supply chain system platform was launched. It aims to provide product data processing, global marketing, order management, multinational online customer service, global warehousing and logistics, cross-border trade settlement and other services. • In May 2016, the OSell APP was formally launched, which provides a complete supply and demand matching system together with business social systems. • In December 2017, the block chain project was launched with the International Trade Digitalization Commission.	• At the beginning of 2009, a cloud warehouse in the European and American markets was built. • In 2013, an overseas branch in Moscow was established and an overseas warehouse in India was built. • In 2014, when the General Administration of Customs' cross-border trade e-commerce customs clearance service platform was launched, the first cross-border e-commerce customs clearance in China was passed. • In April 2016, the first overseas cross-border e-commerce industrial park was formally launched in Dubai. • By the end of 2017, logistics service and experience centres in nearly 20 countries were established.	• In 2014, the DinoWallet payment tool went online. • In 2015, a cooperation with UnionPay International started in cross-border online business to fully accept UnionPay cards in business trades. • In 2015, OSELLPAY was formally incorporated in Hong Kong. It cooperated with many foreign banks to support more than 90 kinds of payment methods worldwide and more than 30international currencies. It covers more than 200 countries and regions in the world and the payment channel success rate is as high as 90%.
Zongteng	• In November 2007, the company started as an export seller on ebay.com. • In 2009, an own B2C mall (Tmart.com) to carry out export business was launched. • In 2014, relying on Tmall International, the B2C platform Lomon.com was built, as was the B2B2C distribution platform haitaole.com.	• In November 2007, the first overseas warehousing and logistics centre was established in the United States, and a Shenzhen Branch was established with a domestic procurement warehouse centre. • In March 2015, overseas warehouse operations were begun. • By the end of 2017, procurement bases in Shenzhen, Guangzhou, Yiwu and Hong Kong were built, and 14 warehouses were established, including 5 in the United States, 3 in the United Kingdom, 2 in Germany, 2 in Japan, 1 in Australia, and 1 in Taiwan.	• In 2016, in cooperation with foreign trade companies, the firm started to carry out supply chain finance. • In 2018, in cooperation with iPayLinks, the firm started to provide supply chain finance products.
BizArk	• In 2006, Nanjing Ketai Information Technology Co., Ltd. was established, and a cross-border e-commerce promotion team was formed. • In 2010, standardized services including website construction, security certification, SEO, PPC, social marketing, PR publishing, and exhibition marketing were provided. • In 2012, "BizArk Commerce" based on a SaaS-based system where customers can develop their own software and applications was developed.	• In 2015, overseas warehouse operations in the USA were begun. • At the end of 2017, overseas warehouses in the United States, Germany, Japan and Spain were built.	• In April 2016, discussions were held with Jiangsu Bank to develop a cross-border e-commerce supply chain finance cooperation. A domestic outsourcing loan business to provide low-cost financial solutions for cross-border export companies and sellers was launched.
Linca	• In June 2015, Nitago tmall B2C (nitago.com) was formally launched. • In October 2015, the Nitago app was officially launched. • In August 2016, the Taipingou app was officially launched. • In August 2017, the Nitabang app was officially launched.	• In September 2015, the logistics business was focused on, and logistics parks were built. • In January 2016, the Fujian Linca Free Trade Zone Bonded Products Exhibition and Trading Centre was officially established. • In June 2017, the "E-Traceability Source Intelligent Business Platform" with CCIC was established, which enables an "Internet + Inspection and Certification" customs clearance and inspection mode.	• In June 2016, the supply chain finance business was launched. The Jiqing Network, as a secure hardware procurement transaction platform for dealers, can provide "machine intelligence information", "transaction protection" and other services. • In 2017, financial services were implemented, such as agency procurement, pledge of movable assets in the warehouse, receivable factoring, and other services.

5.1. Capabilities generated from information flow related resources

We identified supply chain service capabilities to be generated by the combination of various internal resources supporting the three flows (processes) of information, logistics and capital, with information flows playing a fundamental role. Table 5 describes the service capabilities that are generated from information flow related resources. Based on the hierarchy of operant resources and strategy (Madhavaram & Hunt, 2008), we divide information flow related operant resources into three aspects, which are internal orientation, market orientation, and knowledge management orientation—we discuss them in further detail below. The operand resource for the information flow is the IT architecture.

First, the management of information flows enables e-commerce firms to pay better attention to their internal organizational structure. In order to respond to the rapidly changing and dynamic market, the interviewed firms tend to adjust their organizational structures from a mechanistic (centralised and hierarchical) to an organismic framework (highly connected, flat and decentralized). For example, Zongteng has changed their internal structure to be more effective by transforming traditional functions (operations, finance, human resources and IT) into service platforms, with some of the product divisions becoming small independent companies to adapt to markets better. As Tushman and Nadler (1978) point out, an organismic structure would promote the information processing capacity, because such structure is relatively independent of any one individual, and is less sensitive to information overload or saturation compared to a more limited structure. Due to the advantages of organismic structures, almost every employee is empowered with a certain level of decision-making authority, which can provide for better responsiveness and ensuing better service quality for customers.

In addition, the information from the supply chain helps the firm detect business opportunities. For example, Osell provides market information to their employees to encourage internal entrepreneurship. By doing so, Osell can manage their supply chain more effectively in order to provide better customer service. The quotes from BizArk and Linca in Table 5 (a. internal orientation) also suggest that their employees have more power to make decisions. Based on these observations, we propose the following:

P1a. *Information flow management urges e-commerce firms to form a*

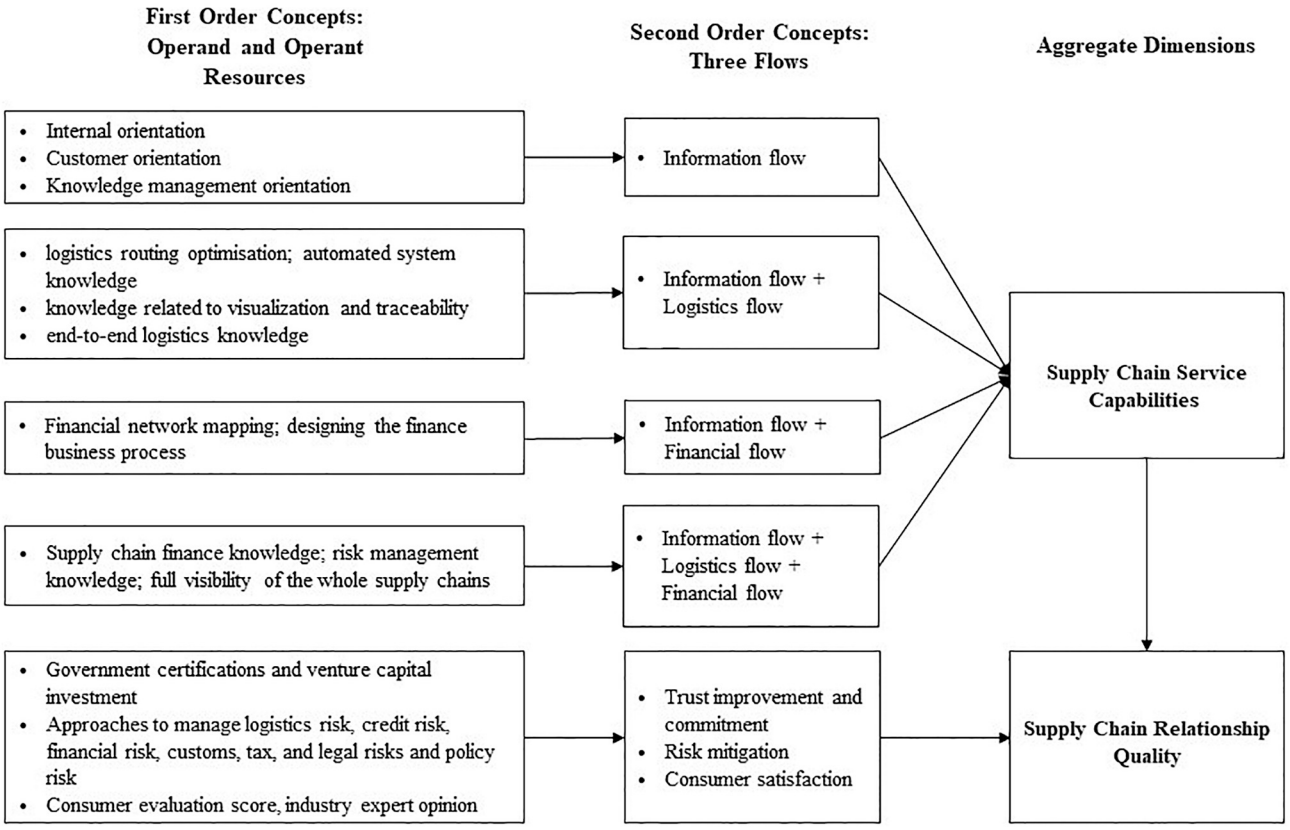

Fig. 2. Data structure.

decentralized organizational structure in order to meet information processing requirements and encourage internal entrepreneurship, which enables these firms to respond to markets in a more timely manner.

Second, information flow management provides e-commerce firms useful customer information to enable a better customer-orientated service delivery. As such, a better understanding of targeted buyers' preferences can be obtained, which enables a continuous creation of customer value (Narver & Slater, 1990). We also noted that the case firms collect customer information (e.g., gender, age, region, purchase habits) from their e-commerce platforms to generate intelligence about current and future needs of targeted customers. Cross-border e-commerce firms use the data to generate a "user portrait" to inform market and product development. This supports similar arguments by Teece (1998) and Grawe, Chen, and Daugherty (2009) in that information exchange enables the development of capabilities, with customer orientation being positively related to service capabilities. Table 5 (b. customer orientation) provides supporting quotes from the four organizations, illustrating the application of market data for product selection, procurement, marketing channel selection and inventory preparation. Based on this insight generated, we propose the following:

P1b. *Market information management drives cross-border e-commerce firms to promote product development and accelerate customer response speed, enabling a better customer orientation.*

Third, technology used in information flow management accelerates trade and provides added service capabilities for customers. Barrett and

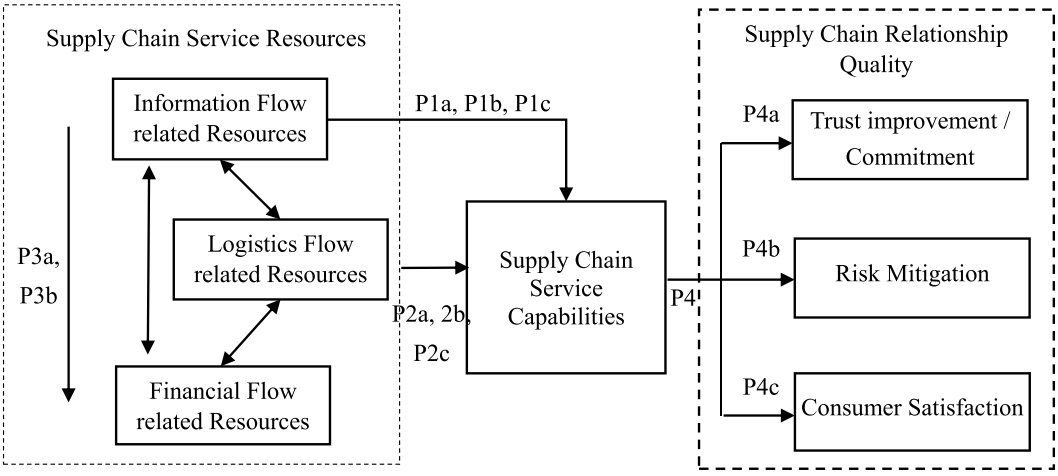

Fig. 3. Proposed framework for the three flows in cross-border e-commerce firms.

Table 5
Service capabilities generated from information flow related resources (I).

Information Flow related Resources	Capability generated	Examples
a. Internal orientation		
Internal market orientation	Information flow management, encouraging internal entrepreneurship and employee participation in decision making.	(Vice President, **OSell**) According to market information, our company can find business chances. Hence, we encourage internal entrepreneurship and provide funds for them. Furthermore, imported goods-display-stores are mostly run by our company's employees. (General Manger, **Zongteng**) The organizational structure is flat and dynamic to respond to the dynamic market. The operations centre, financial centre, human resources centre, and technology centre of our company have become the foundation for our service platform and infrastructure. The original business departments become small independent companies (e.g. logistics, warehousing). These companies collaborate with each other. At the same time, they also participate in external business. Furthermore, front-line decision-making power is increasing, and rights and resources are matched accordingly. For example, customer service representatives can decide whether to refund a certain customer immediately. (**BizArk**) Based on customers' historical data, customer service representatives have new administrative authority levels. (Technical Director, **Linca**) Based on the situation of dead stock and best sellers, staff at the store can make the promotion plan themselves.
b. Customer orientation		
Market orientation, market knowledge competence, and customer response capability	1. Information flow helps to explore the real needs of consumers, segment consumers accurately, and make the product position more instantly, accurately and dynamically. 2. Sourcing and procurement are performed offline based on the sales data from the online platform. 3. Transformation of the organizational structure, improving supplier management.	(Vice President, **OSell**) Platforms will attract customers, which will bring the customer data. The data can provide reference for credit allowances, which is the basis for transactions that drive the supply chain. Integration of customer needs on the platform and connectivity with manufacturing enterprises guide production and sales. When carrying out FBO Integrated Solutions, the enterprises in the whole ecosystem are integrated, such as logistics services, foreign trade enterprises, overseas warehouses, financial institutions and other enterprises. (**OSell**) We provide ERP systems for SMEs. By integrating customer order data, we can determine the time and quantity of stock, and develop purchasing schedules. (Administration Manger, **Zongteng**) The cross-border e-commerce product life cycle is shorter than the traditional retail product life cycle and the actual offline retail curve. Therefore, to achieve iterative development, we establish an elastic organization to achieve a short supply cycle and small-volume supply-flexible supply chain. Based on all the SKUs in the system, their attributes, the sales volume of each platform, and the situation in each warehouse, the data mining department can predict the sales of a certain product in a certain season to be high or low, as well as the reason, and can push the relevant information to the head of the product development department or to the category manager. (Chief Operating Officer, **Zongteng**) Market data determines the selection of products, and this pull triggers the entire supply chain from procurement, to production and sales. (**BizArk**) Based on market data, purchasers forecast customer demand, identify the cycle of hot-selling commodities, make procurement plans in advance, and adjust procurement plans according to supplier logistics speed, time and price of goods preparation. (Technical Director, **Linca**) According to the information of customers, including gender, age, region, purchase habits, repurchase rate, fast consumer goods purchase cycle (family as the main consumer), and other information, accurate marketing can be conducted. We use the data to develop a “user portrait” for better targeting and product development. (Logistics Division Director, **Linca**) Big data has a great impact on products. Firstly, it helps to evaluate whether some products are suitable for cross-border e-commerce. Secondly, it also helps to determine whether some products can be sold both online and offline.

(*continued on next page*)

Table 5 (*continued*)

Information Flow related Resources	Capability generated	Examples
c. Knowledge management orientation Technological competence; Knowledge management competence	Cross-border e-commerce companies provide customers with free use of ERP systems, open API ports to achieve information symmetry and timely communication. By collecting customer data and combining it with order information, the data becomes "knowledge" to provide supply chain services for small business customers.	(**Osell**) The Yueshang APP provides automatic translation into 71 languages, and introduces manual real-time translation to achieve communication with customers anytime and anywhere, which enhances the understanding of the customer. In addition, we utilize OStudy® to train cross-border e-commerce SME talents. (**Osell**) The credit certificate records the historical background of each ticket, bill, historical transaction record, and trade in the blockchain, thereby forming an intelligent contract for automatic supply chain financial services. Blockchain technology makes the information visible and un-changeable, which resolves the trust problem between buyers and sellers. (Administration Manger, **Zongteng**) Zongteng helps customers to optimise sales by using information processing technology. It can estimate customer behaviours and habits in advance and forecasts demand by employing a large amount of consumer data, accumulated information, and analytical systems. **(BizArk**) The biggest feature of Global Export Easy is that it allows overseas customers to place their purchases on the basis of a full understanding of the company. It also allows a one-on-one inquiry and greatly improves the conversion and success of inquiry rates. In addition, we also provide ERP, senior consultants, SOP templates, training courses and think tank services for customers. (Technical Director, **Linca**) According to historical data, people flow, floating forecast indicators, daily average sales (whether it be a promotional period or a non-promotional period), and other information, we can provide small business customers with inventory planning services during the promotion period. Combined with logistics information, we can provide automatic ordering and automatic replenishment services. In addition, we also collaborate with governments to found the e-commerce college, which is a non-profit e-commerce entrepreneurship support platform.
Absorptive capacity (internalise knowledge and create new knowledge)	The application of advanced information technology can shorten transaction time, reduce supply chain costs, transaction costs, and risks to increase trust, encouraging everyone to participate in accounting and share transaction records.	(**Osell**) Osell joins the SilkChain digital chain of international trade with credit at its core, providing customers with fast matching services. At the same time, suppliers can query the buyer's channel distribution, capital status, and business reputation on the blockchain, collect product sales in the local market and customer response information to find a stable export market at a very low cost. (Administration Manger, **Zongteng**) There are more than 100 employees in system development teams, who can develop management systems and provide good user-friendly interfaces for customers. This is our main competitive advantage. (**BizArk**) We have a business management system. We have two business models: one is to establish overseas channels and operations for medium-sized enterprises. The other one is to do consulting, training and counselling for large enterprises in order to improve their supply chain innovation. (Technical Director, **Linca**) Based on the data collected from previous smooth business co-operations, Linca can increase the credit lines of enterprises.

Konsynski (1982) state that information technology that includes computer hardware, software, and communication systems, enables firms to deal with time-consuming processes more rapidly, enabling the transformation of data into useful information. From our case companies, we find that Osell uses the Yueshang APP to communicate with customers anytime and anywhere. Zongteng also helps customers to optimise sales by its information processing technology. BizArk uses the Global Export Easy software to interact directly with stakeholders, allowing overseas customers to indicate their purchasing intentions on the basis of a full understanding of the e-tailers. Finally, Linca provides small business customers with inventory planning services, automatic ordering and automatic replenishment services, as well as training services. See Table 5 (c. knowledge management orientation) for further illustrative quotes.

Information technology adoption enables the establishment of smooth communication channels with customers. Further, the use of information technology (operand resources) is positively associated with inter-firm learning (Rebolledo & Nollet, 2011) to facilitate the efficient transfer, storage and integration of knowledge, i.e., operant resources (Grant & Baden-Fuller, 1995). The information sharing among supply chain partners generates new knowledge and facilitates the coordination and adjustment of business processes to increase the service for customers. We therefore propose the following:

P1c. *Information flow management with the support of technology can achieve data-to-information conversion, generating knowledge to improve supply chain service capabilities (*e.g.*, provide training or knowledge).*

5.2. Service capabilities generated from combining the three flows in pairs or in unison

There are many studies demonstrating that information sharing

Table 6
Service capabilities generated from combining information flow and logistics flow related resources (I + L).

Resources based on Information Flows and Logistics Flows	Services generated	Supporting quotations
Operand resources: Packaging; ICT architecture; automation Operant resources: Logistics routing optimisation; automated system knowledge	Effectiveness of logistics: Enhanced logistics services and better control of logistics risks.	(Vice President, **OSell**) Through data analysis, the corresponding logistics company can be selected automatically according to different countries' express delivery systems, and pack the packages in a unified manner. We also included the international code in advance for the domestic part of the journey, hence, foreign shipments are directly delivered without the need for secondary packaging and sorting. (Chief Operating Officer, **Zongteng**) The order data can help plan the warehouse layout and product stacking, and generate logistics tasks automatically, for instance in regards to sorting and packaging across the warehouse. (General Manager of South China, **BizArk**) We developed an API application program interface, which helps sellers to improve efficiency in managing orders. (Director of Marketing Promotion, **BizArk**) On the one hand, the BizArk Commerce and BizArk OSS technology systems, and the BizArk Deal value-added systems and services owned by Sihai Merchant Shipping accelerate the incubation of brands at Amazon, eBay, Flexispot and other platforms, and enhance the brand value of customer enterprises. On the other hand, overseas operation centers and warehousing service systems help to enhance the advantages for customers in overseas operating systems, and help companies improve operational efficiency. (Director of Cross-Border Business, **Linca**) We built the "E-inspection and traceability source intelligent business platform" with the China Certification & Inspection (Group) Co., Ltd.(CCIC), which aims to establish the "Internet + inspection and certification" customs clearance and inspection mode, forming a traceable and closed loop where sources can be investigated, whereabouts can be traced, and responsibilities can be seen.
Operand resources: RFID; warehouses; ICT architecture Operant resources: Knowledge related to visualization and traceability	Achieve logistics visualization, and traceability of goods by adopting RFID and other information systems.	(Founder, **OSell**) The upstream owner is able to visualize and control the entire process of the goods and operations (order-shipping-inventory-bill-reports). Through order and inventory operations instructions, warehouses and operations can be remotely managed. (**Zongteng**) We can achieve logistics visualization to re-send and reassign services, which is especially helpful when goods are lost. (**BizArk**) We can provide traceability services for goods. (**Linca**) We built the "E-inspection and traceability source intelligent business platform" with CCIC to achieve traceability of goods. Consumers obtain information on the origin, brand, product quality and other information of products by activating the traceability anti-counterfeit code in order to identify the authenticity of the product.
Operand resources: Overseas warehouses; ICT architecture; Bonded warehouses; Supervising warehouses; Operant resources: End-to-end logistics knowledge	Process re-engineering: Enhanced logistics services through overseas/bonded/supervised warehouses.	(**Osell**) The cross-border e-commerce public supervision warehouse is an integrated and efficient cloud warehouse for warehousing, logistics, supervision, and customs clearance. It handles the entire process of logistics and information flow from the inspection of goods storage, sorting and packing, customs declaration and customs clearance to logistics transportation, tax rebate settlement and reverse tracking. The customs clearance time has been reduced from a week to processing it on the same working day, saving more than one third of the logistics costs. (**Zongteng**) For obsolete cargoes accumulated in overseas warehouses, based on the demand information collected from other markets, cargoes are transported to overseas warehouses with new target markets that are in demand, and are sold through e-commerce channels with repackaging, sorting, and distribution services. (Founder, **BizArk**) We built overseas warehouses in the United States. Through overseas warehouses, foreign trade companies can not only reduce barriers to customs clearance, but also use local logistics services to reduce logistics costs and to quickly seize the overseas market. At the same time, local delivery and distribution can reduce the transfer process. In addition, sales localization can avoid trade barriers in some target market countries. (**BizArk**) According to the customer's order information, we will provide different solutions for customers according to price, timeliness, quantity and characteristics of the goods, weather analysis, modes and times of transport modes, freight rates, and other indicators, and combine different logistics transportation and distribution ways. (**Linca**) Cross-border e-commerce import businesses can provide important information on China's differences in import trade and tariff policies, and can facilitate trade and logistics through data exchange with cross-border e-commerce bonded warehouses.

among supply chain partners improves competitiveness and effectiveness of supply chains. Information flows, which have priority over logistics flows (Graham & Hardaker, 2000) and financial flows, are the foundation for any effective supply chain and have thus the ability to reduce uncertainty that can make cross-border e-commerce supply chains risky and reactive (Ellram et al., 2004). In this section we discuss the services capabilities generated from combining logistics and information flows, and from combining financial and information flows.

5.2.1. Service capabilities generated from combining information and logistics flow related resources (I + L)

Table 6 describes the service capabilities generated from combing resources related to information and logistics flows. First, by combining relevant operand and operant resources, logistics visualization can be achieved, enabling the traceability of goods by technologies such as RFID. Technologies like these have been adopted by all four firms in our sample. Second, firms may be able to identify process re-engineering opportunities by utilizing different kinds of warehouses as operand resources, combined with the knowledge of the end-to-end logistics design and associated market information. With this insight, value-added services can be provided to customers. Third, equipped with operand resources of packaging solutions, an appropriate IT architecture, logistics routing optimisation, and automated system knowledge, cross-border e-commerce companies can provide integrated solutions for customers, yielding more effective logistics operations, enhanced logistics services and better control of logistics risks. For example, “Full Performance” service for customers provided by Osell facilitates processes in traditional foreign trade and provides clients with best price evaluation abilities, helping Chinese companies sell overseas with a professional team, one-stop service, monitoring systems, and integrated resources. Such new capabilities generated by the combination of resources related to information and logistics flows can provide more personalised services for customers. Thus, we propose the following:

P2a. *The combination of resources related to information and logistics flows generates new supply chain service capabilities in the form of logistics visualization, logistics effectiveness and logistics process re-engineering.*

5.2.2. Service capabilities generated from combining information and financial flows (I + F)

Table 7 describes the service capabilities generated from combing resources related to information and financial flows. We find that all four case companies rely on third-party financial services providers to carry out basic financial flow services, which reflect their capability in regards to financial network mapping. Together with the information flow, Zongteng and Osell can provide supply chain finance services based on the sharing of financial information systems with customers. For example, Zongteng collaborated with iPayLinks to design innovative financial processes and provide supply chain financial products/services. The companies can also manage their financial risks through the two flows. We therefore propose the following:

P2b. *The combination of resources related to information and financial flows generates new supply chain service capabilities in the form of supply chain finance.*

5.2.3. Service capabilities generated from combining the three flows in unison (I + L + F)

Table 8 describes the service capabilities generated from combing the resources related to information, financial and logistics flows. We find that Osell is the only one in our sample that combines these three flows, thus enabling them to create innovative solutions based on all available operand and operant resources embedded in the three flows. As such, Osell launched its overseas cross-border e-commerce industrial park in Dubai in 2016, which allows Osell to provide logistics finance services based on the visualization of supply chains and the presence of overseas warehouses. Osell joins the SilkChain, a digital chain of international trade enabled by blockchain technology, providing global customers with services such as supplier identification, access to overseas warehousing/logistics, import/export advisory services, insurance

Table 7
Service capabilities generated from combing information flow and financial flow related resources (I + F).

Resources based on Information Flows and Financial Flows	Services generated	Supporting quotations
Operand resources: Financial information systems Operant resources: Financial network mapping; Designing the finance business process	Provision of tailored supply chain services, better control of financial risks, and budgeting management.	(Vice President, **OSell**) The use of transaction gateways (a kind of data system), which has been deployed in SMEs, can be connected with the invoicing module in ERP systems for SMEs. The systems can collect data about customers, such as financial data, production data, electricity consumption, wage levels, order quantity, cash flow, assets and liabilities, investment preferences, success or failure ratio, technology level, R&D investment, product cycle, safety stock, sales distribution, etc. The company's operating data was repeatedly verified using a multi-algorithm model to form an enterprise rating score. The credit certificate records the historical background of each ticket, bill, historical transaction record, and business of the trade in the blockchain, thereby forming an intelligent contract for automatic supply chain financial services. Blockchain technology makes the information visible and un-changeable, which resolve the trust problem between buyers and sellers. (Deputy General Manager, **Zongteng**) To solve the financial problem between sellers and logistics providers, we cooperate with iPayLinks to provide supply chain financial products, such as credit-based credit, online real-time wind control, automatic wind control and loan auditing. Zongteng provides credit products for users, and gives the total amount of credit according to the evaluation. Zongteng provides customer-related data for credit account opening through system docking. iPayLinks can open and credit the user's account, and be used for communication on cross-border loans. Users can apply for the use of local and foreign currency funds within the credit limit. Users can return the funds after the end of their use and restore the credit limit. (Business Development Manager, **BizArk**) The sales information of an enterprise affects the credit level of an enterprise. (Director of cross-border business, **Linca**) We can use big data analysis to achieve advanced procurement and budgeting.

Table 8
Service capabilities generated from combing the three flows related resources (I + L + F).

Resources based on the Three Flows	Services generated	Supporting quotations
Operand resources: Inventory; warehouses; ICT architecture; RFID	Provision of supply chain finance services, application of logistics flows as a way for risk management; Creation of innovative solutions based on the resources embedded in the three flows.	(Co-Founder and Vice President, **OSell**) Inventory in logistics companies can be mortgaged. We have carried out cross-border e-commerce logistics finance, including bonded warehouse financing, warehouse receipts, unified credit and advance payment.
Operant resources: Supply chain finance knowledge; risk management knowledge; full visibility of the whole supply chain		(**OSell**) OSell's overseas cross-border e-commerce industrial park was launched in Dubai in 2016, which allows OSell to provide logistics finance services based on the visualization of supply chains and overseas warehouses. (**OSell**) OSell joins the SilkChain, a digital chain of international trade enabled by blockchain technology, providing global customers with fast matching services, e.g. identifying suppliers, overseas warehousing/logistics, import/export, insurance, and e-payment, among others, for global customers. At the same time, Chinese suppliers can query the buyer's channel distribution, capital status, and business reputation on the blockchain, collect product sales in the local market and customer response information to find a stable export market at a very low cost.

services, and e-payment services. At the same time, Chinese suppliers can query the buyer's distribution channels, capital status, and business reputation on the blockchain, realize product sales in the local market, and obtain customer response information to find a stable export market at a low cost. Based on these findings we propose the following:

P2b. *The combination of resources related to information, logistics and financial flows generates new supply chain service capabilities (*e.g.*, finance risk control) and other innovative solutions.*

5.3. The relationships among the three flows

Table 4 captures the business milestones for the four firms, and delineates their information, logistics and financial flows systems. We observe that the cross-border e-commerce system interweaves the three flows. As illustrated in Table 4, we find that the four case companies develop their businesses according to the following sequence: commencing with the IT infrastructure, logistics systems are built next, with financial services being the final aspect being addressed.

As such, overall information flow management is the cornerstone of an enterprise and supports the other two flows based on the data that is made accessible and visible. Without information or data, the risks of providing logistics and financial services would be too great. From the view of an e-commerce platform, the uncertainty of credits coming from both suppliers and customers, combined with a potentially poor credit appraisal system in the early stages, represents large transactions risks to cross-border e-commerce (Fu & Noche, 2012). As cross-border e-commerce enterprises are gradually developing into comprehensive e-commerce platforms, garnering information processing capabilities is essential, as it reduces the risk for cross-border e-commerce enterprises.

The logistics flow from upstream to downstream supply chain entities needs to be supported by information flows. In Table 6, we find that the information flow can affect the effectiveness of logistics operations as it pertains to the management of distribution, logistics, warehouses, and the selection of transportation modes, among others. For example, Osell can automatically match shipments with the most suitable logistics company in different countries based on data analysis. Zongteng uses information to optimise the selection and sources of products, to plan warehouse layout and automatically decide sorting and packaging routes in the warehouse. In addition, Linca achieved traceability by launching an information platform with partners. Finally, BizArk helps sellers to improve efficiency in managing the orders through IT systems. Similar to Prajogo and Olhager (2012), who suggest that the intensity of information sharing has a positive relationship with logistics integration, our cases provide support for such relationship. Based on these findings we propose the following:

P3a. *Information flow management is the cornerstone of SCM and supports the logistics and finance flows.*

With the support of information flow management, firms tend to combine information and capital management in order to implement supply chain finance and manage financial risks (Tables 7 and 8). As Zeng and Rossetti (2003) point out, logistics controls a significant amount of assets, and thus has a direct impact on the financial flow. Furthermore, financial flows can guarantee the smooth operation of logistics in turn (Lee & Chang, 2007). Thus we propose the following:

P3b. *With the support of information flows, logistics flows have a direct impact on financial flows and* vice versa*,* i.e. *logistics and financial flows co-influence each other.*

5.4. The relationship between supply chain service capabilities and supply chain relationship quality

Table 9 summarizes our observations in regards to supply chain relationship quality (low, medium or high) for the four cross border e-commerce companies. It can be seen that the scores on trust improvement and commitment for Osell is high, for Zongteng it is medium, and for both BizArk and Linca they are low. The score for risk mitigation for Osell is high, with Zongteng, Linca and BizArk receiving medium risk mitigation scores. For customer satisfaction, the score is also high only for Osell, low for Linca, and medium for the other two firms. Thus overall, Osell's relationship quality can be considered as high, Zongteng's as medium, BizArk's as medium to low, and Linca's as low. We offer further insights into the components of relationship quality in the following.

First, trust is the perception of confidence in the exchange partner's reliability and integrity (Morgan & Hunt, 1994). We measure this through the attainment of government certifications demonstrating good customer service, as well as venture capital investment the firms obtained. Osell gained trust from investors, foreign market governments, and Chinese governments, which shows a relatively high level of

Table 9
Supply chain relationship quality for the four cross border e-commerce companies.

	OSell	Zongteng	BizArk	Linca
Trust improvement and commitment	H ● In April 2016, news reported the following (http://china.osell.com/news/government/543.html): The Mayor of Toronto believes that OSell Networks can solve cross-border transaction trust issues and provide information that integrates logistics and financial flows. It will also become a bridge for local Toronto companies to enter the Chinese market. ● In 2009, it received the angel investment of the former Alibaba Group CTO and China Yahoo CTO Wu Hao, and successively introduced investment funds from Northern Lights, Heiner Asia, and Singapore F&H. ● In April 2017, it signed a strategic cooperation agreement with the listed company Kunwu Jiuding Investment Holdings Co., Ltd. to determine the goals of a multi-billion investment, hundreds of specialty towns, and hundreds of billions of market plans. ● During 2015–2016 and 2017-2018, it obtained the "e-commerce model enterprise" which is certified by the Ministry of Commerce. and jointly signed the "Commitment Letter for the E-Commerce Business Integrity Operation" in 2018.	M ● In 2018, it received 100 million yuan investment from institutions such as ProLogis, Internet Capital, Zhongding Venture Capital, and Xunzi Capital, which shows the high trust by investors. ● During 2015–2016 and 2017-, 2018, it obtained the "e-commerce model enterprise" which is certificated by the Ministry of Commerce, and jointly signed the "Commitment Letter for the E-Commerce Business Integrity Operation" in 2018.	L ● In 2010, it received US$40 million investment by IDG Capital. In 2012, it received the second round of venture capital investment. ● During 2017–2018, it obtained the "e-commerce demonstration enterprise" in Jiangsu Province.	L ● During 2017–2018, it obtained the "e-commerce model enterprise" which is certificated by the Ministry of Commerce, and jointly signed the "Commitment Letter for the E-Commerce Business Integrity Operation" in 2018.
Risk mitigation	H ● Credit risk: (Founder, **OSell**) We provide accurate risk control and high value-added services that are tailored to small and medium cross-border e-commerce sellers. After the buyers order on the DinoDirect Network platform, they are guaranteed a credit rating by us based on bank and transaction records. We also established an anti-fraud system based on the customer's IP address, credit card address, and the time zone of the computer's login to reduce credit risks. ● Policy risk: (Co-founder and Vice President, **OSell**) We established a National Policy Research Centre to monitor domestic and international political and policy risks.	M ● Logistics risk: (Chief Operating Officer, **Zongteng**) The self-built overseas warehouses and self-owned major international transportation lines can reduce the overall risk of the supply chain. ● Customs, tax, and legal risks: (Deputy General Manager, **Zongteng**) We established specialized customs, tax, and legal teams to respond to customs declarations, tax returns, and intellectual property disputes.	M ● Financial risk: We can monitor account performance through the IT system and monitor products through overseas warehouses, which can ensure financial and supply chain security. ● Logistics risk: We built overseas warehouses by ourselves, which can reduce logistics overseas storage and sorting risk.	M ● Logistics risk: Linca owns overseas warehouses, border warehouses and bonded warehouses, which can control logistics risks well. ● Customs, tax, and legal risks: We sign an agreement with the partner to stipulate how to avoid risks when the goods are not smoothly cleared or detained. ● Financial risk: Our company has a risk control department to control the risk of depreciation of the collateral, and set the critical point according to the market conditions. Once it reaches the critical point, it will help the lender to sell the goods according to the contract and try to play the role of the channel trader.

(*continued on next page*)

Table 9 (*continued*)

	OSell	Zongteng	BizArk	Linca
Consumer satisfaction	H ● (Co-Founder and Vice President, **OSell**) The core value of our company is "customer value is the first priority". In 2004, we established a global call centre. In 2014, we set up a call centre in India, which provides customer service for 24 h a day, seven days a week all year round. ● The consumer evaluation score by the third-party authoritative evaluation site "sitejabber" (https://www.sitejabber.com/) for OSell DinoDirect is 4.2 (on a 5-point scale). The following is an illustrative comment: "recommended OSell! There was almost no problem with the order. Even if there were some problems, the customer service will resolve them soon, and you may receive a full refund or they will give you a free new one".	M ● The consumer evaluation score by the third-party authoritative evaluation site "sitejabber" for Zongteng's tmart.com is 2.9, with 98% positive comments in the last 12 months (May 2018). However, it also got negative comments, which mainly focused on the inconformity with the different standards of electronic products. For example, it delivered electronic products that meet European standards to customers in the UK.	M ● On the Internet and in interviews with industry insiders, it received both positive and negative comments. In their industries in which they have expertise, such as outdoor and furniture, it achieved better performance and higher customer satisfaction. For example, the person in charge of "Guilin 21G E-commerce Co., Ltd." stated that "BizArk played a very important role in the transformation of the trading companies, and provided a lot of service, including team building, infrastructure construction, personnel recruitment, performance evaluation, training, and promotion" (https://www.zhihu.com/question/303255772/answer/1453724033). However, it also received customer complaints in other industries. For example, a customer complaint stated that three containers of goods had just been sitting in U.S. overseas warehouses for three years, without them being sold.	L ● For the O2O cross-border business, the settled merchants reflected that due to the location of the physical store, and the fact that the online shopping malls do not play a significant role in attracting customers, they lead to a low customer flow in the offline stores.
Overall rating	H	M-M	M-L	L

trust. Zongteng also obtained the status of "e-commerce model enterprise," which is certified by the Ministry of Commerce of China, in addition to receiving 100 million Yuan in investments in 2018. The trust levels of the other two companies are comparatively lower than the first two companies. BizArk also obtained investments and the certification, but the certification is only at a provincial level. Linca has not obtained investments by others, which shows a lower trust by governments.

Through the analysis as summarized in Table 5, we find that a high level of supply chain service capabilities generated by resources related to information flows have a positive effect on trust and commitment by customers. The results are similar to the argument by He, Keung Lai, Sun, and Chen (2014), in that service capability has a positive effect on a firm's level of customer trust and integration. However, our research objectives are different from theirs (they focused on manufacturing firms). We therefore propose the following.

P4a. *Greater levels of supply chain service capabilities generated by the resources related to the three flows by cross-border e-commerce firms improve trust and customer commitment.*

Second, we consider risk mitigation as an important dimension to measure supply chain relationship quality. Risk is the probability and negative consequence of an event (Jia & Rutherford, 2010). The sampled cross border e-commerce companies generally focus on logistics risk, credit risk, financial risk, customs, tax and legal risks, as well as policy risk. For example, Osell uses customer credit ratings on the platform and an anti-fraud system to prevent credit risk, and established a special centre to prevent policy risks. As such, risk mitigation prevention measures by Osell are stronger than these measures at any of the other three firms. These firms obtained medium scores in our ratings, with all of them providing similar risk mitigation services. We therefore propose the following.

P4b. *Greater levels of supply chain service capabilities generated by resources related to the three flows by cross-border e-commerce firms mitigate trading activity risks for the parties involved.*

Third, we measure relationship quality from the views of customers and tap into their satisfaction. We determined customer satisfaction by searching the internet, referring to the consumer evaluation scores by the third-party evaluation site "sitejabber" (https://www.sitejabber.com/), and by summarizing the buyers' comments. With this approach, we found customer satisfaction towards Osell to be rated with 4 stars out of 5; this is a high rating, substantiated by mostly positive customer comments. BizArk and Zongteng (Tmall received 3 out of 5 stars at sitejabber) received both positive and negative comments from various third party platforms, while Linca's consumers always complained about customer traffic in the offline stores due to large volumes of customers, yielding a low rating. Hence, we can conclude that a high level of service capabilities generated from the three flow related resources enables firms to provide more and better service to customers.

P4c. *Greater levels of supply chain service capabilities generated by resources related to the three flows by cross-border e-commerce firms increase customer satisfaction.*

Overall, supply chain capabilities are the building blocks for supply chain strategy and a source of competitive advantage (Morash, 2001). As far as service capability is concerned, Zhang and Chen (2008) point out, in a mass customization context, that a firm that succeeds in enhancing service capabilities will have more opportunities to gain advantages over its rivals, since it represents a significant chance for it to cater to the customers' preferences. Since the high level of service capabilities offered to customers can improve trust, risk mitigation and customer satisfaction, these capabilities can improve the overall supply chain relationship quality. Based on above arguments and findings, and integrating P4a, P4b and P4c, we offer the following integrative proposition.

P4. *Greater levels of supply chain service capabilities generated by resources related to the three flows by cross-border e-commerce firms increase supply chain relationship quality.*

6. Conclusion

Cross-border e-commerce is becoming increasingly popular around the world. In practice, cross-border e-commerce companies are building on their existing business foundation, and transitioning from a product-dominant logic to a service-dominant logic (Lusch et al., 2006, 2007; Vargo & Lusch, 2004). However, research questions, such as what services cross-border e-commerce firms can provide and how cross-border e-commerce firms can improve supply chain relationship quality through the management of the three flows, remain unanswered. Furthermore, the relationship between the three flows of information, logistics and finance has rarely been discussed comprehensively since the founding of the SCM discipline. In order to fill these shortcomings and answer the noted research questions, we conducted a multiple case study and adopted the service-dominant logic in interpreting the findings. We proposed a framework with four sets of propositions, which are reflective of the interaction between operand and operant resources embedded in the three flows, able to generate enhanced supply chain service capabilities, and in turn able to contribute to supply chain relationship quality in terms of trust improvement/commitment, risk mitigation and consumer satisfaction. Our research makes significant theoretical and managerial contributions, which are further discussed in the following.

6.1. Theoretical contributions

We make the following theoretical contributions to the SCM literature. First, we propose a framework that encapsulates the interactions and combinations of the resources related to the three flows as being fundamental for the development of supply chain service capabilities, which in turn contribute to supply chain relationship quality, as reflected in trust improvement/commitment, risk mitigation and consumer satisfaction. Our findings are aligned with the S-D logic in that supply chains can be viewed as value co-creation networks that can promote knowledge and capability (operant resources) growth, as well as exchange among network members via operand resources related to the three flows (Tokman & Beitelspacher, 2011; Vargo & Lusch, 2011). We are the first to map out the operand and operant resources embedded in the three flows and identify supply chain capabilities generated from combining these resources.

Second, we are the first to delineate clearly with cross-border e-commerce industry cases the relationship between the three flows of information, logistics and finance. For cross-border e-commerce companies, the most fundamental requirement for the interaction is the development of information technology. Through visualization and perceptualization of the data, reliable projections and beneficial solutions can be provided for future development. One of the key benchmarks for the upgrading of cross-border e-commerce companies is the establishment of a sophisticated logistic system based on the information flow, which enables the companies to build overseas bonded warehouses, obtain import/export customs clearance inspections, integrate logistic systems, and enable sound and effective financial processes. Our analysis and illustration of the basic hierarchy pertaining to the three flows in cross-border e-commerce companies is helpful for the future development of this industry in China.

Third, we are the first to propose the fundamental notion that cross-border e-commerce companies/platforms are providing SCM services. Hence, this kind of platform provides an ideal setting for us to gain a deeper and better understanding of the very concept of SCM (e.g., Mentzer et al., 2001), which tends to be generally described as the management of the three flows connecting upstream and downstream organizations. It is shown that cross-border e-commerce companies' core competence lies in their capability to provide supply chain services reflected in the management of the three flows. We thus suggest that the key issue in future company development should be more about the ability to effectively provide clients with plausible solutions, rather than the mere transition from a product-dominant logic to a service-dominant logic (Ostrom et al., 2010).

6.2. Managerial contributions

Our research has important managerial implications. The service-dominant logic provides a new operating philosophy of emphasising the services customers' needs, distinguishing operand from operant resources. We applied this theory to the cases sampled to illustrate this logic, and explored the operant capabilities/resources generated from the operand resources of the three flows. Other cross-border e-commerce companies can learn from our propositions and arguments. First, in terms of changing their operating mind-set towards co-creating supply chain networks in order to provide better services to customers, companies should follow the sequence of enhancing information flow capability first, then logistics and finally financial capabilities. Second, cross border e-commerce companies can more innovatively combine and re-arrange their resources related to the three flows in order to design new and tailored services for their customers. Third, these companies need to realize that their relationship quality with their customers hinges on the three aspects of trust, customer risk mitigation, and customer satisfaction.

6.3. Limitations and future research directions

First, although we approached 12 cross-border e-commerce companies and eventually selected four based on the two constructs of supply chain service capabilities and supply chain relationship quality, the sample size is small. A large-scale sample survey should be conducted in the future to test the model developed in this study. Second, the information acquired from the researchers' field visits might not be sufficient to cover all the complexities of cross-border e-commerce, thus longitudinal studies are needed to trace the development of cross-border e-commerce firms over time; this will offer more insights into factors affecting the relationships stipulated in the model.

Third, the measurements or indicators for supply chain relationship quality are subjective and can be improved to be more objective in a survey project. Fourth, our research focuses on Chinese cross-border e-commerce companies, potentially limiting the findings to this geographic region; future research in different geographic and cultural contexts are therefore needed. Finally, even within China, the varied ownership patterns of e-commerce companies may allow for differentiated government incentives, thus making it a complex setting. As such, in the present research, all four companies were private Chinese firms, as opposed to Western companies operating in China, such as Amazon. Future research is encouraged to investigate dynamics inherent to ownership structures not investigated here (in particular Amazon), and compare the findings to the ones obtained herein.

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Appendix A. Interview protocol

1. Background information
   Please introduce the background of your company, your supply chain processes and major supply chain partners. Please describe the development of your company.
2. Resources for providing supply chain service
   How do you provide services to your customers? What supply chain services do you provide to which supply chain partners? Which resources do you need?
3. Supply chain service capabilities
   How do you manage the information, logistics and financial flows in order to provide the supply chain services? What capabilities are developed for this?
4. Supply chain relationship quality
   How do you enhance the supply chain relationship quality? How do you measure your supply chain relationship quality?

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