

# Global logistics and supply chain integration in the digital era: a focus on China's Belt and Road Initiative

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## Abstract

**Purpose** – To delve into the integration of global logistics and supply chain networks amidst the digital transformation era. This study aims to investigate the potential role of China's Belt and Road Initiative (BRI) in facilitating the integration of global flows encompassing both tangible goods and intangibles. Additionally, the study seeks to incorporate third-party logistics activities into a comprehensive global logistics and supply chain integration framework.

**Design/methodology/approach** – Prior research is synthesised into a global logistics and supply chain integration framework. A case study was undertaken on Yuan Tong (YTO) express group to investigate the framework, employing qualitative data analysis techniques. The study specifically examined the context of the BRI to enhance comprehension of its impact on global supply chains. Information was collected in particular to two types of supply chain flows, the physical flow of goods, and intangible information and cash flows.

**Findings** – The proposed framework aligns well with the case study, leading to the identification of global logistics and supply chain integration enablers. The results demonstrate a range of ways BRI promotes global logistics and supply chain integration.

**Research limitations/implications** – The case study, with multiple examples, focuses on how third-party logistics firms can embrace global logistics and supply chain integration in line with BRI. The case study approach limits generalisation, further applications in different contexts are required to validate the findings.

**Originality/value** – The framework holds promise for aiding practitioners and researchers in gaining deeper insights into the role of the BRI in global logistics and supply chain integration within the digital era. The identified enablers underscore the importance of emphasising key factors necessary for success in navigating digital transformation within global supply chains.

**Keywords** Supply chain integration, BRI, Global supply chains, International logistics, Last-mile delivery

**Paper type** Research paper

## 1. Introduction

The ongoing trade war between the United States and China continues in 2024, with signs indicating that a resolution is not imminent (Basu and Ray, 2022). In addition, tensions between Russia and North Atlantic Treaty Organization (NATO) countries, China–Taiwan relations, tensions between China and its neighbouring countries etc. Those geopolitical tensions have escalated the conflicts between the United States and China (Liang and Ding, 2021). We are stepping into a new phase of globalisation, often referred to as Globalisation 2.0



(Patricia *et al.*, 2020; Bernhart, 2022). As a result, a significant geopolitical shift has been observed as China and Western nations embark on a process of decoupling/de-risking. This trend encompasses various aspects of economic, technological and geopolitical disentanglement between these two major global powers (Bernhart, 2022). Friendly shoring, ally shoring, near shoring or de-risking may bifurcate into two primary camps: those advocating for pro-China globalisation and those advocating for pro-Western globalisation post-COVID-19.

As we observe, the Belt and Road Initiative (BRI) has been widely acknowledged as China's interpretation of globalisation. It is important to understand the mechanisms driving the BRI. This paper examines the impact of the BRI on global logistics and supply chain integration from a logistics and supply chain perspective in the digital era. The BRI, initiated by China in 2013, is an extensive infrastructure and development endeavour with the objective of linking China to Europe, Africa, and other regions across the globe. A significant number of Chinese firms are already involved in a variety of BRI projects. These firms rely heavily on the Third-Party Logistics (3PL) service providers to deliver and support their businesses both nationally and internationally (Jiang, 2017; Wang *et al.*, 2018). The 3PL provider has become an important sector in today's BRI (Wang *et al.*, 2018). The impact of the BRI on global logistics and supply chain integration remains a subject of ongoing exploration and analysis. The intangible theory is used to explore how physical supply chain flows are interrelated with more intangible flows (such as workflows; service flows; information flows and communicational flows) (Cardao-Pito, 2012).

China stands as the globe's leading exporter of goods and holds the title of the largest manufacturing nation (Koh Gui, 2015). The Chinese government officially asserts that the BRI is a worldwide infrastructure development strategy launched in 2013 (Chan and Gunasekaran, 2020). The Chinese government has proactively coordinated policies, implemented strategic plans and engaged in cooperation with countries along the New Silk Road (Gerstl and Wallenböck, 2020), on diverse aspects including communication network construction; manufacturing capacity cooperation (international products supply and demand optimisation); and national basic services (financial, insurance, logistics and other basic service system support) (Garlick, 2020; Thüerer *et al.*, 2020). Initially, BRI was to solve China's domestic overcapacity. The trade tensions between China and the United States escalated notably in 2018, marking the beginning of what is often referred to as the "China-US trade war." Then, BRI serves as a strategic tool for the Chinese government to foster connections with its trading partners, particularly amid trade tensions with other major economies such as the United States. Limited research exists on the BRI within the international logistics and supply chain sector. Thus, this article primarily examines the BRI's expansion through the lens of logistics and supply chain dynamics in the digital era.

International logistics and supply chains are crucial components of global trade (Wang *et al.*, 2023). 3PLs play a pivotal role in facilitating the expansion of the BRI international network (Wang *et al.*, 2018). The delivery of physical goods, such as raw materials or commodities is heavily relied on a well-integrated global supply chain network. Consequently, the BRI holds immense potential to enhance and improve the global supply chain (Chan and Gunasekaran, 2020). This study focuses on the Chinese courier YTO Express Group (圆通速递) (McFarlan *et al.*, 2015). This would contribute to the knowledge of global logistics and supply chain integration in the digital transformation era by addressing the following key questions in an empirical setting:

- (1) How does BRI influence global logistics and supply chain integration?
- (2) How aligned are the global integration drivers of BRI with digital transformation factors?

To address these research questions, we examine several examples from the case of Chinese courier YTO Express Group. Through this investigation, we aim to explore the influence of the BRI on global logistics and supply chain integration in the digital transformation era. A global logistics and supply chain integration framework (GLSCIF) is synthesised from the case findings. In the paper, we propose that traditional supply chain flows, as described by Christopher (2005), can be viewed as the physical flow of goods and intangible supply chain flows in the digital era based on the intangible flow theory (Cardao-Pito, 2012). In the context of supply chains, the intangible flow theory highlights the significance of intangible factors in driving supply chain integration and efficiency. For example, the exchange of digital information, knowledge sharing and collaboration among supply chain partners can streamline operations, improve coordination and enhance overall performance. Global integration enablers influence both physical and intangible supply chain flows. The intangible information and financial flows are identified as critical for digital transformation.

This study makes a significant contribution by enhancing our comprehension of the effects of the BRI within the realm of global logistics and supply chain literature. This may help us to understand how China expands its international logistics and supply chain under Globalisation 2.0. Additionally, it aims to construct a comprehensive framework for global logistics and supply chain integration. This study pioneers the examination of the BRI in the context of global logistics and supply chain integration, bridging a significant research gap in the existing literature on international logistics and supply chain.

The remainder of this paper is organised as follows. In the next section, we present the relevant background information and foundational literature. We then describe the research case study and study framework. Subsequently, we present the impact of BRI on the global logistics and supply chain based on the case of YTO Express Group. Finally, we interpret our findings and provide concluding comments.

## 2. Background and framework

### 2.1 Belt and Road Initiative

BRI is a type of international trade agreement, which has significant impacts on global logistics and supply chains (Jiang, 2017; Gerstl and Wallenböck, 2020). The BRI aims to connect China and more than 60 other countries in Asia, Africa and Europe (Ferdinand, 2016). Due to concerns related to China-US relations, some nations have chosen to exit or reconsider their participation in agreements related to the BRI, for example Malaysia's government announced the cancellation of several infrastructure projects linked to the BRI, citing concerns over high costs and doubts about their necessity (Leman, 2019). Italy's government has faced scrutiny and criticism for its involvement in the BRI, particularly from its European Union partners and the United States (Kazmin and Yang, 2023).

BRI includes both maritime and terrestrial Silk Roads, which are traditional logistics trade routes between China and other countries (Chan and Gunasekaran, 2020). The Chinese Central Government is implementing the 13th five-year plan for economic and social development, and this plan heavily promotes BRI to focus on innovation, collaboration, green economics and an open-door policy. Under the plan, many firms have gained access to the international market (Wang *et al.*, 2018; Chan and Gunasekaran, 2020). Since President Xi launched the initiative in 2013, the Chinese Central Government has actively coordinated the policies and cooperated with the countries along the routes. China does not only invest overseas but also launches BRI projects inside China. For example, the Chinese government committed up to US\$1 trillion to develop infrastructural investment transport links inside the country, much of which will be invested in the western part of China (Ferdinand, 2016).

In this study, we focus on firms involved in international logistics and associated global supply chains utilising BRI, 36% are Chinese Central Government-owned enterprises, 20%

are Chinese local government-owned enterprises, 42% are private enterprises and 2% are Chinese and foreign joint ventures enterprises (Garlick, 2020). State-owned enterprises and private enterprises play an important role in the implementation of BRI. Firms come from a range of sectors including manufacturing, construction, finance, transportation, warehousing, postal, Internet, software, information technology (IT), information transmission services, mining and real estate (Garlick, 2020). While the state-owned enterprises play a vital role in the construction of the “Belt and Road”, they need to collaborate with the private sector (Jiang, 2017). According to statistics from China’s Ministry of Finance, the total number of “One Belt, One Road” projects has exceeded 10 trillion Yuan. In 2017, private enterprises managed projects of over 3 trillion Yuan, making up 45%.

### 2.2 International courier business

Firms require effective logistics and supply chain operations to survive and succeed in modern-day markets (Wang *et al.*, 2020b; Jiang, 2017). Firms may decide to concentrate on their core activities and outsource their logistics activities to an external company. 3PLs offer a wide range of logistical activities (Wang *et al.*, 2015, 2020b) by leveraging a range of resources, assets and expertise (Lambert *et al.*, 1998). Many firms along BRI, especially those involved in cross-border e-commerce rely on 3PLs to access international markets (Jiang, 2017; Wang *et al.*, 2018; Giuffrida *et al.*, 2020). In this study, we focus on how 3PL couriers support and integrate global logistics and supply chains along BRI in the digital era. In addition to the basic pickup and delivery services 3PLs offer a wide range of additional value-adding services, such as obtaining proof of delivery signature, tracking and tracing and collection of payment (Wang *et al.*, 2015, 2020b).

The international courier service is used to deliver parcels across national boundaries (Jiang, 2017). Due to customs and security screening such a service has to deal with complex regulations (Wang *et al.*, 2018, 2020b). All courier firms inevitably collaborate with international counterparts to achieve efficiencies and scope (Wang, 2011). The in-house customs brokers or freight forwarders may be used to process customs clearance, then international cargo is booked with an appropriate transportation mode to be shipped to the desired destination (Wang, 2011; Wang *et al.*, 2020b). Table 1 summarises international courier services throughout the delivery process.

Courier services have emerged as a crucial transport method for shipping small to medium-sized items, primarily owing to their provision of efficient last-mile delivery solutions (Wang *et al.*, 2018). The rapid development of cross-border e-commerce in China has heightened the significance of the courier delivery in the international trade (Giuffrida *et al.*, 2020). Moreover, they enable businesses to achieve just-in-time (JIT) strategies and minimise

Phase	Description
Pickup	Parcel and other customs paperwork are collected by a courier from a shipper, then the item is transported to an original depot
Consolidation	The origin depot forwards the international items to the international freight agents/carriers. All the items will be consolidated and moved to the destination countries
International transportation	The international agents/subcontract carriers process and transport the cargo internationally
De-consolidation	The foreign freight forwarders receive and de-consolidate the cargo to a destination depot
Last mile delivery	The local courier delivers the parcel from the destination depot to its receiver

Source(s): Wang *et al.* (2020b)

**Table 1.**  
A typical international courier service

global supply chain inventories (Christopher *et al.*, 2011). International logistics is more complex than domestic, additional value-adding services can be included in international logistics, such as inventory management, customs, order fulfilment and supply chain risk management (Wang *et al.*, 2018). Each country may have different regulations and customs requirements for international freight. Courier services often provide a one-stop delivery solution for international shipments, providing a convenient option for international trade.

### 2.3 Logistics and supply chain integration

Conventionally, a supply chain network is connected groups of companies that service end-customers via a range of interrelated flows (Christopher and Peck, 2004). Logistics management is a critical aspect of these supply chain networks that focus on working across organisational boundaries to deliver raw materials, work-in-progress and final products. Logistics is a channel of a supply chain that enables time and place utility (Christopher, 2005). The Council of Logistics Management defines it as, the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements (Simchi-Levi *et al.*, 2007).

Managing the supply chain is about integrating logistics and the supply chain, as the supply chain often contains a myriad of firms, it is vital to integrate these firms (Wang *et al.*, 2021). Through effective integration, firms can improve responsiveness, reduce cost, improve profitability and thus achieve superior performance (Wiengarten *et al.*, 2016; Maloni and Benton, 2000). Furthermore, integration can enable a company to focus on its core business, create value and compete in its markets (Simchi-Levi *et al.*, 2007; Wang, 2020). Supply chain integration occurs in different forms such as internal, external, supplier and customer integration (Maiga, 2016; Kim, 2006; Flynn *et al.*, 2010).

Physical flow of goods (materials) integration refers to specific logistics operational activities that coordinate the physical flow of goods including raw materials, work in process and final products, from suppliers to customers throughout the value chain (Stock *et al.*, 2000; Paulraj and Chen, 2007), it can be internal and external (Stock *et al.*, 2000; Flynn *et al.*, 2016; Qi *et al.*, 2017). Material integration would provide the operational mechanisms that support these inter-organisational interactions in a network (Stock *et al.*, 2000; Jiang, 2017). Integration of supply chain activities is enabled through supply chain coordination (Childerhouse and Towill, 2003).

Information flow integration refers to the extent of operational, tactical, and strategic information sharing that occurs between a focal firm and its supply chain partners (Rai *et al.*, 2006; Wang *et al.*, 2021). Information is a valuable logistics resource (Wang *et al.*, 2021). Information flow has been widely recognised as equally important to materials flow in a supply chain (Paulraj and Chen, 2007). IT is important for integrating suppliers/partnering firms in virtual enterprises and supply chains (Gunasekaran and Ngai, 2004; Wang *et al.*, 2021). Information sharing allows the formation of better partnerships and promotes integration between suppliers and manufacturers in the supply chain (Kim and Chai, 2017). Information flow integration is enabled through information sharing and information visibility (Silvestro and Lustrato, 2014; Ivanov, 2021).

Financial flow integration is often considered in the field of supply chain finance (SCF) (Wuttke *et al.*, 2013; Gelsomino *et al.*, 2016). It is defined as the degree to which the exchange of financial resources between a focal firm and its supply chain partners is driven by workflow events (Rai *et al.*, 2006). There are two types of financial flow downstream flows to be managed including prices, invoices and credit terms, and essential upstream flows to be coordinated including payments and account payables (Rai *et al.*, 2006; Silvestro and Lustrato, 2014).

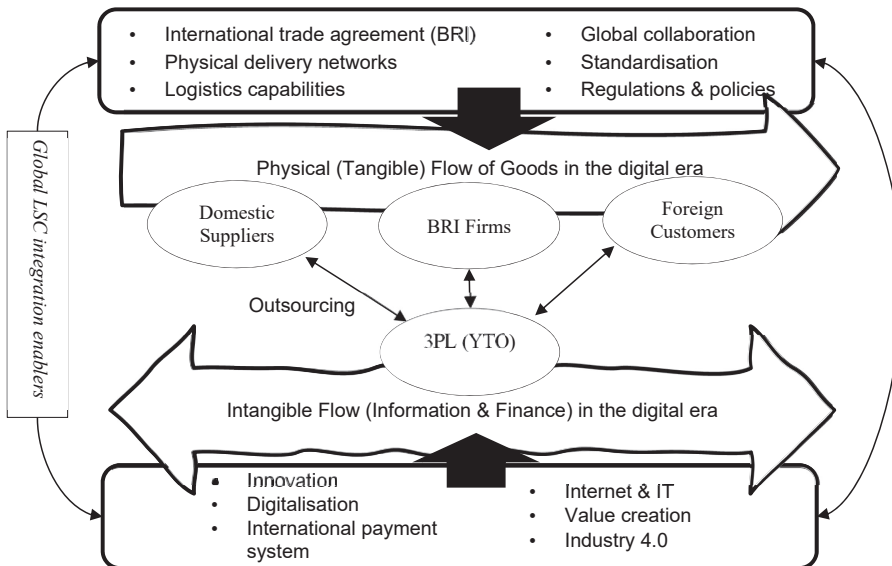
2.4 Global logistics and supply chain integration framework

In this study, we develop a global logistics and supply chain integration framework GLSCIF (Figure 1) based on the global supply chain forum framework (GSCF) (Ellram *et al.*, 2004; Croxton *et al.*, 2001; Lambert *et al.*, 1998). The GLSCIF model incorporates the logistics triad (3PL) (Beier, 1989; Larson and Gammelgaard, 2001; Wang *et al.*, 2020b), as a logistics service provider, such as courier plays a vital role to link the supply chain partners including domestic suppliers, BRI firms and overseas BRI customers in a model.

Conventionally, supply chain integration encompasses three vital flows in the global supply chain: materials, information and finances (Lee, 2000; Simchi-Levi *et al.*, 2007). Previous studies often focus on information and material (logistics) (Flynn *et al.*, 2016; Prajogo and Olhager, 2011; Stock *et al.*, 2000; Childerhouse and Towill, 2003) and financial (Gelsomino *et al.*, 2016; Silvestro and Lustrato, 2014; Rai *et al.*, 2006) in supply chain integration respectively.

Financial flows are included inside a functional silo in the GSCF. In the GLSCIF, we argue that financial and information flows can be incorporated based on the intangible theory (Cardao-Pito, 2012). Moreover, information can well represent digital currency in the modern era, such as Blockchain technology, which can record order information and process payment across a global supply chain network (Wang *et al.*, 2021).

In summary, we propose two main types of supply chain flows in the digital era, the tangible physical flow of goods and the intangible flow of information and finance. Global logistics and supply chain integration enablers are included in the GLSCIF model; these enablers can directly facilitate both the physical flow and intangible flow, such as information and finance flows. Developing the framework involves outlining the global integration enablers and relating them to the GLSCIF. In this study, 3PL play a crucial role as service providers, connecting various stakeholders within global supply chains. They serve as intermediaries, facilitating seamless coordination and integration between different parties involved in the supply chain process. By leveraging their expertise and resources, 3PL



Source(s): Authors' own creation/work

Figure 1. Global logistics and supply chain integration framework (GLSCIF)

providers bridge the gap between manufacturers, suppliers, distributors, retailers and customers, ensuring smooth and efficient logistics operations. Through their services, 3PL providers enable effective collaboration, enhance supply chain visibility and contribute to the overall optimisation and success of global supply chains.

Figure 1 presents the GLSCIF, which will be used in Section 4 to match the impact of BRI on global logistics and supply chain integration in the digital era.

### 3. Research method

A case study is used as the main research methodology in this study. The basic case study entails the comprehensive analysis of a single case. Single case studies offer several advantages: They allow researchers to thoroughly examine a specific phenomenon, entity or situation, providing a detailed understanding that may not be achievable through broader research methods. They can contribute to theory development by providing empirical evidence and insights that can help refine or develop existing theories. They can serve as illustrative examples to support broader arguments, theories or concepts, providing concrete evidence to bolster academic or professional discussions (Bryman and Bell, 2011; Yin, 2018). The study was undertaken to give greater insight into the impacts of BRI on international logistics and supply chain integration by examining the different types of supply chain integration within a 3PL. YTO Express Group Co. Ltd is a leading company in the Chinese express logistics industry (McFarlan *et al.*, 2015). According to the news, it has been involved in the construction of the “Belt and Road” and the promotion of China’s internationalisation. YTO’s development strategy revolves around prioritising global express delivery and parcel services under the BRI. This aims to bolster cross-border e-commerce and facilitate Chinese expansion into overseas markets (Rita, 2020; McFarlan *et al.*, 2015).

YTO Express has established itself as a key logistics player in supporting the BRI. The YTO express serves as an appropriate and representative case (Seuring, 2008; Bryman and Bell, 2011). The reason the YTO case is considered suitably representative is not due to its extreme or unusual nature, but rather because it exemplifies a broader category of cases and offers a suitable context for addressing our research questions. The other rationale for using representative cases is that they allow the examination of key social processes (Bryman and Bell, 2011). For example, YTO is known to have implemented a BRI strategy to support its international business (2020a). Furthermore, YTO has positioned itself as a trailblazer in providing support for the BRI. In this study, we want to know what and how the company did to develop and integrate its global supply chain based on published information. This implies the impacts of BRI on global logistics and supply chain integration. Therefore, YTO is selected in this research.

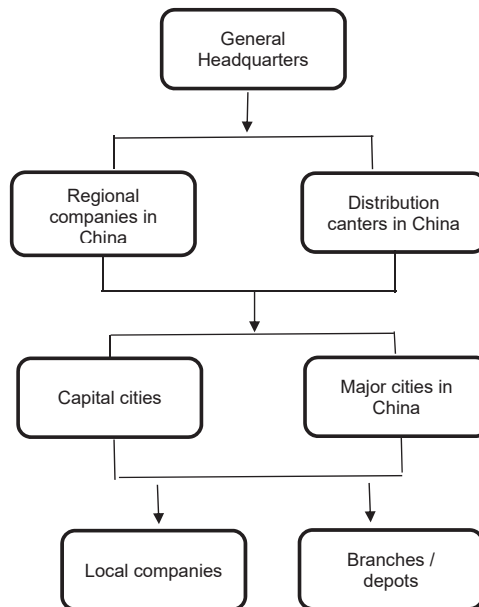
Data collection was based on various sources which contained information about the company including company-published reports, documents, journals, news articles and the company website, covering the period between 2017 and 2021.5-years of history were used to improve our interpretation of data and allow a better understanding of the current circumstances in BRI. All the interview data used in this study were obtained from the company’s website and published company reports to ensure data validity. Relevant documents such as company reports, marketing strategies, technology implementation plans and financial reports are collected and analysed to provide additional insights into digital transformation efforts and outcomes. Several researchers and professors participated in the data analysis process. Transcripts from interviews and key documents are analysed using qualitative analysis techniques to identify recurring themes, patterns and insights related to our research questions. Through the case study, we demonstrate how YTO’s internationalisation experience exemplifies different types of supply chain integration. This includes not only the physical flow of goods but also intangible flows like information

and finance. In this way, we make a valuable contribution to enhancing the current body of knowledge on global logistics integration in the context of the BRI.

3.1 Overview of YTO Express Group

YTO Express Group Co. Ltd is a leading logistics and courier service provider in China (McFarlan *et al.*, 2015). YTO Express was established in 2000 and is based in Shanghai, China. Presently, YTO Express Group Co. Ltd has evolved into a large-scale enterprise group that seamlessly integrates courier/express logistics, new technology, e-commerce and domestic and international air and sea cargo services. Additionally, the company owns airline subsidiaries to facilitate air freight deliveries. The company offers a comprehensive range of express delivery and logistics services both within China and to countries along the new Silk routes. These services encompass regional same-day, nationwide next-morning, nationwide next-day and international small parcel delivery options. Additionally, YTO Express Group Co. Ltd provides warehousing, distribution and special transportation services to cater to diverse customer needs (Rita, 2020).

YTO boasts an extensive delivery network, covering both domestic and international operations. Yuantong Airlines, a subsidiary of YTO Express, operates 12 cargo aircraft on more than 1000 belly cabin routes, connecting over 120 domestic cities. Furthermore, YTO Express operates on 2000 international routes and collaborates with over 100 overseas network agents, establishing a global presence in over 50 countries across four continents. As part of its strategic vision, YTO Express aims to become the largest Chinese mainland courier in terms of international business. To achieve this, the company plans to capitalise on routes aligned with the Chinese government’s Belt and Road trade strategy (2021a). Figure 2 shows the company network in China.



Source(s): YTO company website

Figure 2.  
YTO domestic network  
in China



In 2017, YTO Express made a significant acquisition, obtaining a 62% stake in On Time Logistics Holdings Ltd. As a result, YTO gained control over the On Time Group, marking the largest international merger and acquisition in the Chinese express logistics sector at that time (2017b). YTO expressed its commitment to creating an international logistics network to bolster the development of the “Belt and Road” initiative. Additionally, this undertaking aligns with and contributes to essential Chinese national strategies, such as “Made in China” and “Service in China” (2020a).

On Time Group is a rapidly expanding international logistics company primarily focused on air and sea freight forwarding, warehousing, delivery, customs clearance and other logistics services. With a widespread presence, On Time operates branches in 17 countries and regions, along with 52 trans-shipment centres globally, facilitating more than 2000 lines that cover over 150 countries. On Time has successfully cultivated a diverse customer base, encompassing various forwarders and direct clients (2017b). YTO harnesses the resources of the On Time group to expand and strengthen its international delivery network. By leveraging the capabilities and assets of On Time, YTO significantly enhances its capacity to offer efficient and dependable international delivery services. YTO has global offices in the United Arab Emirates, Bangladesh, Hong Kong, Indonesia, India, Japan, Cambodia, South Korea, Sri Lanka, Malaysia, Netherlands, Singapore, Thailand, Taiwan, America and Vietnam. This strategic collaboration allows YTO to leverage the expertise, network and infrastructure of the On Time group to expand its reach and strengthen its presence in the global delivery landscape. By capitalising on these shared resources, YTO can effectively develop and optimise its international delivery operations to better serve its customers worldwide.

As stated in YTO’s report, due to the escalating labour costs and the increasing demand for enhanced logistics efficiency, the company is driven to develop innovative delivery models to address the challenges associated with last-mile delivery. These innovative models include the implementation of Smart Parcel Lockers, drones and unmanned vehicles. By embracing these technologies, YTO aims to enhance its last-mile delivery capabilities and overcome the obstacles posed by increasing labour costs and the need for improved efficiency in logistics operations. Consequently, YTO formulates its comprehensive digital transformation strategy by leveraging unmanned and smart delivery technologies. These cutting-edge advancements serve as the foundation for YTO’s digital transformation efforts, enabling the company to optimise its operations, enhance customer experiences and achieve greater efficiency and effectiveness throughout its delivery processes. By integrating unmanned and smart delivery technologies into its overall strategy, YTO embraces the opportunities presented by digitalisation to drive innovation and stay at the forefront of the evolving logistics industry.

YTO has established a global network to integrate information services and logistics express networks to support BRI firms. Message from YTO Express Group chief executive officer (CEO), Yu Weijiao said, “*The eCommerce platform in China operates with ‘Buy Globally’ and ‘Sell Globally’, and we will be responsible for ‘Transport Globally’ and ‘Deliver Globally’.* China Express is in a leading place globally, and YTO Express will bring a new experience of “China Service” and “China Speed” to global customers.” In recent years, YTO Airlines has continued the expansion of its international freight operations to support cross-border e-commerce, which is a part of BRI. It now operates eight international services covering Southeast Asia, Central Asia and Asia Pacific (2020b). In this case, we find that BRI has enhanced the flow of its goods, and intangible flow (Information and finance) in the global logistics and supply chain, YTO has played a critical role to enable global logistics and supply chain integration (Isa, 2020).

#### 4. YTO case study

In this section, we present the YTO Express Group case insights. The key global logistics and key supply chain integration enablers are discussed, analysed and mapped onto the GLSCIF. Firstly, we take a closer look at the global supply chain flow of goods and explore how the BRI enhances these flows. Then we analyse how YTO can further enhance their physical goods and intangible flows. Both tangible and intangible flows are intricately interconnected and influence each other within various aspects of economic activities. Figure 3 shows the key elements/systems in the tangible and intangible flows. Tangible flows mainly refer to the physical goods movement through the supply chain systems. Intangible flows encompass the exchange of non-physical elements, such as knowledge, information, intellectual property and data. These intangible assets play a crucial role in driving innovation, enhancing competitiveness and facilitating the efficient functioning of supply chains. Intangible flows often involve the transfer of ideas, technology, expertise and best practices among supply chain partners, enabling them to improve processes, develop new products and create value.

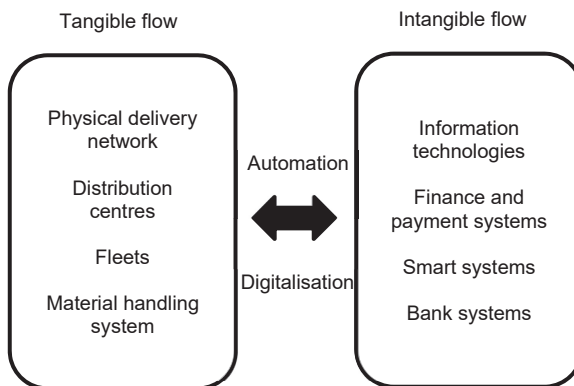
Tangible flows rely on intangible assets, such as information and knowledge, to optimise transportation routes, manage inventory and make informed decisions. At the same time, intangible flows depend on the tangible infrastructure of logistics and supply chains to facilitate the physical movement and exchange of goods. Moreover, advancements in technology, such as digitalisation and automation, have further blurred the boundaries between tangible and intangible flows. For instance, the digitisation of documents, the use of IoT devices and the integration of supply chain management systems enable real-time tracking and sharing of information, bridging the gap between tangible and intangible aspects of supply chains.

##### 4.1 BRI facilitates global logistics and supply chain integration

YTO participated in the joint construction, in Dubai, of a world-class hub for commerce and logistics. Dubai is a central hub in the Middle East, it connects the Red Sea and Gulf countries, linking Asia, Africa and Europe, it accounts for nearly 80% of UAE’s re-export trade. Gulf states heavily rely on imported goods and services, with 90% of online goods being imported from other countries. China is the UAE’s largest trading partner, with bilateral trade volume reaching US\$52bn in 2017. The BRI networks have laid a solid foundation for trade exchanges across borders and global supply chain operations (2019).

##### 4.2 Extended a global physical delivery network

Physical goods flow relies heavily on logistical networks, courier services are viewed as an effective way to deliver freight door-to-door based on intermodal freight transport



Source(s): Authors’ own creation/work

Figure 3. Tangible and intangible flows

(Wang *et al.*, 2018, 2020b; Wang, 2011). A range of transport modes can be used for global delivery. Common intermodal transports include road and air, road and railway, and road and ship (Wang, 2011). To achieve effective and efficient intermodal transport, it is imperative to access an efficient network with effective infrastructure.

After the acquisition of On Time Ltd, Hong Kong becomes the headquarters of YTO Global and YTO's global logistics hub. YTO CEO Yu said, "*Acquiring On Time Group gives us much easier access to expand our overseas business than building the networks by ourselves . . .*". The global logistics network coverage of YTO can be rapidly enhanced. YTO can further extend the scope of global logistics business services based on the On-Time Group's existing customers and overseas agents' network. In addition, integrating the service capabilities of both companies' express delivery, freight forwarding and warehousing, will initially form a comprehensive service capability around the world. The existing On Time Group's network and resources greatly reduces the time required for YTO to build its global business team.

Although shipping is a major component of global trade and a global logistics network, the COVID-19 pandemic has disrupted global shipping (Velayutham *et al.*, 2021; De Beukelaer, 2021). The Sino-Euro railway, which is a part of BRI, provides an alternative way to transport goods and increase global supply chain resilience. YTO is aligned with the BRI strategy to expand its global services, it does not only extend the road and air transport network but also attempts to utilise Sino-Euro international railway to develop its global delivery network.

Another example, relating to China-EU BRI (Gerstl and Wallenböck, 2020), YTO has established a logistics centre in the Czech Republic to support the focus of Chinese BRI firms to make cross-border transactions easier and improve European cross-border e-commerce cargo distribution. In addition, the logistics service centre for imported goods can significantly simplify conventional international trade, and cross-border e-commerce logistics processes, reduce service response time and increase the customers' satisfaction.

Southeast Asia is an important strategic partner in BRI (Garlick, 2020). According to the air cargo news on 21/06/2019, YTO is expanding international services with the introduction of a Bangkok route. YTO Airlines has started a three-times-per-week Boeing 737-300F service between Xi'an and Bangkok. The company representative said "*The service would act as a bridge between China's northwest inland regions and Thailand and shorten transport times . . . . At present, most of the imported fruits sold in the north-western region of China are transported through east China, south China and other places . . .*" YTO has significantly improved material flow between China and other countries along the new silk roads.

#### 4.3 Improved global collaboration and standardisation

Integrated logistics services are commonly associated with collaborative supply chain processes (Chen *et al.*, 2010; Childerhouse and Towill, 2003). Global parcel alliance (GPA) which was initiated by YTO is one of the world's first private delivery firms, providing an alternative to traditional postal services. In May 2017, YTO took the lead in launching GPA, more than 50 well-known express logistics companies from more than 20 countries became the first members of the alliance, and they were hailed as "the logistics belt of the Belt and Road". According to an interview from South China morning post, "*We can't meet our needs simply through ordinary acquisitions, so we're promoting a YTO style alliance,*" YTO vice president, Hao Wenning, said "*It will become a global logistics service provider for businesses around the world.*". GPA provides opportunities to standardise logistics processes including physical goods and intangible flows and facilitate information sharing and trust to integrate the global supply chain (2017a). Accordingly, "*one of the new alliance's main goals will be to standardize logistics procedures for a growing volume of cross-border delivery services,*" said YTO CEO Yu Weijiao, "*If we can't achieve this level of standardisation, then it's not an alliance*

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*and it's just a short-term thing.*" This indicates that global supply chain collaboration and standardisation can improve both physical goods and intangible flows.

In June 2017, Whistl, the leading delivery management company with activities in Business Mail, Doordrop Media and Parcels, has become the only UK member of the GPA. Nick Wells, Whistl CEO said: "*Our membership of the GPA underlines our commitment to building our presence in the global post and parcel market. Being the first UK member of the group also highlights our commitment to provide our customers with the latest, most efficient, ways to trade internationally.*" YTO demonstrates global collaboration and standardisation through the alliance (GPA) to further enhance supply chain flows to enable global logistics and supply chain integration.

#### 4.4 Innovation and digitalisation

Innovation promotes new ideas, new ways and new technologies to resolve business problems (Tidd, 2013). As we enter the digital era, such as industry 4.0 is about applying transformative technologies for managing and optimising production and supply chain systems (Lee *et al.*, 2015; Ivanov *et al.*, 2019). Businesses will inevitably encounter many new and complex problems during the digital transformation era, thus it is critical to embrace innovative and transformational technologies to adapt to the digital environment (Chan *et al.*, 2019). Many previous studies have investigated the impacts of innovations (Wang *et al.*, 2020a) and new technologies (Wang *et al.*, 2021) on supply chains in the Industry 4.0 era.

YTO embraces innovation to develop its global logistics and supply chain networks. YTO is viewed as a pioneer in China's express business sector (McFarlan *et al.*, 2015). In October 2017, YTO established the first international chamber of commerce in international logistics, and YTO Express Group CEO Yu Weijiao became the first President. The International Chamber of Commerce envisages "innovation and liaison" among business partners in the global supply chain and is committed to promoting the new global business logistics models by developing "the Belt and Road", such as global customs clearance, multimodal transport, smart warehousing and the integrated information system and digital supply chain network.

The Chinese government is investing in non-infrastructure digitalisation projects including the development of the Digital Silk Road, for information connectivity to enable BRI cooperation (PwC, 2018). The Digital Silk Road reduces the Digital Divide by supporting developing countries' digitalisation. This also provides many opportunities for global supply chain digitalisation post the COVID-19 pandemic (Ivanov, 2021). For example, international buyers may use the digital platform to search for Chinese suppliers and producers. Despite facing doubts and criticism from Western countries (Young and Lin, 2018; He, 2019), BRI could be considered a role model of digital global logistics and supply chain management in the digital transformation era.

Digitalisation and IT are critical for supply chain integration (Gunasekaran and Ngai, 2004; Paulraj and Chen, 2007; Rai *et al.*, 2006). Information integration refers to the sharing of key information along supply chain networks which is enabled by IT (Prajogo and Olhager, 2011; Rai *et al.*, 2006). IT and Industry 4.0 technologies, such as 5G, big data, cloud computing, IoT and blockchain facilitate intangible flows (Information and Finance) in the digital era (Ivanov, 2021) and indirectly enhance goods flow. In 2017, YTO established a national engineering laboratory to focus on logistics information-sharing technologies and industrial applications. This will help build a credible logistics platform, standardise global logistics and promote global logistics facilitation.

According to the report from the YTO research department, YTO Express focuses on drone delivery and utilises drones as vehicles for unmanned concepts, such as artificial intelligence (AI) and automation technologies, including barcode scanning, RFID (radio frequency identification) tagging and robotic systems, facilitate accurate inventory

management, efficient order fulfilment and faster processing of goods. Drone delivery enables real-time tracking and tracing of goods throughout the supply chain, enhancing visibility and reducing the risk of loss or theft. Drones improve last-mile delivery technologies like autonomous vehicles and route optimisation algorithms are transforming last-mile logistics, enabling faster and more efficient delivery of goods to customers.

Vice president of YTO Xiang Feng gave a speech at the 2019 Global Logistics Technology Conference and emphasised “5G can allow real-time analysis through big data centre and cloud services, this can provide customers with more comprehensive logistics services; there are many embedded devices in logistics, and based on 5G and data computing platforms, real-time feedback can be given to real-world scenarios, such as drone distribution. . . . We must pursue the integration of “three flows of the supply chain” including material flow, information flow and financial flow”, and the information technology supports material flow . . . Therefore, we must pay attention to every development of information technology in the Logistics industry.”

The Alibaba group, which is one of the largest e-commerce companies in China, has been working closely with YTO to develop an integrated supply chain system to facilitate the goods, information and financial flows among producers, suppliers and customers (Rita, 2020). In line with previous studies, IT is critical for supply chain integration (Gunasekaran and Ngai, 2004), as it supports both information and material flows (Prajogo and Olhager, 2011; Gunasekaran and Ngai, 2004) and bank payment technology (Silvestro and Lustrato, 2014).

In the last decade, propelled by rapid e-commerce growth, the sales volume of e-commerce in the Middle East has increased by 1500%. Over 60% of online shoppers in the Middle East purchase from businesses outside the Gulf region. With a combined population of more than 40 million, the UAE and Saudi Arabia are the largest e-commerce markets in the Middle East (Fulton, 2019). In 2020, YTO and Alibaba Group reached new strategic cooperation (Rita, 2020). The two parties will jointly proactively cooperate, including for express courier service, air freight, international logistics and supply chain networks, and IT, and jointly enhance their customer service and globally integrated e-commerce services capability. For example, online customers can buy products from China in UAE. This provides more business opportunities for BRI companies to access these emerging markets (2019).

BRI is relatively new firms face many new problems and challenges, innovation is critical to help firms to resolve these new issues. Innovation is considered a firm’s ability to continuously transform knowledge and ideas into new products, services, processes and systems for the benefit of the firm (Lawson and Samson, 2001; Yang, 2012). In this case, YTO promotes innovation and new technologies to enhance its logistics operations. YTO demonstrated its new logistics innovations at the 2019 Global Smart Logistics Summit, including AI customer service, unmanned delivery drones, autonomous cargo vehicles, fully automated warehouses and new energy logistics vehicles. New industry 4.0 technologies may help firms reduce costs and improve overall effectiveness in the long run. The new technologies facilitate material, information and financial flows (Prajogo and Olhager, 2011; Silvestro and Lustrato, 2014). Innovation and digitalisation play a vital role in supply chain integration (Gunasekaran and Ngai, 2004).

#### 4.5 Third-party mobile payment system

With the development of logistics and supply chain technologies and information systems, financial flows have attracted increased attention (Wang *et al.*, 2021). Conventionally, banks play a crucial role in integrating the flows of goods, information and money within supply chains. Suppliers, manufacturers and retailers often rely on various banking systems to facilitate the processing of payments (Silvestro and Lustrato, 2014). The implementation of integrated banking and payment systems fosters supply chain coordination and integration.

In the present day, numerous third-party mobile and online platforms are emerging. These platforms play a pivotal role by enabling accelerated payment processing, streamlining supply chain processes and mitigating payment-related risks among supply chain partners.

Alipay and WeChat pay dominate China's mobile payments market and enable overseas payments (2021b). As mentioned before, YTO has been working closely with its major shareholder Alibaba Group (Rita, 2020; Isa, 2020), who is the founder of Alipay, to promote their online payment system. Through the Alipay system, both shippers (sellers) and receivers (buyers) can conveniently organise courier deliveries and make payments. Additionally, YTO offers its mobile app or mini program within WeChat, enabling businesses and customers to use it for various delivery-related tasks, including parcel pickup, tracking and tracing and payment arrangements. YTO adopted the third-party mobile payment system to integrate the financial flow between buyers and suppliers. It simplifies the material flow, facilitates information flows and enhances supply chain coordination (Childerhouse and Towill, 2003).

Multiple types of supply chain integration including the physical flow of goods, and intangible flows (information and finance) have been investigated in this case study. These types of supply chain integration are inseparable. The smooth flow of information also plays a crucial role in facilitating the material flow (Paulraj and Chen, 2007), and financial flow (Silvestro and Lustrato, 2014) within the supply chain. We used the examples of YTO to demonstrate how the case integrates its global supply chain and logistics network under BRI. In shaping future logistics and supply chains, it is imperative to take into account the dynamics of international trade (Garlick, 2020). Furthermore, as discussed before, we are entering the digital era (i.e. industry 4.0) (Lee *et al.*, 2015; Ivanov and Dolgui, 2021), and there are many challenges and opportunities in the digital era (Tang and Veelenturf, 2019). This case study boldly incorporates the impacts of BRI on global logistics and supply chain integration in the digital era. This sheds light on international logistics and supply chain management in the digital era.

## 5. Discussion

According to the findings, we observe that the BRI enhances supply chain integration from a company's perspective, for example, YTO extended the physical delivery network in line with the BRI strategy. BRI enables a wide range of companies to internationalise their businesses and networks along the Belt and Road routes. YTO responded to the Chinese government's call to build a global logistics hub in Dubai to support China-UAE BRI (Fulton, 2019). YTO also established a logistics centre in the Czech Republic to support the China-EU BRI (Gerstl and Wallenböck, 2020). Although BRI has received a lot of criticism and doubts, the integration shows positive impacts on supply chain integration, such as an expansion of logistics networks, improved global collaboration and standardisation, accelerated innovation, new technology and digitalisation. Table 2 summarises the key global logistics and supply chain integration enablers identified in the case study. The identification of key enablers in the case study is reinforced by prior research conducted in the field. The findings from previous studies provide support and validation for the factors that were identified as crucial drivers in the case. This alignment between the case study and existing research enhances the credibility and robustness of the identified enablers, strengthening the understanding of their significance and impact.

The YTO case has identified the enablers for global logistics and supply chain integration in the digital era. The insights from the study are valuable for both researchers and managers regarding the impacts of BRI on global logistics and supply chain management. YTO has utilised the Chinese government's BRI strategy to develop its global supply chain along the Belt and Road routes (2020a) and continues to enhance its physical delivery networks and

**Table 2.**  
Global logistics and  
supply chain  
integration enablers

Enablers	Relevant studies
International trade agreement	Wang <i>et al.</i> (2018), Hong-Fei <i>et al.</i> (2018), He (2019), Liu and Dunford (2016)
Physical delivery networks	Thürer <i>et al.</i> (2020), He (2019), Hong-Fei <i>et al.</i> (2018), Wang <i>et al.</i> (2020b)
Logistics capabilities	Wang <i>et al.</i> (2018), Chan <i>et al.</i> (2019), Thürer <i>et al.</i> (2020), Wang <i>et al.</i> (2020a)
Internationalization/Global collaboration	Jone (2020), Liu and Dunford (2016), Thürer <i>et al.</i> (2020), Wang <i>et al.</i> (2021)
Standardization	Behnke and Janssen (2019), Thürer <i>et al.</i> (2020)
Regulations	Young and Lin (2018), He (2019), Abuza (2020)
Innovation	Hahn (2020), Chan <i>et al.</i> (2019), Wang <i>et al.</i> (2020a)
Digitalisation	Wamba and Queiroz (2020), Wang <i>et al.</i> (2021)
International payment system	Jone (2020), Thürer <i>et al.</i> (2020)
Internet & IT	Lee <i>et al.</i> (2015), Wang <i>et al.</i> (2021), Gilchrist (2016)
Value creation/adding	Thürer <i>et al.</i> (2020), Dittmer (2021)
Industry 4.0 technologies	Ivanov <i>et al.</i> (2019), Choi (2019), Wang (2020), Frank <i>et al.</i> (2019)

**Source(s):** Table created by authors

logistics capability (Rita, 2020) e.g. building domestic and international multi-modal transport and logistics hubs, and adding more international flights between China and BRI countries (2020b). In addition, YTO initiated the establishment of the GPA to standardise and globalise logistics networks and has adopted innovation and new technologies to transform and integrate their goods and intangible flows, embracing the digital transformation era (2017a). YTO has worked closely with Alibaba to enhance its digital service and IT capability to support both goods and intangible flows (Rita, 2020). Moreover, YTO utilises third-party mobile payment systems, e.g. Alipay, and WeChat payment to enable inclusive finance flows between BRI countries (2021b).

Excluding specific geopolitical considerations, the BRI has enhanced connectivity within global supply chains. As discussed before, BRI is a massive infrastructure and development project. The new transportation infrastructure under the BRI, such as railways, highways and ports, enhances connectivity between participating countries. This can reduce transportation costs, improve transit times and facilitate the movement of goods along the BRI routes. Enhanced connectivity can lead to increased trade and investment between regions, stimulating economic growth. However, the BRI's influence extends beyond economic aspects, as it also carries geopolitical implications (Liang and Ding, 2021). BRI serves as a mechanism for China to bolster its economic and political influence by strengthening relationships with participating countries. As nations become more closely connected through infrastructure projects and trade agreements under the BRI, China gains greater leverage and sway over these countries' economic policies and political decisions (Leman, 2019; Abuza, 2020). It could lead to shifts in trade routes, investment patterns and supply chain dependencies.

While our study focused on a single case, YTO can be viewed as a representative company operating within the BRI. By actively collaborating with other BRI-engaged firms, YTO supports the BRI strategy by delivering products and services to customers. Our findings offer insights valuable to both practitioners and researchers seeking to comprehend how the BRI integrates global supply chains in the digital era. Particularly in the context of "Globalisation 2.0," where geopolitics significantly influences supply chains, this case sheds light on China's interactions with pro-China nations. Multiple examples have been discussed from different aspects of global logistics and supply chain integration to validate our framework, GLSCIF. Furthermore, the intangible flow theory suggests that countries and

companies with a strong presence and effective management of intangible assets are better positioned to participate in and benefit from global trade and supply chains. For example: Intangible assets such as patents, copyrights and proprietary technology drive innovation and technological advancement. Companies that invest in research and development (R&D) to create and protect intellectual property can develop innovative products and services that differentiate them from competitors and capture market share globally. Intangible assets also include relationships with customers, suppliers and partners. Companies that cultivate strong relationships and networks across the value chain can access new markets, secure reliable sources of supply, and collaborate more effectively with partners to create value for customers. Tangible and intangible flows are intertwined and mutually reinforcing within global supply chains. They interact and influence each other in various ways, from optimising logistics operations to driving innovation and shaping consumer behaviour. Recognising and managing the interconnectedness of these flows is vital for organisations to effectively navigate the complexities of modern supply chains and gain a competitive advantage in the global marketplace.

YTO's cases demonstrate how BRI promotes global logistics and supply chain integration. We also found in this case study, YTO focuses on expanding its global network, by adopting new technologies, standardisation and simplifying its processes to support Chinese firms to access international opportunities presented by BRI, especially in globalisation 2.0, those international opportunities are mainly located in pro-China and developing countries (Bernhart, 2022; Chan and Gunasekaran, 2020). Global supply chain integration, as facilitated by the BRI, primarily focuses on enhancing connectivity and collaboration between China and the countries participating in the BRI. Young and Lin (2018) argue that BRI should encourage cross-partnering with firms from a wider range of countries to avoid the emergence of a narrow 'hub and spoke' system and promote the development of multi-lateral institutions for appraising and governing resources under the broader BRI framework, including dispute resolution mechanisms. The report prepared by PwC (2018) suggests establishing hubs in China or elsewhere utilising BRI infrastructure will enhance asset value.

We have entered a new era, enterprises are impelled to take new opportunities during the digital transformation (Hong-Fei *et al.*, 2018) and globalisation 2.0 (Bernhart, 2022). YTO CEO, Yu Weijiao, is of the opinion that China's express courier service has transitioned into a new digital phase. He highlights the following types of integration:

- (1) Global supply chain and technology integration,
- (2) Global logistics and international trade integration,
- (3) Upstream and downstream value chain integration,
- (4) Talent, technology and finance integration.

A new era of digitalisation in logistics and supply chains has begun, while the U.S.–China trade war remains unresolved. Global logistics and supply chain networks have been severely affected by the COVID-19 pandemic (Wang and Wang, 2023). Due to geopolitical factors, there will undoubtedly be more uncertainty post COVID-19 (Patricia *et al.*, 2020). In traditional trade theories, the focus is primarily on the exchange of tangible goods, such as raw materials or manufactured products. However, the intangible flow theory argues that intangible flows, such as information technologies and financial regulations play a crucial role in global supply chains. We also argue that it is important to also consider other intangible factors, such as geopolitical influences. From our case study, we investigated the role of BRI from the perspective of logistics and supply chain. BRI has also received a lot of criticism and doubts. These aspects provide research opportunities in further studies. Both



challenges and opportunities coexist in the future of global logistics development, those that can adapt and evolve will be able to mitigate the risks and leverage the opportunities.

As with all case studies generalisation is limited, however, this does not necessarily affect the accuracy of findings (Zikmund, 2013). Secondary data were used to analyse the case, this also limits the breadth of case activities examined. Case study depends on researchers' subjective ideas and opinions, thus future research is required to verify and expand the findings in different contexts.

There is a probability that China will become the world's biggest economy by 2030 (Maddison, 2006). BRI research provides empirical opportunities to understand the future development of China's international trade policies (Hong-Fei *et al.*, 2018). This paper provides a good starting point for discussion and further research on BRI and global logistics and supply chain management (Thürer *et al.*, 2020). As we can see, geopolitical influences are increasingly shaping international logistics and supply chains, further multi-disciplinary research will be required to tackle some specific issues in certain countries. For example, how BRI be leveraged to further optimise global logistics and supply chains? What are the drawbacks or negative aspects of the BRI? How can the potential issues with BRI be overcome? Moreover, the GLSCIF is presented for the first time in this paper, further research is required to validate and enrich this model in the digital transformation era to embrace supply chain digitalisation.

## 6. Conclusion

The paper makes several contributions to research and practice. First, we provide in-depth insights into the impacts of BRI on global supply chain integration, underlining the significance of international trade agreements, on global supply chain operations. Our synthesised framework, GLSCIF, advances supply chain integration theory by incorporating a logistics triadic perspective and the combination of physical (tangible) and intangible flows. According to the intangible flow theory, intangible assets have become increasingly important in shaping global competitiveness. They enable companies to differentiate their products and services, develop innovative solutions, and gain a competitive edge. The case study is used to verify the framework and extends the conversation to include innovation, digitalisation and new technologies that facilitate the physical and intangible flows when integrating global supply chains. Thus, providing further insights into upstream and downstream value chain integration and value creation in the digital era and globalisation 2.0. Finally, this paper provides an empirical contribution to the emerging field of research on the interface of global supply chain and BRI (Gerstl and Wallenböck, 2020; Thürer *et al.*, 2020).

The study possesses certain limitations that present potential avenues for future research exploration. First, this is a single case study with multiple examples, we only focus on a typical company – YTO under BRI, the utilisation of a single case study may impose constraints on the generalisability of the results. Geopolitical impacts are not considered in the case study, as our focus lies on China's interpretation of globalisation (BRI) from the perspective logistics and supply chain. This highlights the need for additional research to broaden the scope and enhance the applicability of the findings. Second, the GLSCIF model is introduced for the first time in this paper, presenting a unique contribution to comprehending China's expansion of its international network through the countries involved in the BRI from a logistics and supply chain perspective, paving the way for further validation in various contexts. Further research can focus on validating the model across different scenarios and contexts to enhance its robustness and broaden its potential applications. Third, BRI is a broad project across industries and countries, it has been criticised by different parties and perspectives, our study only focused on the global and supply chain integration from 3PL's perspective, further research may be considered to further understand different effects of BRI from different perspectives.

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