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E-BRI: The role of fourth-party logistics for Sino-Russian e-commerce

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Abstract

The Belt and Road Initiative (BRI) has garnered significant attention over the past decade. This expansive project promises lucrative opportunities and a potential boost to global trade. However, infrastructure, policy, and strategic challenges pose risks to its international success. This study examines the forces driving the growth of e-commerce supply chain companies participating in the BRI, focusing on China and Russia as research context. Using the Value Chain theory, we explain how combination of its primary and support activities influences the development of international supply chains within the BRI. We employ a multilinear regression model to test the proposed framework, with an ANOVA model to verify the robustness of our findings. The results reveal that primary and support activities have different significance within BRI collaboration. Exogenous factors, particularly industrial and municipal policies, as well as infrastructural development, are the key drivers of e-commerce success in the BRI supply chains. This study contributes to the growing body of literature on the BRI by providing empirical evidence of the factors influencing e-commerce growth in participating countries. Our findings offer insights for firms and policymakers seeking to capitalize on the opportunities presented by the BRI and highlight the areas requiring attention to ensure its long-term viability and success.

Keywords

Belt and Road Initiative (BRI); e-commerce; forth-party logistics (4PL); value chain

JEL: F42, F55, F63, O19, O33, R40.

1. Introduction

The Belt and Road Initiative (BRI) is a global project launched by China in 2013, aimed at enhancing economic cooperation across Asia, Europe, and Africa. It comprises two main components, Silk Road Economic Belt and the 21st Century Maritime Silk Road, designed to create extensive trade networks and improve connectivity. The initiative focuses on infrastructure development, policy coordination, and collaborative efforts among participating countries (European Bank for Reconstruction and Development, 2024). To address challenges such as logistics disruptions caused by the Covid-19 pandemic, China is promoting e-commerce as part of the BRI, establishing logistics bases and cross-border digital parks (People's Daily, 2022; TMO Group, 2024). However, significant hurdles such as outdated infrastructure and regulatory restrictions hinder the progress (Daly & Cui, 2003; C.I. Process, 2024). The fourth-party logistics (4PL) model is an emerging solution to optimize supply chains by managing logistics comprehensively (Win, 2008; Savino del Bene, 2024).

Recent studies indicate that the BRI increasingly incorporates e-commerce as a strategic response to economic challenges and insufficient innovativeness of Chinese firms, which could hinder the project's potential and affect partner economies (Lai et al., 2023; Li & Branstetter, 2024). E-commerce has the potential to effectively address some of these challenges, including logistic restrictions caused by Covid-19 pandemics, as it can smooth out trade flows and enhance market access. Several studies on e-commerce in the context of the BRI highlighted the significance of geographic factors for the infrastructure development, unequal trade dynamics between coastal and inland nations, and advantages for trade in specific commodities (Lee, Hu et al., 2022; Zhao, 2020; Shen et al., 2024). The 4PL model can be particularly useful for the BRI's e-commerce, as it seeks to optimize supplier relationships and broaden logistics services beyond the traditional third-party logistics (3PL) focusing on transportation and warehousing. This model is essential for navigating the complexities of cross-border trade within the BRI and adapting to the evolving landscape of both Chinese and global e-commerce (Jian et al., 2023; TMO Group, 2024). By leveraging digital platforms and information systems, 4PL supports the increasing demand for digitalization in logistics, thus enhancing operational efficiency for stakeholders involved in BRI projects (Wei, 2016; Tasnim, 2020).

Despite the significance of 4PL, the studies exploring the role of e-commerce for the BRI remain scarce. Research into the BRI has increased over the past decade (Panibratov et al., 2022), but most studies focus on China's outcomes while there is a need for exploring broader international implications (Lee, Hu et al., 2022). Adapting global supply chains is critically important for the BRI participants who, in pursuit of post-pandemic recovery, have to tackle serious economic challenges (Chen et al., 2022). Understanding factors that drive successful 4PL implementation will inform the ongoing debates about the effectiveness of various logistics models (Mehmann & Teuteberg, 2016). Analyzing how companies adapt strategically

can enhance our understanding of global supply chain management within extensive trade initiatives (Carrai, 2021; Ye, 2021).

We ground our research with Michael Porter's value chain (VC) theory, which explains how companies create value through structured activities (Porter, 2001). Although interest in VC analysis has waned, significant international collaborations like the BRI could revitalize it by moderating VC tasks and presenting new competitive advantages. While e-commerce offers resilience to businesses, it also poses risks associated with infrastructure issues and emerging regulations that can hinder value creation in logistics (Zheng et al., 2021; Ram & Zhang, 2020). To thoroughly investigate this complex topic, we need to answer the following question: *Which factors influence the adoption of the 4PL model by e-commerce firms participating in the BRI?*

In this paper, we use the Sino-Russian context as an empirical venue. There are several reasons for this choice. Russia is an active participant of the BRI; it has well-developed commercial relationships with China. In 2022, Sino-Russian trade achieved a notable growth marking the record of 7.2 bln USD (General Administrator of Customs, 2023). The two countries have signed agreements on strategic infrastructure development. Mutual development of international road, aerial and cargo connections means that we can expect rapid unfolding of logistic infrastructure in the near future (TASS, 2024; Civil Aviation Administration of China, 2018). Furthermore, since Russian firms experience decline in international cooperation and many of the previous trade linkages have been broken, their involvement in the BRI should intensify their growth and development (Kireeva, 2023).

We carried out an online survey of 152 Russian and Chinese respondents engaged in 4PL logistics. The acquired data have been analysed using multiple linear regression (MLR). This method serves to examine the relationship between one dependent variable and multiple independent variables, assuming a linear relationship between them. To validate the regression results, we also applied Analysis of Variance (ANOVA). This method tests hypotheses about group means, helping determine whether observed differences in sample means are due to actual population differences or random sampling variability.

This research makes several important theoretical contributions to the BRI studies, e-commerce and logistics. First, we have identified the forces that enable logistics companies to develop within the BRI context. Second, we have tested and validated many previously reported qualitative findings, demonstrating that the theories and models from prior analyses have broad applicability. Third, our research seeks to expand the applicability of VC theory to immature markets in developing countries. Although VC theory as theoretical lens has been less popular in recent years, our study shows that it can be applied to research into value creating activities of the firms that participate in international trade cooperation. We have also found that VC provides a compelling explanation for the dynamic competitiveness of Chinese and Russian 4PL companies. From the managerial perspective, the research indicates the direction of development of the BRI e-commerce and highlights the strengths and weaknesses in value creation process, which can be highly informative for investors.

The remainder of the study is organized as follows. First, we present a priori information to justify the choice of variables from theoretical perspective. Next, we conduct quantitative analysis and interpret results. After that we comment on the acquired insights and finally draw theoretical and managerial conclusions.

2. Theoretical background

2.1. BRI as international trade initiative

The BRI was launched in 2013 as a major initiative to increase China's economic links to Southeast Asia, Central Asia, Russia and Central and Eastern Europe (Panibratov et al., 2022). It reflects the aspirations of China to become a dominant player in the international financial system and to exert its soft power (Taliga, 2021). The proponents of the initiative emphasize the trade advantages and mutual benefits it offers both to China and participating countries. Potentially, its implementation should influence not only trade and finance but also sectors such as energy and technology markets, health, tourism, education, and culture (Ohashi, 2018; Dong & Pan, 2020).

By December 2023, 151 countries had joined the BRI by signing a Memorandum of Understanding (MoU) with China; most of them were emerging markets (Green Finance and Development Center, 2023). They had different motivations for participation, including the opportunity to access capital markets and financial resources through Chinese investments and loans (Lai et al., 2023). The promise of financial support particularly encourages participation, especially among smaller economies that may lack alternative funding sources. The BRI also advances a political agenda by inviting emerging markets to forge closer ties with China through political support and economic partnerships (Lu et al., 2021). Besides, BRI aims to reduce the trade costs globally by providing the necessary infrastructure. This reduction can lead to increased trade between China and other participating countries and incentivize new membership in the initiative (European Bank for Reconstruction and Development, 2024).

The BRI, as a global trade initiative, presents not only opportunities but also considerable risks. Despite the positive narrative consistently promoted by the Chinese government, around 35% of BRI projects have been classified as failures for various reasons (Nelson, 2023). Alongside financial burdens imposed on emerging economies through these projects, the BRI could have exacerbated economic challenges for participating countries (Lai et al., 2020). Analyzing the progress towards the goals of 'Made in China 2025', another ambitious government initiative to promote international collaboration, Li & Branstetter (2021) indicates that Chinese firms still have insufficient innovation capability. Other authors refer to the irrelevant and redundant policies and multi-vectored goals that are hard to achieve simultaneously (Wang et al., 2020).

In addition to economic challenges, the participant countries are facing political risks. Numerous sources point out that Chinese companies, especially state-owned enterprises, are not always welcome in host countries because of their substantial bargaining power and expansion threats (Li et al., 2021). These companies are also frequently favored with government subsidies and financial loans as part of their involvement in BRI projects (Wen & Zhao, 2021). Besides, global political and economic climate are important moderators of BRI, causing fluctuations in the conditions, under which the BRI projects operate (Schulhof et al., 2022). This volatility can propagate shocks in stock markets, currency values, and commodity prices, which may adversely affect investment opportunities (Lee, Karim et al., 2022).

2.2. Sino-Russian e-commerce and logistics

Silk Road e-commerce is another constituent of the BRI which serves as a platform for international cooperation facilitating two-way trade between China and countries along the route. In 2021, the Covid-19 pandemics caused disruption of the global industrial and supply chains, which resulted in reduction or cancellation of many maritime and aerial transportation streams (Atayah et al., 2022). To maintain the speed of cross-border e-commerce logistics between China and the countries involved in the BRI, China began to set up logistics bases, overseas warehouses and cross-border digital industrial parks. One of such these is Lianyungang logistics base that was jointly funded and constructed by China and Kazakhstan (People's Daily, 2022). The analytical reports claim that e-commerce will keep expanding globally (TMO Group, 2024) and especially in China, where the e-commerce transactions account for 47% of total sales compared to a global average of 25%, underscoring the important role of China in global economy and significance of BRI for the country's economic growth (Statista, 2023).

Since the time of initiating bilateral agreements on e-commerce, China has established cooperation mechanisms with over 20 countries, enhancing policy exchange, industry promotion, and capacity building (National Development and Reform Commission, 2022). Logistics plays a crucial role in establishing trade networks with the participant countries. The impact of the trade regulations of developed countries on China's CBEC exports is second only to that of the logistics environment, and the impact of the e-commerce environment in developing countries is greater than that of logistics (Guo et al., 2024). This indicates certain overlaps between different layers of business environment.

China's logistics industry started to develop comparatively late but it is growing rapidly and over the past decade it has achieved impressive results. The major determinant of success has been maritime transport logistics (Wang et al., 2021). In 2019, the total social logistics in China was 298 trillion yuan, a year-on-year increase of 5.9%; its total cost was 14.6 trillion yuan, a year-on-year increase of 7.3%. Covid-19 pandemics led to serious disruptions in global supply chains, with severe downfall of Chinese logistics, which has not recovered entirely even now. At the same time,

the pandemic catalyzed innovation in Chinese firms and prompted them to adopt more digitalized and resilient logistic models. This shift included the use of green supply chain practices spurred by both global and national sustainability initiatives (Li et al., 2021).

Logistics business models mostly operate within a bottom-up hierarchy but they fundamentally differ in the range of services and functionalities. 1PL and 2PL are better suited for manufacturers and small enterprises respectively, whereas 3PL and 4PL are both meant for larger companies but differ in functionality. In the 4PL model, all supply chain processes are outsourced to external parties. Compared to the 3PL, 4PL offers more sophisticated ways of outsourcing logistics as it integrates all activities of a company and provides customers with integrated logistics operation solutions. It attaches great importance to the integration and optimization of resources for the entire logistics system, rather than focusing on specific logistics operations, such as shipping or warehousing (Gruchmann et al, 2020; Feng et al., 2023).

Russia and China have announced ambitious cooperation agreements on the development of transport infrastructure and logistics. The two countries' firms have much to improve in the technological sphere. They need to establish information exchange through satellite navigation systems of both countries, construct 5G mobile communication networks and build infrastructure (Liu et al., 2022). Concerning the development of 4PL logistics, Russia faces challenges such as insufficient technological adoption and less developed infrastructure compared to China. Besides, the Russian e-commerce sector may experience skilled labour shortages because of low unemployment rate and persistent outflow of talent (Latukha et al., 2023; Oreanda News, 2024), which can affect logistics in some regions.

Government policies are also very important for the BRI logistics. In China this sector is heavily regulated, with multiple layers of regulations imposed by national, regional, and local authorities. This regulatory environment can differ significantly at the region and city levels, complicating efforts to establish a national logistics network and hindering international collaboration (C.I. Process, 2024). Since China's accession to the WTO in 2001, some restrictions have been loosened but local governments still maintain bureaucratic barriers that protect local businesses, making it difficult for the new players to enter the industry and compete effectively. Indeed, the national and local industrial policies sometimes present thorny issues for 4PL activities (Yu, 2018).

2.3. Value chain in the BRI

Sustaining the VC is one of the strategies to achieve competitive advantage that involves the full range of activities a business undertakes to deliver a product or service, from initial conception to final delivery and beyond (Figure 1). VCs are essential for firms engaging in BRI, as they enable successful collaboration under rapidly changing international business environment with the potential to become transformed into the global VCs. This is a development (Porter, 2001) that enjoys the support of the

BRI. While policies, infrastructure, and industrial standards are crucial exogenous factors, the firm-level ones also significantly impact the success of 4PL e-commerce. The present study employs the VC theory to explore these determinants.

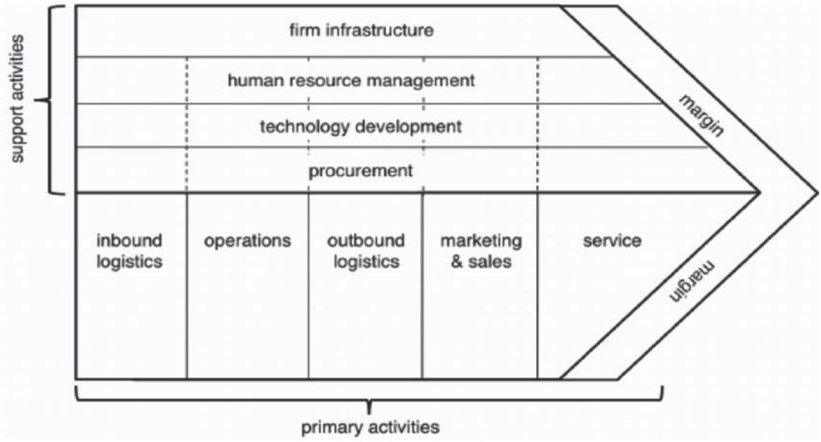

Figure 1. Porter's value chain (Porter, 2001)

VC-related activities include primary and support activities. Primary activities involve tasks that directly contribute to value creation through operations and products. 4PL as a business model deals with the other type: it outsources logistic activities of customer enterprises. It differs from 3PL in that it can handle a much larger scope of tasks.

At the level of primary activities, BRI can drive demand for various logistic services, thus creating growth factors for enterprises. The development of the railway Land bridge between China and Europe is an example of how service companies seize a lucrative business opportunity. This initiative created a faster, more reliable and cost-effective transport alternative to traditional maritime routes, connecting 27 Chinese cities with eleven EU destinations by May 2017. Enhanced service (improved tracking, less-than-container-load services and refrigerated containers) made the project more attractive to traders and reduced the trade costs (Pomfret, 2019).

BRI significantly influences marketing and service strategies of partnering enterprises. Respective market-oriented activities become a key instrument for cultivating knowledge about partners which improves the use of information within collaboration and helps to secure the necessary assets (Ahmat et al., 2021). Furthermore, the BRI positively impacts the image of contributing countries, thereby increasing marketing effectiveness of firms belonging to them (Deng et al., 2024; Liu & Ding, 2024). As for the service, which is one of the primary activities in the VC, digitalization facilitates service delivery and contributes to general satisfaction. It also provides opportunities for development of more innovative services, suggesting possibilities for diversification (Agostino et al., 2021; Ambalov & Heim, 2020).

The support activities are secondary component of VC aimed to enhance its primary activities. They can support the entire VC or be associated with certain primary activities (Porter, 2001). They are normally linked with a particular functional division of an enterprise and encompass HRM, procurement, and firm infrastructure and technologies. Human resources in BRI are regarded as a form of intellectual capital that helps evaluate the strengths and weaknesses of strategies employed by the Chinese companies (Kong et al., 2020). Consequently, the Chinese government expects that the BRI will not only foster the development of partnerships but also increase the workforce supply through technical and vocational training (Johston, 2023).

Infrastructure and technologies are critical components of VC everywhere and the BRI is no exception. The development of logistics infrastructure is prioritized as its key objective, often overshadowing social projects. Infrastructure has become central to the BRI, with the Chinese government actively providing funds to support these developments. However, there are concerns about the possible underestimation of the project-related risks that can result in costly failures. It is therefore essential that clear infrastructural policy programs are implemented to meet the needs of the participant enterprises. Such programs could greatly improve collaboration within the BRI framework.

The interplay between firm-level determinants and external factors is crucial for the success of 4PL and e-commerce, particularly for the VCs exposed to dynamic and international business environments. Drawing upon the insights from the literature, we have identified the items that appear to be directly and indirectly linked to specific VC activities and analyzed their connection with the development stage of logistics. Table 1 below presents a summary of the factors which constitute the core of a priori knowledge required for quantitative analysis.

Table 1. 4PL influencing factors

The driving factors of Sino-Russian 4PL	Item	VC activity
Logistics development stage	S1	
Logistics service scope	S2	Primary
Logistics industry standards	S3	General
Logistics organizational structure	S4	Primary
Government management functions	S5	General
Logistics professionals	S6	Support
Logistics infrastructure	S7	Support
Industry entry barriers	S8	General
Supply chain resource integration capabilities	S9	Primary
Resource development capability	S10	Support
Coordination of logistics and industrial development	S11	Support
Customer recognition and trust	S12	Primary
Logistics system and policy	S13	Primary

These 13 factors can also be divided into external and internal ones. To understand how firms can effectively navigate challenges and seize opportunities in a rapidly evolving marketplace, it is necessary to analyze the significance of these factors. In the next section we explain the methodology and present the outcomes of our analysis.

3. Methodology

3.1. Data and respondents

The data for this study were collected through a survey conducted in 2021-2022 in China and Russia. The purpose of the survey was to gather the data that characterize the factors influencing 4PL industry in Sino-Russian e-commerce. Respondents were selected according to the two criteria: they were to work in a Sino-Russian e-commerce logistics company and its affiliated logistics companies were to have joined the BRI support plan. The survey consisted of 55 questions; it was divided into three parts in order to collect the demographic data of respondents, find out the 4PL development level of their company, and identify the factors that influence the development of 4PL firms. All the questions were in the Chinese language so the Russian respondents had to possess the Chinese reading skills to participate in the survey. The limitations of the study were determined by the following facts: first, the Chinese respondents generally have greater knowledge of the BRI and their influence is comparatively more significant; second, the language barrier prevented some of the potential Russian respondents from participating. To create the questionnaire and access the respondents we used the WIX[1] online survey platform. To ensure that the sample is large enough, we collaborated with professional companies for the distribution and collection of questionnaires. Ultimately, 152 questionnaires were filled out by representatives of the two countries' e-commerce logistics companies.

3.2. Method and analysis

After collecting all the necessary data and encoding them, we conducted a quantitative analysis. The primary method employed was MLR, which is a type of regression model that examines the relationship between one dependent variable and multiple independent variables. The MLR model assumes a linear relationship among the variables, enabling the simultaneous analysis of the impact of various independent variables on the dependent variable. This approach provides insights into complex

[1] WIX.com is a professional online questionnaire survey, examination, evaluation, and voting platform, focusing on providing users with a series of services such as questionnaire design. The Chinese official site - [URL]: https://www.wjx.cn/?source=baidu&plan=问卷星

relationships that simpler models may overlook, making it well-suited for the objectives of our study (Uyanik & Güler, 2013).

To enhance the robustness of our regression results, we also applied ANOVA. This method serves to test hypotheses allowing researchers to determine whether observed differences in the sample means are attributable to actual differences in the populations or merely the result of random sampling variability. In our study, ANOVA was employed to validate the findings from our regression analysis (Ahmand & Harison, 2015).

Prior to conducting MLR, we performed Exploratory Factor Analysis (EFA), which included assessments such as Cronbach's Alpha, the Kaiser-Meyer-Olkin (KMO) Test, and Bartlett's Test of Sphericity (BTS). For these analyses, we utilized SPSS analytical software as our primary tool.

3.3. Data Analysis

To control for bias and validity of the results obtained, we asked the respondents about their professional qualities. The descriptive statistics allowed us to create a profile of a typical respondent. Most respondents are ordinary employees of the company, aged 31-50, with a bachelor's degree or college education and a salary of 3001-6000 RMB. The majority of respondents have certain industry experience and about 50% of them are middle and senior managers who have full understanding of the industry. The collected data are consistent with our expectations and suitable for further analysis.

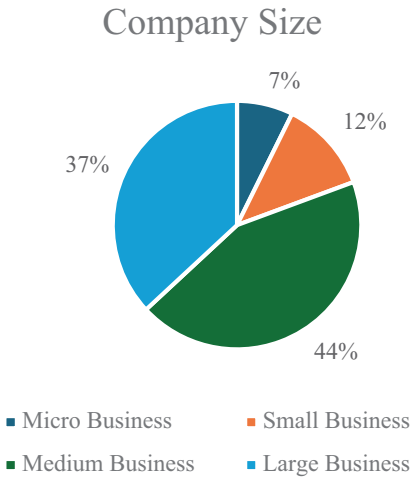

Figure 2. Company Size

Most respondents work for medium or large logistics companies (see Figure 2) characterized by relatively high level of informatization that have major influence in the logistics industry and sufficient talent reserves (Latukha et al., 2023). We also addressed a considerable number of respondents from small and medium-sized companies.

It should be noted that, because of the vast employee numbers in large companies, the possibility of several groups of samples from the same company cannot be ruled out. That is why samples from small and medium-sized companies also need to be considered.

3.4. Linear analysis

Having processed the data, we moved on to the analysis itself, beginning with EFA. We applied KMO test and BTS. These statistical tests, that are essential parts of EFA, are used primarily in factor analysis. They help assess the appropriateness of the relationships between variables. We observe that KMO statistic value is 0.789. A higher KMO value suggests that the variables share a high degree of common variance, which makes them suitable for factor analysis (Zhang et al., 2024). The BTS determines whether the correlation matrix of variables is an identity matrix, which would indicate that the variables are uncorrelated and unsuitable for factor analysis. The null hypothesis states that there are no significant correlations among the variables (Tobias & Carlson, 1969). In our cases the significant result is 0.000, which is less than 0.05, indicating that correlations exist in the data. It means that both tests support the appropriateness of proceeding with factor analysis.

Further, we apply the KMO and BTS to each analyzed factor (Table 2). The values of KMO range from 0.7 to 0.75 which is slightly less than overall consistency of data but allows to conclude that factors have good consistency when taken separately. BTS significance result of all the indicators is 0.000, which is less than 0.05, indicating that the reliability of the research data is high, and the next step can be taken.

Table 2. Factor-focused KMO and Bartlett's test

№	Indicator	KMO value	Sig. Bartlett
1	Logistics development stage	.719	.000
2	Logistics service scope	.746	.000
3	Logistics industry standards	.727	.000
4	Logistics organizational structure	.734	.000
5	Government management functions	.759	.000
6	Logistics professionals	.725	.000
7	Logistics infrastructure	.730	.000
8	Industry entry barriers	.744	.000
9	Supply chain resource integration capabilities	.729	.000
10	Resource development capability	.729	.000
11	Coordination of logistics and industrial development	.722	.000
12	Customer recognition and trust	.749	.000
13	Logistics system and policy	.709	.000

Having prepared the data and ensured their reliability and consistency, we proceeded to the quantitative analysis in the form of linear regression and ANOVA modelling.

Given the multifaceted nature of the capabilities that companies need to ensure international success of 4PL model, we codified the data into factors to test their influence on the development of 4P logistics in Sino-Russian companies that participate in BRI. To take account of multiple factors, we decided to use multiple linear regression that included 13 factors.

The theoretical formula for our regression

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} \ldots + \beta_{13} x_{i13} + \in$$

where y_i is the predicted value of the dependent variable, β_0 is the y-intercept (constant), β_i are the coefficients for each independent variable and x_{ij} are the independent variables themselves. $\in$ represents the residuals (Uyanik & Güler, 2013).

In accordance with the aim of our study, we selected the *development level of 4PL* as dependent variable in our model. We assessed the model using the least squares estimation method to acquire the coefficient weights and saw that several factors related to logistics significantly influence the dependent variable, with strong evidence supporting their effects (as indicated by p-values). Table 3 features the key indicators of the model that point to its properties.

Table 3. Regression Summary

R	R- Square	Adjusted R-square	Std. Error of the Estimate	R-Squared Variation	F- Variation	DF 1	DF 2	Sig.F Variation
0.750	0.563	0.521	0.64643	0.563	13.651	13	138	0.000

The significant F variation indicates a statistically meaningful relationship between at least one independent variable and the dependent variable at conventional significance levels (e.g., $p < 0.05$). This suggests that the model is statistically significant.

According to the Adjusted R^2, the predictors account for approximately 52% of the variance in the dependent variable, demonstrating a relatively strong explanatory power. The F-statistic value of 13.651 further confirms the significant relationship between the predictors and the response variable.

Overall, this regression analysis suggests a strong relationship between the predictors and the dependent variable, with moderate explanatory power and statistical significance indicating that the model is likely to capture the meaningful patterns of data.

Next, we used ANOVA model to verify these results (Table 4). P-value of 0.0 indicates that the results are statistically significant, which means that there

are no differences between the group means. Also, the calculated regression sum of squares is significantly larger than the residual sum which suggests that the model explains a substantial amount of variability in the outcome variable. Overall, ANOVA results suggest that regression model is statistically significant and effectively explains variability in the dependent variable.

Table 4. ANOVA model results

model	Sum of squares	df	Mean square	F	P
regression	74.158	13	5.704	13.651	0.000
residual	57.666	138	0.418		
total	131.824	151			

Next, we analyzed the distribution of the regression residuals. From the histogram (Figure 3) we can see that the distribution of regression residuals is normal. Its mean comprises -4.69E-15, standard deviation makes 0.956.

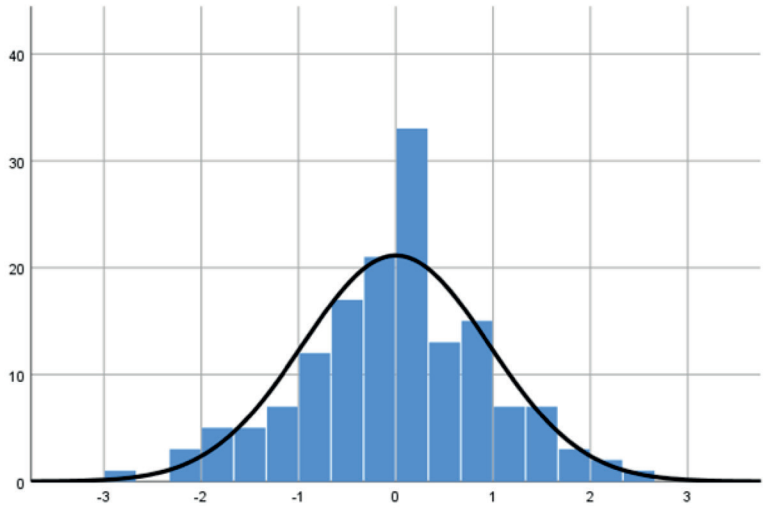

Figure 3. Sample distribution

The individual analysis of the variables helped identify five insignificant variables, the p-values of which are greater than 0.05 confidence level (Table 5). These are Logistics Service Scope, Logistics Professionals, Supply Chain Resource Integration Capabilities, Resource Development Capabilities, Customer Recognition and Trust. These results will be interpreted and discussed in the next part of the paper.

Table 5. Regression Coefficients

		Unstandardized		Standardized Coefficients			95.0% confidence interval	
	Variables	Coef. weights	Std. Error	Beta	t-statistic	p-value	Lower limit	Upper limit
0	(Constant)	-0.515	0.348		-1.481	0.141	-1.204	0.173
1	Logistics development stages	0.100	0.049	0.125	2.058	0.041	0.004	0.196
2	Logistics service scope	0.054	0.048	0.070	1.114	0.267	-0.042	0.150
3	Logistics industry standards	0.110	0.047	0.146	2.327	0.021	0.016	0.203
4	Logistics organizational structure	0.116	0.048	0.152	2.429	0.016	0.022	0.210
5	Local government management functions	0.104	0.050	0.133	2.076	0.040	0.005	0.204
6	Logistics professionals	0.089	0.048	0.116	1.844	0.067	-0.006	0.185
7	Logistics infrastructure	0.125	0.053	0.157	2.363	0.020	0.020	0.229
8	Industry entry barriers	0.111	0.048	0.143	2.326	0.021	0.017	0.206
9	Supply chain resource integration capabilities	0.034	0.051	0.042	0.663	0.508	-0.067	0.135
10	Resource development capabilities	0.018	0.049	0.022	0.373	0.710	-0.079	0.116
11	Logistics and industrial development coordination	0.134	0.048	0.167	2.771	0.006	0.038	0.229
12	Customer recognition and trust	0.062	0.049	0.078	1.278	0.204	-0.034	0.159
13	Logistics systems and policies	0.139	0.050	0.172	2.777	0.006	0.040	0.237

4. Discussion

The findings of our study underscore the transformative potential of the BRI in shaping the logistics of Sino-Russian e-commerce through the adoption of 4PL models. Our analysis reveals that primary and support activities identified as a priori factors, particularly industrial and municipal policies alongside infrastructural development, are pivotal in driving the success of e-commerce supply chains within the BRI framework.

We find that infrastructure inadequacies, high transportation costs, and regulatory barriers represent critical factors that could impede the effective implementation of 4PL in the Sino-Russian context. Addressing these challenges requires collaborative efforts between governments and businesses to invest in infrastructure improvements and streamline regulatory processes. Moreover, the technological divide between China and Russia presents both a challenge and an opportunity (Castello Esquerdo et al., 2023). While China has made significant advances in logistics technology and digitalization (Pomfret, 2019), Russia's slower pace necessitates targeted investments in technology transfer and capacity building, which may indicate that Russia and China could increase the proportion of infrastructural cooperation agreements (Liu et al., 2022).

Government policies significantly shape the logistics landscape under BRI. It is possible to infer from our findings that national, industrial, and municipal policies are critical external factors of e-commerce supply chains success. The numerous agreements for mutual collaboration and infrastructure development indicate that the Chinese government acknowledges their primary importance. Both countries, however, exhibit unequal pace of infrastructural development, suggesting that further advancement of BRI may require a longer time frame, as infrastructure development is inherently a time-consuming process (C.I. Process, 2024; National Development and Resource Commission, 2022).

At the same time, the five factors relating to internal capabilities have been proven insignificant for the success of 4PL companies. The insignificance of logistic professionals as variables raises questions considering the importance of skilled employees for digitally driven 4PL firms. One possible explanation for this result is the variability in understanding the issue among respondents, which may arise from their diverse occupations and company backgrounds. Besides, 4PL companies often engage in remote work activities, enabling them to tap into a broader inter-regional and international talent pool.

The constraints imposed by industry-specific limitations and global events (such as pandemics and geopolitical tensions) may restrict some companies' resource integration capabilities (Panibratov & Fitzpatrick, 2020). However, these limitations are often temporary and context dependent (Heim et al., 2024). The presence of established large and medium-sized companies with better resource access may affect new entrants' ability to compete but does not fundamentally disrupt existing logistics frameworks.

Lastly, our analysis accentuates the customer trust and loyalty among the respondents as an insignificant factor, which can be accounted for by the nascent phase of Sino-Russian logistic relations; this reduces the significance of marketing activities in the companies. Despite a long history of mutual trade relations, the Russian firms started rapidly shifting towards eastern markets only in recent years and have not had enough time to build large customer bases.

To summarize the results of this study, we interpret them through the VC theory. We synthesize our findings in the theoretical framework (Figure 4).

Companies operating within the BRI are primarily driven towards growth by the right policies and infrastructure development; their insufficiency would result in a decline of 4PL performance and the future success of the whole Initiative may be hindered by insufficient technological development of Chinese companies (Castello Esquerdo et al., 2023). Primary and support activities differ in their influence on the value creation in the BRI. This difference can be attributed to the relatively nascent state of Sino-Russian trade relations and the repercussions of Covid-19 pandemic. Besides, the internal competencies that were found significant in this study still warrant attention. As companies advance, their competitive edge increasingly depends on their internal resources rather than solely on the investment advantages offered by the BRI project.

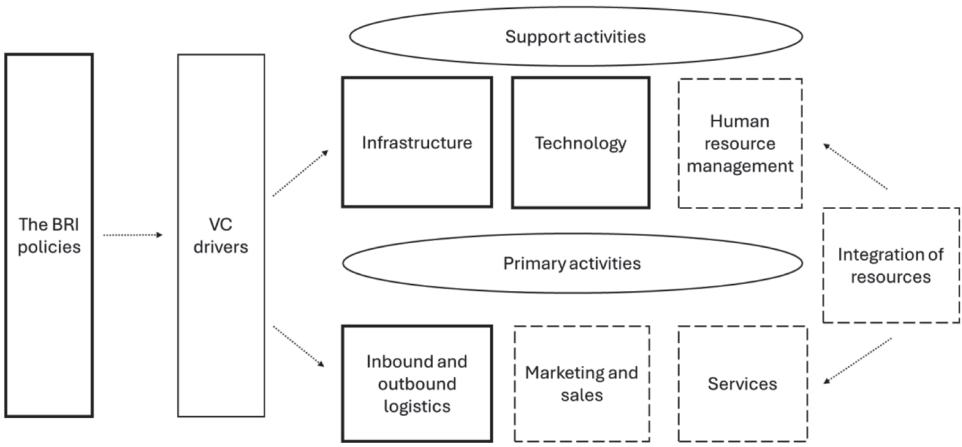

Figure 4. VC development within the BRI

5. Conclusion

This paper examines the potential of the development of 4PL within Sino-Russian e-commerce, particularly in the context of the BRI. By integrating VC theory, the study analyzes various factors that influence the growth of 4PL in Sino-Russian e-commerce and explores how they contribute to the 4PL companies' competitive advantages .

The policies of China and Russia, along with their recent diplomatic, political and economic activities and initiatives are obviously based on the assumption that the BRI creates a favorable environment for the logistics industries in both countries, e.g. Special Economic Zones and Free Trade Zones, which enhances the innovative component of the project (Panibratov & Rysakova, 2022). The vast territories of China and Russia, particularly in Northwest China, and their uneven economic development present both challenges and opportunities for logistics growth. Utilizing 4PL based on 3PL can significantly enhance operational efficiency for both parties.

Companies are propelled towards growth by external factors, including policies and infrastructure, which play a crucial role in facilitating expansion under the BRI. A lack of these essential elements can lead to a decline in the performance of 4PL providers. VC analysis indicates that the significance of the factors that drive VC in the BRI varies across the primary and support activities, which can be explained by comparative nascency of Sino-Russian trade relations and the effects of Covid-19. At the same time, internal competences, although not found significant in our study, require attention too. When companies achieve certain progress, their competitive advantage will be more dependent on internal resources rather than investment benefits provided by BRI programs.

This research has limitations, notably the small sample size, which affects the reliability of findings in the niche field of Sino-Russian e-commerce logistics. The survey's use of only the Chinese language narrows down the scope of Russian participants excluding those who are not proficient in it. Besides, although the data reflects a wide range of company sizes—micro to large enterprises—the unique circumstances of each firm may limit the generalizability of insights derived from the VC model to all 4PL companies.

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