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**Book**

## Belt & Road Initiative in Times of 'Synchronized Downturn': Issues, Challenges, Opportunities

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# Belt & Road Initiative in Times of ‘Synchronized Downturn’ Issues, Challenges, Opportunities

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Edited by

Anna Visvizi and Miltiadis D. Lytras

Printed Edition of the Special Issue Published in *Sustainability*

# **Belt Road Initiative in Times of 'Synchronized Downturn': Issues, Challenges, Opportunities**





# **Belt Road Initiative in Times of 'Synchronized Downturn': Issues, Challenges, Opportunities**

Editors

**Anna Visvizi**

**Miltiadis D. Lytras**

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### *Editors*

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Effat College of Business	Effat College of Engineering
Effat University	Effat University
Jeddah	Jeddah
Saudi Arabia	Saudi Arabia

### *Editorial Office*

MDPI  
St. Alban-Anlage 66  
4052 Basel, Switzerland

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# About the Editors

## **Anna Visvizi**

Anna Visvizi, Ph.D. (dr hab.) is an economist and political scientist, editor, researcher, and political consultant, with extensive experience in academia, think-tank and government sectors in Europe and the United States, including the OECD. The author of several published studies, Prof. Visvizi has presented her work across Europe and the United States. A practiced team-worker, researcher, analyst, and lecturer, Prof. Visvizi's expertise covers issues pertinent to the intersection of politics, economics, and ICT. This translates into her research on applied aspects of ICT, especially AI and blockchain, in such domains as smart cities/smart villages, geopolitics, and business management. Prof. Visvizi's publications also cover issues such as knowledge and innovation management and technology diffusion, especially regarding the EU and the BRI. In her work, Dr. Visvizi emphasizes engaging academia, the think-tank sector, and decision-makers in dialogue to ensure well-founded and evidence-driven policymaking. Prof. Visvizi serves as an Associate Professor at the SGH Warsaw School of Economics and is a Visiting Scholar at Effat University.

## **Miltiadis D. Lytras**

Miltiadis D. Lytras, Ph.D., is an expert in advanced computer science and information management, and an editor, lecturer, and research consultant, with extensive experience in academia and the business sector in Europe, Saudi Arabia, and Asia. Prof. Lytras is an expert in the fields of cognitive computing, information systems, technology enabled innovation, social networks, computers in human behavior, and knowledge management, especially applied in the healthcare domain. In his work, Prof. Lytras seeks to bring together and exploit synergies among scholars and experts committed to enhancing the quality of healthcare for all. Prof. Lytras serves as a Visiting Scholar at Effat University, as well as a Distinguished Scientist at the King Abdulaziz University.



# **Preface to “Belt Road Initiative in Times of ‘Synchronized Downturn’: Issues, Challenges, Opportunities”**

The launch of the Belt and Road Initiative (BRI) in 2013 sparked debates among experts and academics. Symptomatically, very little information about the initiative was available at that time; therefore, a sense of confusion was induced in the discussion on the scope of the BRI as well as its potential influence on all stakeholders involved. Connotations with the historical Silk Road had infused the debate on BRI not only with great expectations and hopes, but also with fears. Clearly, considering that China epitomizes an export-led growth model, many observers have argued that the BRI might be just another way of facilitating Chinese exports. Additionally, caution has been recommended concerning the modes of financing BRI-related projects, regarding sustainable financing, potential indebtedness, and the management of debt problems in borrower countries. In the same context, implications for Southeast Asian regional architecture and the prospect of Sinicization have been stressed.

Nearly ten years since the official launch of the Belt and Road Initiative (BRI), an understanding of what the initiative’s objectives are has been consolidated. The short-, mid-, and long-term implications for the initiative remain subject to contention and debate. This is reflected in academic research and even more so in policy-oriented publications stemming from the think-tank sector worldwide. Similarly, there is growing recognition on the part of international organizations, such as the World Bank Group (WB), and other key players on the international scene, such as the International Chamber of Commerce (ICC), that a great number of issues and challenges, pertaining to dispute resolution, investor protection, etc., are bound to emerge and will have to be tackled. From a different angle, developments on the ground suggest that in as much as the BRI embodies a bold vision of the future, it is also beset by a variety of contingencies and constraints, similarly to the original Silk Road. This book offers a glimpse into selected developments related to BRI, including its conceptualization, features, evolution, and prospects.

Seven papers have been included in this collection. Chang et al. explore the question of whether existing foreign direct investment (FDI) theories can explain specific aspects of BRI. Indeed, the data the authors collect suggest that the majority of existing theories apply to Chinese OFDI. In other words, Chinese OFDI is likely to favor countries with a large market size, abundant natural resources, cheap and unskilled labor, stable politics, good infrastructure, high trade costs, and high investment costs. However, caveats apply. By means of continuing the conversation, Zhao et al. focus on the Chinese Overseas Economic and Trade Cooperation Zones (COCZs), including the determinants of their localization and ways of improving their efficiency. The latter is viewed as a measure of inclusive and sustainable industrialization and a tool to attain the United Nations’ Sustainable Development Goals. Ho et al. add to the same thread by exploring the impact of the BRI on sectoral trade between countries included in the initiative and countries that show little support for the BRI. Specifically, the changing patterns of clothing imports by the United States from China and 14 BRI countries in Asia are explored. The results of the study show a positive effect of BRI on the clothing exports of some developing Asian countries. The following paper, by Sun et al. focuses on political risk along the

BRI and its impact on investment and planning decisions over the period 2013–2019. By separating political risk into two components, domestic and international, and examining their spatiotemporal evolution, the results of this study suggest that the number of BRI countries with extremely high and high levels of domestic, international, and (overall) political risk all reached peaks in 2015, and decreased thereafter. It is also argued that, often, the level of domestic political risk along the BRI is higher than the international political risk. A strong positive correlation between political risk and China's total investments and construction contracts along the BRI was identified. In the defined context, Thees conducts an extended literature review to examine the scope of the existing publications' focus on environmental issues. The latter are considered as crucial for the socio-cultural dimension of sustainability on a local scale. The author argues that more research on this aspect of the BRI is necessary. The notion of broadly conceived sustainability is also addressed by Hu and Wang [10], who explore uncontrolled and unprofitable urban expansion, frequently associated with the establishment or re-emergence of special economic zones (SEZs). In context of the BRI, SEZs are frequently employed tools of OFDI; therefore, this paper deserves our readers' particular attention. Finally, Ghao reviews policy documents and the existing literature on the BRI to examine how the narrative, as well as a BRI-specific language ecosystem, have evolved.

**Anna Visvizi, Miltiadis D. Lytras**  
*Editors*



## Article

# Can Existing Theories Explain China's Outward Foreign Direct Investment in Belt and Road Countries

Le Chang <sup>1</sup> , Jing Li <sup>2,\*</sup> , Kee-Cheok Cheong <sup>1</sup> and Lim-Thye Goh <sup>1</sup> 

<sup>1</sup> Faculty of Economics and Administration, University of Malaya, Kuala Lumpur 50603, Malaysia; changle1984@siswa.um.edu.my (L.C.); keecheok1@yahoo.com (K.-C.C.); ltgoh@um.edu.my (L.-T.G.)

<sup>2</sup> Fashion Department of International United Faculty between Ningbo University and University of Angers/Faculty of Geography Science and Tourism Culture, Ningbo University, Ningbo 315201, China

\* Correspondence: lijing2@nbu.edu.cn

**Abstract:** This study examines the extent to which existing foreign direct investment (FDI) theories apply to Chinese investment in the Belt and Road Initiative (BRI) countries. This is important because existing explanations of Chinese outward FDI (OFDI) generally make scant reference to these theories. By using OFDI data for BRI countries between 2003 and 2017, we tested hypotheses applicable to existing theories by using both pooled ordinary least squares (PLOS) and stochastic frontier analysis (SFA) methods. The results show that a large part of the existing theories apply to Chinese OFDI. Chinese OFDI is likely to choose countries with big market size, abundant natural resources, cheap unskilled labor, stable politics, good infrastructure, high trade cost and high investment cost. These positive findings notwithstanding, they do not invalidate the alternative factors cited by commentators which have not been subject to direct testing, which may require the use of qualitative analytical approaches.

**Keywords:** Chinese OFDI; FDI theory; BRI; Chinese multinational firms



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## 1. Introduction

China's fast economic growth has relied on absorbing foreign direct investment (FDI) [1–3]. In 2009, China ranked second in the world in terms of inward foreign direct investment. However, since 2002, the Chinese government adopted its “go abroad” policy to encourage Chinese enterprises to invest in foreign countries. With China's growing economic strength, Chinese outward FDI (OFDI) began to rise sharply. From 2002 to 2018, the average annual growth rate of China's OFDI reached 28.20%. In 2012, China ranked among the top three source countries of foreign direct investment for the first time and maintained the position for the last few years. By the end of 2018, China had made investment in 43,000 overseas enterprises from 188 countries [4]. In the same year, China became the second largest source country for foreign direct investment for the third time [5].

In 2013, the Belt and Road Initiative (BRI) was launched as a Chinese grand strategy by Chinese President Xi Jinping to promote economic development and regional integration. The BRI is partly based on the Silk Road Economic Belt, which was proposed in September of 2013 when President Xi Jinping made a speech at Nazarbayev University, Kazakhstan. The Silk Road Economic Belt aims to build a land channel from the Pacific Ocean to the Baltic Sea by improving cross-border infrastructure and international trade and capital. Another component of the BRI is the 21st Century Maritime Silk Road which was proposed in October of 2013 when President Xi Jinping made a state visit to Indonesia and delivered a speech at the Indonesian Parliament. The 21st Century Maritime Silk Road not only connects China to the Association of Southeast Asian Nations (ASEAN) but also tries to link the countries together from the South China Sea to the Mediterranean Sea and the South Pacific Ocean. The BRI aims to establish and strengthen partnerships among the

countries along the Belt and Road by policy coordination, facility connectivity, unimpeded trade, financial integration, and people-to-people bond.

After the launch of the BRI, OFDI stock increased significantly in BRI countries, from US\$72.02 billion in 2013 to US\$154.40 billion in 2017. China's rapid increase of the investment in BRI countries has aroused the interests of researchers, as most of the BRI countries are developing economies and the investment in BRI countries has its own characteristics. From the location distribution perspective, most of China's OFDI in BRI countries are concentrated in Asian countries, especially Southeast Asia countries. Intensive concentration is one of the characteristics of China's investment in BRI countries. Until 2017, out of the top 10 recipients of Chinese OFDI in BRI countries, 8 out of 10 were Asian countries (Singapore, Indonesia, Kazakhstan, Laos, Pakistan, Myanmar, Cambodia, and Thailand), and 6 out of 10 were from Southeast Asia countries (Singapore, Indonesia, Laos, Myanmar, Cambodia, and Thailand). From the sectoral distribution perspective, China's investment mainly targets energy, metals, and transport, which account for 68.56% of total industry distribution in BRI countries. Investment in energy sector is mostly merger and acquisition (M&A) FDI, while the others are greenfield FDI. Energy subindustries such as oil, coal, gas, and hydro are the core drivers for BRI, which helps China to access reliable and efficient energy network. Except for the demand for traditional energy consumption, China is looking for environment-friendly energy such as gas from the Russian Federation and Kazakhstan, as environmental pollution is attracting more attention in the progress of economy development [6,7].

With the development of BRI, the motivations behind BRI are being discussed extensively [8,9]. In the context of the "new normal" of slower growth of China's economy, it has been argued that the BRI is aimed to avoid the excess production capacity in the domestic market and secure natural resource supplies. Others have argued that the initiative promotes Chinese OFDI in infrastructure sectors by state-owned enterprises (SOEs) and non-infrastructure sectors by private enterprises [10]. What is striking about these motives is that they are primarily state priorities. Chinese SOEs as the main actors of Chinese government policies engage in overseas investment. When the Chinese government makes overseas investment policies from the national security, energy security, foreign policy, and geopolitics perspectives, Chinese SOEs will be pioneers to complete the tasks of the central government instead of considering the profitability and interests like the private enterprises. Meanwhile, the SOEs in China are easily financed by the government and banks; this results in Chinese overseas investment being high risk and even failing [11,12]. By contrast, existing theories explaining FDI are based on decision-making by private-sector firms. This leaves open the question of whether these theories can help explain Chinese OFDI.

China makes for an interesting study to test existing FDI theories given that it has several distinctive features. These are the central role of the state and its state enterprises, its being a major source of OFDI when most countries at a comparable level of development are focused on receiving inward FDI, and its OFDI flows to developed instead of developing countries [13,14].

This paper is arranged as follows. Section 2 reviews the existing general FDI theory and gives the hypothesis of motivations of Chinese investment in BRI countries. Section 3 describes the data source and the empirical strategy. Section 4 shows the results of regression analysis. The last section concludes the paper.

## 2. Literature Review and Hypothesis Development

FDI theories come almost exclusively from Western scholars and are based on enterprise behavior from developed countries [15]. The main objectives of FDI theory are internalizing imperfect markets and reducing operating costs.

## 2.1. Existing FDI Theory

Hymer (1976) [16] explained the flows of FDI under the assumption that the market is imperfect. The imperfect market gives multinational enterprises (MNEs) a monopolistic advantage and the capacity to compete with local enterprises in host countries [17,18]. To compete with the local companies in host nations, an advantage should be owned by the international corporations to undertake investment abroad. The monopolistic advantage is a result of imperfect competition in goods and factor markets, economies of scale, and the obstacles from government [19].

Vernon's product life-cycle theory is used to explain why firms substitute foreign direct investment for exporting in the United States. Product life-cycle theory assumes that the flow of knowledge across regions or countries produces cost. The dynamic production of new products is a decision process between international trade and international investment [20]. It separates the product life cycle into three stages: innovation, maturity, and standardization. In the maturing product stage, threats from local industry rivals, foreign governments controlling imports, and lower labor costs in other countries force firms to undertake foreign direct investment. In the standardized product stage, less-developed countries have absolute advantage in labor. To keep a competitive advantage, firms invest in lower-cost countries. Labor-intensive products are transferred to developing countries for production first and later resold to a home country or other advanced countries.

The internalization theory can be tracked to the pioneering study by Coase (1937) [21], who tried to find the reasons for the emergence and for restricted growth of firms. Firm growth stops when the cost of organizing one more transaction within the firm equals the cost on the open market. Following Coase's theory, Buckley and Casson (1976) [22] explained the determinants and motivation of FDI in terms of firms' efforts to internalize transactions to reduce costs. Multinational enterprises make investment abroad when more benefits are acquired to have branches abroad than exporting, or when the costs of internalization are less than the costs of external transactions [23].

Dunning's eclectic paradigm claims that ownership, location, and internalization advantages are the main contributors of FDI. The ownership advantage, also known as monopolistic advantage, refers to the assets and ownership that a country's enterprises own or can acquire, which are not available to other enterprises. It mainly includes the asset ownership advantage and transactional ownership advantage [24]. The location advantage refers to the favorable conditions of foreign market relative to home market in terms of market environment for enterprise production and operation. It includes direct location advantage and indirect location advantage [25]. The internalization advantage refers to the ability of an enterprise to keep its advantages within the enterprise in order to avoid the influence of the incomplete external market on the enterprise interests [26].

Dunning (1981) [27] proposed the investment development path (IDP) theory, which is a dynamic approach to study the relationship between the development of an economy and foreign direct investment. The IDP theory assumes that with the development of the economy, the conditions for the domestic and foreign enterprises transform, which will finally affect the position of both inward and outward FDI [28]. According to the theory, a country will experience five stages of development which result in the dynamic change of the ownership, location, and internalization advantages of enterprises. For stage 1, as the domestic market is small and undeveloped, there is no inward FDI and OFDI. In stage 2, as the country has some location advantages, inward FDI flows into consumer goods and infrastructure sectors. There is no OFDI during this period. In stage 3, with the growing of ownership advantages of domestic enterprises, overseas investment is increasing. In stage 4, the country changes to a net OFDI position, as the advantages that enterprises have to manage the dispersed production are more important than the advantages that are based on the home country characteristics. In stage 5, the country has high stock of both inward and outward FDI. The empirical studies have tested the role of home country development, innovation, openness to trade and investment, and institutions [1,29,30]. As part of China's continuous government policies to support both inward and outward FDI, the stock of

OOFDI has surpassed inward FDI. According to the analysis in the introduction part, China's OOFDI has the characteristics of stage 3.

Dunning's theory suggests that FDI is mainly characterized as market-seeking, asset-seeking, and resource-seeking. With respect to the first objective, MNEs invest in foreign economies to sell goods and services there. Some firms feel that the best way to access those markets is by foreign direct investment [31]. Market-seeking investment focuses on sustaining or exploiting new markets. According to the eclectic paradigm and the IDP theory, market size of both home and host country and the prospect for market growth of host economic stimulate capital inflows from outbound [32]. The market size difference between home and host country has a negative effect on FDI flows, which means that horizontal foreign direct investment (HFDI) reaches a maximum value when the GDP of the home country and host country is equal and with similar relative endowments [33]. Thus, with specific reference to China:

**Hypothesis 1 (H1).** *Chinese OOFDI along BRI countries is correlated positively with absolute home country size.*

**Hypothesis 2 (H2).** *Chinese OOFDI along BRI countries is correlated positively with absolute host country size.*

**Hypothesis 3 (H3).** *Chinese OOFDI along BRI countries is correlated negatively with a difference between home and host country size.*

When investors access frontier technologies and information by mergers and acquisitions (M&A), they will upgrade their own high-tech production capabilities [34]. The motivation behind asset-seeking investment is to obtain advanced proprietary technology, high-skilled labor, brands, and distribution networks in local markets in order to strengthen a firm's own specific advantage or weaken its competitors [35–37]. To strengthen competitiveness, Chinese MNEs invest in advanced countries to access intellectual capital by M&A, especially in the European Union (EU) and USA [38]. The measure of asset-seeking motivation is proxied by the rate of patenting or endowment of skilled labor in the host economies [39,40]. Thus:

**Hypothesis 4 (H4).** *Chinese OOFDI along BRI countries is correlated positively with host country endowments of technology.*

Enterprises are also spurred to invest abroad to procure natural resources at a lower price than in the home country. Profit maximization is the main motivation for enterprises' investment of this kind. According to Dunning and Lundan (2008) [41], cheap and highly motivated unprofessional labor or primary labor is still the target of natural resource-seekers. This type of investment usually comes from the home country with higher labor costs than the host country. As China becomes the world factory since joining the World Trade Organization (WTO) in 2001, its position changes from one of a net oil exporter to a net oil importer [42]. Chinese investment in Africa mainly focuses on natural resources. Chinese enterprises even invest in advanced countries such as Australia to achieve the efficient mining sector in order to guarantee the demand of the energy in the home market [43,44]. Thus:

**Hypothesis 5 (H5).** *Chinese OOFDI along BRI countries is correlated positively with host country endowments of natural resources.*

Beyond these motivating factors are others suggested by empirical studies. They include:

#### 2.1.1. Geographic Distance

Geography distance affects location choice of MNEs by increasing investment costs [45]. Thus:

**Hypothesis 6 (H6).** *Chinese OFDI along BRI countries is correlated negatively with host country increasing physical distance.*

#### 2.1.2. Political Risk

Political risk refers to the risk that a host country government changes the rule of a business game with no advance notice. The higher the risk, the less likely the chance of a favorable FDI decision [46]. Thus:

**Hypothesis 7 (H7).** *Chinese OFDI along BRI countries is correlated negatively with host country increasing political risk.*

#### 2.1.3. Trade Cost

Trade and foreign direct investment are trade-off relationships [47]. MNEs will choose the strategy of foreign direct investment if the cost of exporting to overseas and producing in the home market is more than the cost of operating and producing in the home market plus the cost of importing to the home country [48]. Thus:

**Hypothesis 8 (H8).** *Chinese OFDI along BRI countries is correlated positively with host country trade cost.*

**Hypothesis 9 (H9).** *Chinese OFDI along BRI countries is correlated negatively with home country trade cost.*

#### 2.1.4. Investment Cost

Investment cost refers to the cost of doing foreign business in a host country. The higher the investment cost, the less likely it is for FDI [49]. Thus:

**Hypothesis 10 (H10).** *Chinese OFDI along BRI countries is correlated negatively with investment cost in host country.*

#### 2.1.5. Infrastructure

Infrastructure is one of the key determinants of foreign investment [50,51]. The relationship between infrastructure and foreign investment is usually positive. Countries with good quality infrastructure will attract more investment inflows as it increases the accessibility and decreases the transport cost. Thus:

**Hypothesis 11 (H11).** *Chinese OFDI along BRI countries is correlated positively with physical infrastructure in a host country.*

#### 2.1.6. Government Effectiveness

Government effectiveness captures the capacity for the government to provide public services. Good governance in a host country matters for foreign direct investment, and it insures the favorable environment of business. Government effectiveness ensures the consistence of implementing foreign investment policy, and enhances the confidence of foreign investors [52–54]. Thus:

**Hypothesis 12 (H12).** *Chinese OFDI along BRI countries is correlated positively with government effectiveness in a host country.*

### 3. The Model and Data

To assess the determinants of Chinese investment in BRI countries, both pooled ordinary least squares (PLOS) and stochastic frontier analysis (SFA) are used [55,56].

Based on Carr et al. (2001) [32], the specific model used is as follows:

$$FDI_{ij}^t = \beta_0 + \beta_1 GDP_i^t + \beta_2 GDP_j^t + \beta_3 SQDGD P_{ij}^t + \beta_4 DIS_{ij} + \beta_5 DSKILL_{ij}^t + \beta_6 RESOURCE_i^t + \beta_7 (DGD P_{ij}^t \times DSKILL_{ij}^t) + v_{ij}^t - u_{ij}^t \quad (1)$$

where

$$u_{ij}^t = \alpha_0 + \alpha_1 TRADECOST_i^t + \alpha_2 TRADECOST_j^t + \alpha_3 INVCOST_j^t + \alpha_4 INFRA_j^t + \beta_5 GOVERNMENT_j^t + \beta_6 POLITICAL_j^t + w_{ij}^t \quad (2)$$

where

$i$  = home country

$j$  = host country

$FDI_{ij}^t$  represents the outward foreign direct investment from China to countries along the BRI (Table 1). The accumulative volume of OFDI is used as the dependent variable [57]. The data are from 2003 to 2017 and come from the various years of *Statistical Bulletin of China's Outward Foreign Direct Investment*.

**Table 1.** Countries along One Belt One Road.

Region	Country
East Asia (2)	China (CHN), Mongolia (MNG)
Southeast Asia (11)	Brunei (BRN), Cambodia (KHM), Indonesia (IDN), Laos (LAO), Malaysia (MYS), Myanmar (MMR), Philippines (PHL), Singapore (SGP), Thailand (THA), Timor-Leste (TLS), Vietnam (VNM)
Central Asia (5)	Kazakhstan (KAZ), Kyrgyzstan (KGZ), Tajikistan (TJK), Turkmenistan (TKM), Uzbekistan (UZB)
Middle East and North Africa (15)	Bahrain (BHR), Egypt (EGY), Iran (IRN), Iraq (IRQ), Israel (ISR), Jordan (JOR), Kuwait (KWT), Lebanon (LBN), Oman (OMN), Palestine (PSE), Qatar (QAT), Saudi Arabia (SAU), Syria (SYR), United Arab Emirates (ARE), Yemen (YEM)
South Asia (8)	Afghanistan (AFG), Bangladesh (BGD), Bhutan (BTN), India (IND), Maldives (MDV), Nepal (NPL), Pakistan (PAK), Sri Lanka (LKA)
Europe (24)	Albania (ALB), Armenia (ARM), Azerbaijan (AZE), Belarus (BLR), Bosnia and Herzegovina (BIH), Bulgaria (BGR), Croatia (HRV), Czech Republic (CZE), Estonia (EST), Georgia (GEO), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Macedonia (MKD), Moldova (MDA), Montenegro (MNE), Poland (POL), Romania (ROU), Russia (RUS), Serbia (SRB), Slovakia (SVK), Slovenia (SVN), Turkey (TUR), Ukraine (UKR)

$GDP_i^t$  and  $GDP_j^t$  denote the home country GDP and host country GDP in a given year  $t$ , respectively. The data come from the World Bank's World Development Indicators. A positive correlation is expected for both variables.

$SQDGD P_{ij}^t$  is squared difference of GDP between home country and host country. It is used to test the similarity of market size. According to Carr et al. (2001) [32], when the similarity of market size is close to zero, foreign direct investment reaches the maximum. The correlation is expected to be negative.

$DIS_{ij}$  is the physical distance between home country capital city and host country capital city. Increasing physical distance increases the transport cost and decreases the flow

of foreign investment [58]. Measured in kilometers, the data are accessible from the Centre for International Prospective Studies and Information (CEPII).

$DSKILL_{ij}^t$  measures the skill difference between home country and host country in year  $t$ . According to Voss (2011) [59], percentage ratio of enrolment in tertiary education is used to represent the skill level of a home country. The data come from the World Bank's World Development Indicators. The positive relationship between skill and FDI is expected.

$RESOURCE_i^t$  equals the home country demand of natural resources in a given year  $t$ . China's import of energy represents its natural resources-seeking behavior [60]. The data are from various years of the *China Statistic Yearbook*. A positive relationship between natural resources and FDI is expected.

$DGDP_{ij}^t \times DSKILL_{ij}^t$  is an interaction term between the difference of market size and skill difference. When a home country is relatively small and has abundant skilled labor, foreign investment is the highest [32]. Thus, correlation is expected to be negative.

$INFRA_j^t$  represents the infrastructure in the host country. Available from the World Bank's World Development Indicators, water, electric power, railway, internet, mobile cellular, and airport are all included to measure the infrastructure with the same weight. Thus, the correlation is expected to be positive.

$TRADECOST_i^t$  and  $TRADECOST_j^t$  represent the trade cost of home country and host country in year  $t$ , respectively. Because of data limitations, we calculate the trade cost indirectly by 100 minus trade freedom. The trade freedom index is a composite measure of the tariff and nontariff barriers that affect the cost of international trade. Nontariff barriers include quantity restrictions, price restrictions, regulatory restriction, customs restriction, and direct government intervention. The value ranges from 0 to 100. The trade freedom data come from the Index of Economic Freedom released by the Heritage Foundation. We expect a negative sign for trade cost of home country and a positive sign for trade cost of host country [61].

$INVCOST_j^t$  means the investment cost in the host country in a given year  $t$ . Because of data limitations, we calculate the investment cost indirectly by 100 minus the index of investment freedom. The investment freedom index includes the national treatment of foreign investment, foreign investment code, restrictions on land ownership, sectoral investment restrictions, foreign exchange controls, and capital controls. This value ranges from 0 to 100. The index also comes from the Index of Economic Freedom released by the Heritage Foundation. A negative sign is expected for the relationship between investment cost and FDI.

$GOVERNMENT_j^t$  refers to government effectiveness of the host country in a given year  $t$ . Greater government effectiveness helps foreign companies invest in the local market [62]. The data are available from the World Bank's World Development Indicators. A positive correlation is expected for both variables.

$POLITICAL_j^t$  measures the political stability of the host country. It measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. The data are from the World Bank's Governance Indicators. The correlation is expected to be negative.

#### 4. Results and Discussion

Descriptive statistics of the data are summarized in Table 2. All variables are expressed in natural logs except the data from the Index of Economic Freedom and Governance Indicators (trade cost, investment cost, government, and political stability).

**Table 2.** Descriptive Analysis of the Data for SFA Model.

Variable	Obs	Mean	Std. Dev.	Min	Max
$FDI_{ij}^t$	896	3.89	2.92	−4.61	10.70
$GDP_i^t$	960	29.39	0.39	28.70	29.95
$GDP_j^t$	949	24.64	1.64	20.60	28.60
$SQDGP_{ij}^t$	948	16.17	2.88	3.11	22.64
$DIS_{ij}$	960	8.57	0.38	7.07	8.95
$RESOURCE_i^t$	780	2.05	1.65	−9.54	17.50
$Enroll_j^t$	873	3.35	0.82	−1.64	4.56
$DSKILL_{ij}^t$	868	0.70	1.10	$5.76 \times 10^{-7}$	19.04
$DGDP_{ij}^t \times DSKILL_{ij}^t$	858	−2150.52	9594.97	−99,192.33	29,651.07
$TRADECOST_i^t$	960	32.57	7.83	26.40	49.40
$TRADECOST_j^t$	862	25.52	12.86	10.00	100.00
$INVCOST_j^t$	863	51.58	21.35	10.00	100.00
$POLITICAL_j^t$	927	40.68	27.76	0.00	119.31
$INFRA_j^t$	960	12.05	3.10	−1.84	16.96
$GOVERNMENT_j^t$	928	0.03	0.83	−1.84	2.44

Notes: 1. All variables are in natural logs except  $TRADECOST_i^t$ ,  $TRADECOST_j^t$ ,  $INVCOST_j^t$ ,  $GOVERNMENT_j^t$ , and  $POLITICAL_j^t$ . 2. For the definition of each variable and its source, refer to Appendix A.

For the market size variable, the mean of China's GDP is higher than that of BRI countries as a whole. Most of the BRI states are developing economies, and their market sizes are relatively small, which means that China's enterprises have advantages in competition and technology over those of enterprises from BRI countries.

For trade cost, the mean of BRI countries' trade cost is lower than that of China. The relatively low trade cost gives the host country strong trade efficiency that will attract more direct investment from overseas. Also, the benefit of producing outside the home country outweighs the loss of economies of scale compared to merely concentrating on production in the home market.

The Pearson Correlation matrix is shown in Table 3. China's outward FDI has a strong relationship with the GDP of the host country, which is 0.48. The relationship between China's outward FDI and infrastructure of the host country is the same as above. The strongest negative relationship is −0.84 between the GDP of the home country and the investment cost of the home country. Although this value means that the two variables are highly correlated as the value is above 0.8, the variance inflation factor (VIF) test shows that all VIF values are below 5 (Table 4). The VIF test shows that the multicollinearity problem does not exist.



Table 3. Correlation Matrix for All Variables.

	$FDI_{ij}^t$	$GDP_i^t$	$GDP_j^t$	$SQDGDPI_{ij}^t$	$DIS_{ij}$	$RESOURCE_i^t$	$Enroll_j^t$	$DSKILL_{ij}^t$	$DGDP_{ij}^t \times DSKILL_{ij}^t$	$TRADECOST_i^t$	$TRADECOST_j^t$	$INVCOST_j^t$	$POLITICAL_j^t$	$INFRA_j^t$	$GOVERNMENT_j^t$
$FDI_{ij}^t$	1.00														
$GDP_i^t$	0.48	1.00													
$GDP_j^t$	0.45	0.02	1.00												
$SQDGDPI_{ij}^t$	0.10	0.28	0.20	1.00											
$DIS_{ij}$	−0.45	0.00	0.06	0.17	1.00										
$RESOURCE_i^t$	0.01	−0.05	0.06	0.05	0.07	1.00									
$Enroll_j^t$	−0.13	0.18	0.11	0.08	0.35	0.07	1.00								
$DSKILL_{ij}^t$	−0.07	−0.23	−0.01	0.03	0.03	−0.22	0.04	1.00							
$DGDP_{ij}^t \times DSKILL_{ij}^t$	0.12	0.08	−0.16	−0.41	−0.25	−0.06	−0.20	−0.20	1.00						
$TRADECOST_i^t$	−0.40	−0.84	−0.02	−0.27	−0.03	0.03	−0.16	0.19	−0.01	1.00					
$TRADECOST_j^t$	0.05	−0.34	0.03	−0.32	−0.37	−0.05	−0.58	0.11	0.24	0.34	1.00				
$INVCOST_j^t$	0.28	−0.16	0.20	−0.25	−0.38	0.14	−0.34	−0.02	0.21	0.10	0.46	1.00			
$POLITICAL_j^t$	−0.17	0.02	−0.14	0.40	0.16	0.11	0.31	0.06	−0.37	−0.01	−0.37	−0.33	1.00		
$INFRA_j^t$	0.47	0.06	0.74	0.10	−0.12	0.05	0.02	−0.03	−0.12	−0.04	0.08	0.24	−0.22	1.00	
$GOVERNMENT_j^t$	0.09	0.04	0.14	0.19	0.19	−0.12	−0.03	−0.14	−0.26	−0.03	−0.13	−0.18	0.09	0.07	1.00

**Table 4.** Variance Inflation Factor (VIF) Test.

Variable	VIF	1/VIF
$GDP_i^t$	3.85	0.26
$GDP_j^t$	2.59	0.39
$SQDGDPI_{ij}^t$	1.75	0.57
$DIS_{ij}$	1.44	0.69
$RESOURCE_i^t$	1.20	0.84
$Enroll_j^t$	1.88	0.53
$DSKILL_{ij}^t$	1.27	0.79
$DGDPI_{ij}^t \times DSKILL_{ij}^t$	1.58	0.63
$TRADECOST_i^t$	3.57	0.28
$TRADECOST_j^t$	2.14	0.47
$INVCOST_j^t$	1.65	0.61
$POLITICAL_j^t$	1.66	0.60
$INFRA_j^t$	2.50	0.40
$GOVERNMENT_j^t$	1.26	0.80

*Empirical Findings for BRI Countries*

The empirical findings of the stochastic frontier analysis (SFA) of China's OFDI along BRI countries are shown in Table 5. According to the characteristic of the SFA model, before doing an SFA analysis, the skewness and kurtosis test [63] is used to test the negative skewness of the OLS residuals, in order to reject the null hypothesis of zero skewness in the errors and to check whether the stochastic frontier analysis is suitable for analysis.

**Table 5.** A Stochastic Frontier Specification of China's OFDI along BRI Countries.

	1	2	3	4	5	6
<b>Frontier Determinants</b>						
$GDP_i^t$	3.50 *** (0.25)	3.56 *** (0.26)	3.64 *** (0.26)	3.77 *** (0.29)	3.82 *** (0.25)	4.01 *** (0.24)
$GDP_j^t$	0.95 *** (0.05)	0.97 *** (0.04)	0.94 *** (0.05)	0.95 *** (0.05)	0.87 *** (0.06)	0.75 *** (0.07)
$SQDGDPI_{ij}^t$	−0.09 *** (0.03)	−0.09 ** (0.03)	−0.07 ** (0.03)	−0.09 *** (0.03)	−0.09 *** (0.03)	−0.09 *** (0.03)
$DIS_{ij}$	−3.27 *** (0.19)	−3.33 *** (0.19)	−3.24 *** (0.19)	−3.30 *** (0.19)	−3.16 *** (0.20)	−3.14 *** (0.21)
$RESOURCE_i^t$	0.12 *** (0.04)	0.12 ** (0.04)	0.10 ** (0.04)	0.10 ** (0.04)	0.12 *** (0.04)	0.15 ** (0.04)
$Enroll_j^t$	−0.59 *** (0.10)	−0.74 *** (0.12)	−0.69 *** (0.12)	−0.76 *** (0.12)	−0.74 *** (0.12)	−0.58 *** (0.12)
$DSKILL_{ij}^t$	0.39 *** (0.11)	0.44 *** (0.12)	0.42 *** (0.12)	0.40 *** (0.12)	0.41 *** (0.12)	0.57 *** (0.13)
$DGDPI_{ij}^t \times DSKILL_{ij}^t$	0.00001 (7.46 × 10 <sup>−6</sup> )	0.00001 * (7.56 × 10 <sup>−6</sup> )	0.00001 * (7.52 × 10 <sup>−6</sup> )	0.00001 * (7.42 × 10 <sup>−6</sup> )	0.00001 * (7.41 × 10 <sup>−6</sup> )	0.00002 *** (6.79 × 10 <sup>−6</sup> )
Intercept	−89.99 *** (7.31)	−91.67 *** (7.58)	−94.20 *** (7.68)	−97.72 *** (7.82)	−97.84 *** (7.53)	−101.19 *** (7.11)
<b>Inefficiency Determinants</b>						
$TRADECOST_i^t$	0.04 *** (0.01)	0.04 * (0.02)	0.03 (0.02)	0.03 (0.02)	0.02 (0.01)	0.01 (0.01)
$TRADECOST_j^t$		0.03 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)	0.02 *** (0.01)
$INVCOST_j^t$			−0.01 *** (0.01)	−0.01 ** (0.01)	−0.01 ** (0.01)	−0.02 *** (0.01)
$POLITICAL_j^t$				−0.01 * (0.01)	−0.01 ** (0.004)	−0.01 ** (0.004)
$INFRA_j^t$					−0.12 ** (0.05)	−0.16 *** (0.05)
$GOVERNMENT_j^t$						−0.61 *** (0.12)
No. of obs	662	621	621	607	607	593

Notes: 1. \*\*\*, \*\*, and \* denote the significance at the 1%, 5%, and 10% levels. 2. For the definition of each variable, refer to Appendix A. 3. Standard Errors Are Reported in Parentheses.

As seen in Table 6, all residuals have negative skewness at the 5% or 1% levels proving that the SFA model is suitable for this data analysis. Meanwhile, the Chi-square statistics [64] reject the null hypothesis of constant variance of errors, and thus provide evidence of technical inefficiency in the independent variables. The non-constant variance of errors also means that heteroscedasticity exists, which will lead to serious problems in the estimation of the Maximum Likelihood (ML) parameters [65].

**Table 6.** Skewness and Variance Tests based on China's OFDI along BRI Countries.

	1	2	3	4
$GDP_i^t$	3.47 *** (0.18)	3.85 *** (0.19)	4.06 *** (0.19)	4.03 *** (0.20)
$GDP_j^t$	0.97 *** (0.04)	0.96 *** (0.04)	0.96 *** (0.04)	0.97 *** (0.04)
$SQDGP_{ij}^t$	−0.05 ** (0.02)	−0.10 *** (0.03)	−0.11 *** (0.03)	−0.10 *** (0.03)
$DIS_{ij}$	−3.79 *** (0.18)	−3.25 *** (0.19)	−3.27 *** (0.19)	−3.25 *** (0.19)
$RESOURCE_i^t$	0.08 * (0.04)	0.08 ** (0.04)	0.13 * (0.04)	0.13 *** (0.04)
$Enroll_j^t$		−0.55 *** (0.10)	−0.55 *** (0.10)	−0.54 *** (0.10)
$DSKILL_{ij}^t$			0.44 *** (0.11)	0.45 *** (0.11)
$DGDP_{ij}^t \times DSKILL_{ij}^t$				$5.39 \times 10^{-6}$ ( $7.99 \times 10^{-6}$ )
Intercept	−88.95 *** (5.44)	−102.01 *** (5.84)	−108.31 *** (5.99)	−107.85 *** (6.03)
No. of obs	726	666	662	662
R square	0.65	0.66	0.67	0.67
Skewness	−0.20 **	−0.37 ***	−0.29 ***	−0.30 ***
Chi square	8.51 ***	7.23 ***	10.81 ***	10.79 ***

Notes: 1. \*\*\*, \*\*, and \* denote the significance at the 1%, 5%, and 10% levels. 2. For the definition of each variable, refer to Appendix A. 3. Standard Errors are reported in parentheses.

Table 5 presents the single-step ML estimates for the two-equation stochastic frontier specification (Equations (1) and (2)). In columns 1 to 3, the OFDI inefficiency is represented by the cost variables, while columns 4 to 6 increasingly augment a set of technical efficiency effects with extra OFDI-related variables.

The results of the SFA model show that the market size of both home country and host country are significant at the 1% level and with correct relationship. The GDP of the home country has a positive influence on China's OFDI (Hypothesis 1), with a 1% increase in the variable increasing China's OFDI by 4.01%. Although, the host country's GDP has a positive influence on China's OFDI (Hypothesis 2), the effect is limited and a 1% rise in the variable will increase China's OFDI by only 0.75%. As stated before, China's GDP is bigger than the BRI countries; with a 1% increase of GDP, the home market's GDP has more influence on China's OFDI than the host market's GDP.

The difference between the home country's market size and the host country's market size has a strong negative effect on the OFDI from China on the 1% level, which means that China's investment mainly flows to the host country with similar GDP (Hypothesis 3).

For asset-seeking motivation, the correlation between the skill and China's OFDI is strongly negative at the 1% level, which means that China's OFDI seeks the country that has a low technology level. This result is opposite to Hypothesis 4, which has been proven by other studies [66,67]. As this study is focused on the countries along the BRI, the Chinese government is the major player of promoting OFDI. The investment in BRI countries is mainly contributed by SOEs or private enterprises with a close relationship with the Chinese government [68]. FDI is mainly concentrated in the manufacturing, energy, and infrastructure sectors with Chinese enterprises usually bringing the management team and skilled workers from China to a host country. Finally, it reduces the employment of skilled workers from the host country. Meanwhile, as the labor cost increases in China in

recent years, some labor-intensive industries have transferred their production from China to countries with lower labor costs [69].

China's OFDI is motivated by natural resources needs [70,71]. The analysis shows a strong positive relationship between natural resources and China's OFDI at the 1% level, which means a 1% rise in the variable, increasing China's outward investment by 0.15%, and the result confirms Hypothesis 5.

The distance between the home country and the host country has a significant negative effect on China's OFDI. With a 1% increase in distance, China's OFDI decreases by 3.14%, which confirms Hypothesis 6. China's OFDI focuses on countries near home and that have a good relationship with the Chinese government.

The technology difference between China and the host country has a significant positive relationship with China's OFDI at the 1% level. This means that most of the OFDI from China flows into the country that has lower technology than China. Infrastructure development is one of the crucial aims of the BRI, so that investment from China to BRI countries is not technology-seeking.

The interaction term between the difference in GDP and skill has a significant positive relationship with the dependent variable. Although its influence on China's OFDI is small, with a 1% rise in the variable increasing only 0.00002% of China's OFDI, its influence is significant at the 1% level. Contrast this to the expectation that China's OFDI is likely to choose the country with big market size and low-skilled workers. For the country with abundant low-skilled workers, the difference in GDP has a positive effect on attracting Chinese investment although the home country's market size is small, which means that market-seeking is not the goal of Chinese investment.

According to the characteristics of the SFA model, the inefficient elements should be signed oppositely to the conventional determinates of OFDI. Specifically, the home country's trade cost, host country's trade cost, and host country's investment should be associated with positive, negative, and positive signs in SFA model, respectively. For the other inefficient elements such as political risks, infrastructure, and government, the correlations should be positive, negative, and negative (Table 7).

**Table 7.** Summary of the SFA Results.

	Real Sign	Expected Sign
$GDP_i^t$	+	+
$GDP_j^t$	+	+
$SQDGDP_{ij}^t$	—	—
$DIS_{ij}$	—	—
$RESOURCE_i^t$	+	+
$Enroll_j^t$	—	+
$DSKILL_{ij}^t$	+	+
$DGDP_{ij}^t \times DSKILL_{ij}^t$	+	—
$TRADECOST_i^t$	NS	+
$TRADECOST_j^t$	+	—
$INVCOST_j^t$	—	+
$POLITICAL_j^t$	—	+
$INFRA_j^t$	—	—
$GOVERNMENT_j^t$	—	—

Notes: 1. NS = Not significant at 10% level. 2. For the definition of each variable, refer to Table 2.

For the political variable, there is a significant negative relationship between the political stability of the host country and that of China's outward investment at the 5% level. This proves Hypothesis 7. This means that China's investment is trying to find the country with relatively stable politics.

With regard to trade cost for both the home country and host country (Hypothesis 8 and 9), the results show that there is no evidence to prove that the home country's trade cost

has any significant relationship with the home country's OFDI except in SFA interpretation in columns 1 and 2. The trade cost of the host country has a significant negative strong relationship with China's OFDI at the 1% level; the correlation sign is opposite to our Hypothesis 8. One of the reasons is that, as for the vertical foreign direct investment (VFDI), the home country usually sets the plant in the host country and the headquarters in the home market, the products are re-imported to the home country after finishing the production in the host country [72,73]. In this case, the VFDI is mainly decided by the trade cost of both home country and host country. In this study, the home country's trade cost has no effect on the flow of China's investment; the only determinate is the host country's trade cost (Hypothesis 9). When the trade cost of the host country increases, the VFDI decreases.

For the investment cost of the host country, the result shows the opposite sign to Hypothesis 10. Normally, the investment cost of the host country has a negative influence on the OFDI from the home country. In the SFA model, the results are significant at the 1% level but with the opposite signs. This means that China's investment along the BRI countries tend toward the markets with high investment cost.

With regard to infrastructure, there is still a significant negative relationship between the infrastructure of the host country and China's OFDI at the 1% level. Hypothesis 11 has therefore been confirmed. The same conclusion applies to government efficiency. The results show that China's investment is mainly focuses on the host country that has a relative better infrastructure and higher government efficiency.

## 5. Conclusions

Chinese investments in BRI countries over the period of 2003–2017 have been tested against hypotheses from existing FDI theories by using both OLS and SFA methods. These tests show that the market size of BRI countries does matter for China's OFDI, which seeks to remove excess capacity in the production of construction and other materials in China [74]. This proactive FDI strategy releases the stress of excess capacity in China's manufacturing industry, such as steel production. From the firm level, this strategy enlarges the market size and makes profits for the firm. At the country level, the core interest behind China's proactive FDI strategy is to maintain the rate of economic growth despite excess production. Natural resources also have a significant positive effect on Chinese investment in this area. As the world's factory, China consumes more natural resources to produce the products that will be sold to all over the world. Meanwhile, to satisfy the desire for domestic consumption, there is a huge demand for natural resources. All of the above contributes to the natural resources-seeking FDI, which becomes more significant than market-seeking FDI in BRI countries. Especially, for the countries that have rich natural resources and a good relationship with China.

In contrast to analysis that asset-seeking is one of the motivations for FDI from China [75], China's investment in BRI is not motivated by asset-seeking but by low-cost labor in host countries. In other words, China is transferring its labor-intensive industry to BRI countries because of the increasing labor cost in China [76,77]. The negative effect of geographic distance also shows that the vertical foreign direct investment is the main type of Chinese OFDI. All in all, this new phenomenon indicates that China's investment in BRI countries is more like the "North to South" investment. China is acting the role of "developed country" to invest to less-developed countries to seek markets, natural resources, and cheap labor.

Contradicting De Soyres, Mulabdic, Murray, Rocha, and Ruta (2019) [78], trade cost and investment cost of host countries have negative effects on attracting Chinese investment. Chinese investment prefers to flow to the countries with unstable politics. These contradictory results hint at Chinese OFDI behaving somewhat differently from the traditional FDI of private enterprises [79]. This difference is the result of Chinese government policy which aims to promote the investment in BRI countries mainly from the perspective of state interests. The state interests consider both the economic element and the strategical element. Normally, the stated-owned enterprises (SOE) will act as the agent of government

to fulfill the strategical aim, while the economic aim is fulfilled by private enterprises. When we focus exclusively on an economic perspective, the strategic element will not fit.

Yet, the above results show existing theory to be able to explain a large part of Chinese OFDI in BRI countries. However, there are some limitations of this research. As Chinese government issues all kinds of policies to promote OFDI in BRI countries, it is still unavailable to use the quantitative method to test the role of government policies. As for the data limitation, there is no comprehensive firm level data to exam the motivation difference between the SOEs and private enterprises. Further, the case study will be used to test the role of government policies in the way of encouraging enterprises to make investments overseas. In specific, the interaction between government policy and enterprises (SOEs and private enterprises) will be explained by using document review and interviews.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Variable Description.

Variable	Description	Expected Sign	Data Source
<b>Dependent Variable</b>			
$FDI_{ijt}$	The log of OFDI stock of China in country j		Statistical Bulletin of China's Outward Foreign Direct Investment
<b>Frontier Determinants</b>			
$GDP_{it}$	The log of GDP for the home country	(+)	World Development Indicators
$GDP_{jt}$	The log of GDP for the host country	(+)	World Development Indicators
$DGDPSQ_{ijt}$	The square of the difference between the log of the two countries' GDP:	(−)	World Development Indicators
$DIS_{ij}$	The log of the great circle distance between the capital cities of two countries	(−)	CEPII
$DSKILL_{ijt}$	The difference between the log of the two countries' skills level, measured by the ratio of enrolment in tertiary education	(+)	World Development Indicators
$RESOURCE_{it}$	The log of the import of energy	(−)	China Statistic Yearbook

Table A1. Cont.

Variable	Description	Expected Sign	Data Source
$DGDP_{ijt} \times DSKILL_{ijt}$	An interaction term between the log of the difference of GDP and the log of the difference in the skills level	(−)	World Development Indicators
<b>Inefficiency Determinants</b>			
$TRADECOST_{it}$	Trade costs for the home country: 100-Tradefreedom <sub>it</sub>	(+)	Index of Economic Freedom
$TRADECOST_{jt}$	Trade costs for the host country: 100-Tradefreedom <sub>jt</sub>	(−)	Index of Economic Freedom
$INVCOST_{jt}$	Investment costs for the host country: 100-Investmentfreedom <sub>jt</sub>	(+)	Index of Economic Freedom
$INFRA_{jt}$	An index related to the road, railways and water	(−)	World Development Indicators
$GOVE_{jt}$	The government effectiveness of the host country	(−)	Index of Economic Freedom
$POLITICAL_{jt}$	The political stability of the host country	(+)	Governance Indicators

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## Article

# Evaluation Research on Planning Implementation of Chinese Overseas Economic and Trade Cooperation Zones along the Belt and Road: Evidence from Longjiang Industrial Park, Vietnam

Sidong Zhao, Xingping Wang \*, Xuefeng Hu and Dongxue Li

School of Architecture, Southeast University, Nanjing 210096, China; sdzhao2018@163.com (S.Z.); huxuefengnj@163.com (X.H.); lidx@seu.edu.cn (D.L.)

\* Correspondence: 101010501@seu.edu.cn

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**Abstract:** Chinese Overseas Economic and Trade Cooperation Zones (COCZs) under the “One Belt and One Road” initiative are committed to promoting inclusive and sustainable industrialization, becoming an important platform for the countries and regions where they are located to achieve the sustainable development goals of the 2030 agenda. The planning of COCZs plays a strategic leading and rigid control role in the sustainable development of parks, and the planning implementation effectiveness evaluation has been a key to the sustainable development of COCZs. From the perspective of sustainable development, we established a rating system depending on the deconstruction “effectiveness = efficiency + effect + benefit + capacity” to measure the planning implementation effectiveness evaluation indexes of COCZs, and conducted empirical research based on the evidence of Longjiang Industrial Park, Vietnam. The research results show that Longjiang Industrial Park has a good planning implementation effectiveness with remarkable comprehensive economic, social, ecological and political benefits. It features a good efficiency, effect and benefit from an excellent production capacity, reflected in the consistency between spatial planning and implementation results and a high satisfaction with planning implementation. However, planning implementation is also faced with problems such as the lag of time, imbalance between profit and loss, uneven achievement of goals, and lack of a refined planning control system. To make COCZs more sustainable in development and planning, the suggestion is, on the one hand, to accelerate the establishment of a regular and institutionalized mechanism for the planning preparation and implementation evaluation of COCZs, and bring sustainable development into the management requirements, and, on the other hand, to promote the transformation of COCZs planning from “Function and Scale Orientation” to “Quality and Effectiveness Orientation”, and guide the creation of a model for sustainable development and the planning of COCZs.

**Keywords:** China’s overseas industrial parks (COCZs); planning implementation; planning evaluation; effectiveness; Longjiang Industrial Park

## 1. Introduction

The aim of the “Belt and Road Initiatives” is to help the countries along the belt and road achieve their vision of sustainable development, and Chinese Overseas Economic and Trade Cooperation Zones (COCZs) under the “Belt and Road Initiatives” are committed to promoting inclusive and sustainable industrialization [1]. According to China’s Ministry of Commerce, by the end of 2018, COCZs had invested more than USD 40 billion, paying more than USD 3 billion in taxes and fees to host countries and creating more than 300,000 jobs for the local community. Over the past ten years,

COCZs have developed into an engine for promoting trade and economic growth of host countries and an important platform for host countries to achieve their sustainable development goals of Agenda 2030 by actively integrating the development practice of China's industrial parks with the development needs of the host countries, continuously sharing China's experience in industrialization with global partners, and contributing to the economic and social development of the host countries. Two questions, addressing whether the industrial park can help achieve the goal of sustainable development and what the path is for its own sustainable development, have produced some exploratory academic achievements. For example, Lilian Bechara Elabras Veiga argued that industrial parks are an important tool to promote sustainable development [2], Huong T analyzed the strategies to promote the sustainable development of industrial parks in northern Vietnam [3], and Liu and Zhe made a comparative analysis of the sustainable development paths of industrial parks in China and Canada [4]. Transforming Our World: The 2030 Agenda for Sustainable Development puts forward 17 sustainable development goals, including the elimination of all forms of poverty worldwide and adoption of sustainable consumption and production patterns. It also gives a further detailed description of each goal. The introduction of the concept of sustainable development to the "Belt and Road Initiative" enables the countries along the belt and road to keep their industrialization and urbanization in line with the sustainable development goals, and ensures the sustainable planning, development and operation of industrial parks outside China, playing an important role in promoting and driving the sustainable development of cities along the belt and road.

First of all, the development of industrial parks outside China has greatly contributed to the achievement of Sustainable Development Goal 9 (SDG9): build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. COCZs have promoted the development of inclusive industrialization in cities along the "belt and road". With a large number of Chinese companies, host country companies, and third-country companies gathered, the parks have increased the industrial added value and its share in the local city's GDP, and have expanded industrial employment and the share of the total employed population in the local city, and upgraded the local industrial development infrastructure and business environment. Secondly, the development of COCZs has better contributed to the achievement of Sustainable Development Goal 8 (SDG8); that is, it has promoted sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. The overseas industrial parks of China implement development-oriented policies, focusing on the development of high value-added and labor-intensive industries. By sticking to diversified business, technological upgrades and innovation, they have created decent employment opportunities for urban residents in host countries and improved the efficiency of the local resources used, while establishing entrepreneurship and innovative spirit in local communities and even larger regions. Thirdly, with the help of employment creation, and improvement of industrial infrastructure and the business environment, COCZs will also play an important role in aims such as no poverty (SDG1), zero hunger (SDG 2), good health and well-being for people (SDG3), responsible consumption and production (SDG12), and climate action (SDG13), showing great potential in promoting sustainable economic, environmental and social development and helping the host country realize the goals of the 2030 Agenda.

For sustainable development and operation, COCZs need to plan and play a strategic leading and rigid control role, where planning an implementation effectiveness evaluation has become a key link in the sustainable development of COCZs. It should be noted that "strategic leading" here refers to the fact that planning plays an encouraging and supporting role in the positive effect on human construction, mainly manifested in flexible goals and visions, alternative paths and strategies, consensual space programs and development directions; "rigid control" refers to the fact that planning plays a controlling and restraining role with regard to the negative effect in human construction, mainly manifested in protecting the ecological environment and prohibiting ecological destruction, saving resources and energy, controlling pollution, among others. As a vision and hope that the plan

presents, “strategic leading” does not have to become a reality, while “rigid control” should or must be achieved, otherwise it may pose a threat to the sustainable development of a larger region.

In recent years, the research on sustainable development and planning of COCZs has gradually received the attention of industry and academic circles, and a number of important research results have emerged, including a case study on planning of the Sihanouk Ville Special Economic Zone in Cambodia [5], construction modes [6], current situations and trends of development [7], construction characteristics and development suggestions [8] of China’s overseas cooperation industrial parks along the Belt and Road, and China’s cross-border cooperation in building industrial parks in Africa [9,10], Southeast Asia [11,12], Central and Eastern Europe [13] and its impact. The development and planning of the development zone and China’s international cooperation parks in the context of globalization have also attracted the attention of scholars, reflected in the research results including a case studies on Suzhou Industrial Park jointly built by China and Singapore [14–17], interactive characteristics and the internal mechanism of globalization and the development of Chinese development zones [18], and international cooperation parks in China [19]. Overall, the existing research results still highlight the characteristics of “attaching importance to making plans while neglecting using them” [20], rarely involving the effectiveness of planning implementation [21] of COCZs, and also failing to incorporate the ideas and methods of sustainable development into the development and planning of COCZs. Whether the planning implementation achieves the purpose of the planning itself and whether it helps to carry out the follow-up planning in an orderly manner is related to the full play of the planning role of COCZs, and also directly affects the sustainable construction and development of COCZs [22]. In view of this, based on the public policy and the experience in urban planning implementation evaluation, this paper takes Longjiang Industrial Park (LJIP) in Vietnam as an example to carry out an empirical analysis, trying to construct a method system for planning an implementation effectiveness evaluation of COCZs from the perspective of sustainable development, to provide some reference for relevant theoretical research and practical work.

## 2. Theoretical Thinking and Method Construction

### 2.1. Logical Framework: $Effectiveness = Efficiency + Effect + Benefit + Capacity$

According to the Athens Charter, life, work, recreation, and transportation constitute four basic functions of a city. Industrial parks are the space carriers for creating job opportunities in most cities, especially in industrial cities. The relationship between industrial parks and urbanization has attracted the attention of relevant scholars, and industrial park planning has been generally incorporated into urban planning in academic research and practical work in many countries [23–25]. Industrial parks have become an effective tool for the government to promote sustainable development [26]. The performance evaluation of industrial parks has received much attention by scholars with a lot of leading research results. Maria Laura Franco Garcia has provided a set of more realistic sustainability indicators for Mexico Industrial Parks [27]. Maria Zenilda Da Silva, by the Multicriteria Methodology for Constructivist Decision Aid (MCDA-C), has established a qualitative and quantitative analysis model for the performance evaluation in the implementation stage of high-tech industrial parks, offering an important support tool to the management decision-making of the industrial parks [28]. Yang Jin put forward a multi-criteria framework for sustainable evaluations and applied it to the sustainability assessment of low-carbon industrial parks in Beijing, China, in the light of life cycle analysis [29]. By studying the comprehensive benefit assessment of eco-industrial parks, Zhao Haoran constructed a comprehensive benefit assessment framework for sustainable development in eco-industrial parks with nine quantitative indexes and four qualitative indexes in terms of economic benefit standard, social benefit standard and environmental benefit standard, and carried out empirical research using five cases [30]. However, there are few researchers to evaluate the performance of industrial park planning, except Ersin Türk who carried out exploratory research on the planning evaluation of industrial parks in Turkey with Izmir as an example [31]. INTERNATIONAL GUIDELINES FOR

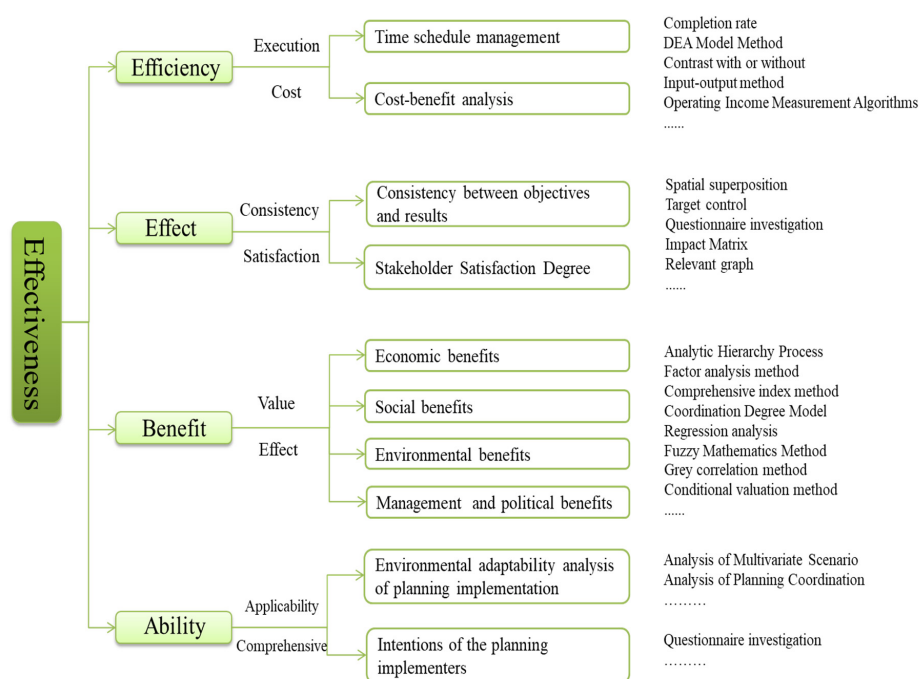
INDUSTRIAL PARKS puts forward definite requirements for key procedures such as the planning and implementation evaluation of industrial parks, but there is still a lack of necessary tools in practical operation. Overall, the performance evaluation of industrial park development is of great importance, but there is still a lack of effective tracking research and analysis tools. The performance evaluation of urban planning implementation has been mature, and it is of great reference value to the construction of the performance evaluation framework of industrial park planning.

Vitor Oliveira and Paulo Pinho divided the public policy and urban planning implementation evaluation into two basic concepts: conformance and performance, which has influenced the practice and theoretical research of planning implementation evaluation [32]. Alexander et al. presented the Policy-Plan/Programme-Implementation Process (PPIP) and Policy-Plan-Programme-Project (PPPP) models [33], and Oliveira et al. put forward the PPR ('Plan-Process-Results) model [32,34], guiding the planning implementation evaluation towards a comprehensive evaluation. A planning implementation effectiveness evaluation is not equal to planning implementation performance evaluations, as the latter is performance-oriented and pursues the maximum output, while the former pursues the balance between output and capacity, which requires both a steady performance rise and sustained capacity growth, more in line with the concept of sustainable development. Now, there are few studies on the planning implementation effectiveness evaluation in academia—some that have covered this topic include: Zhu Jie's study which argued that space-leading effectiveness has always been the core contents of evaluation on the implementation of city master plans [35]; frameworks for evaluating effectiveness of land-use planning in containing urban sprawl constructed by Shen Xiaoqiang [36] and Gennaio Maria-Pia [37], respectively; an analysis of controlling effectiveness of urban planning on urban growth [38] in Hangzhou by Wu Yizhou et al. and Longying's evaluation of spatial and temporal heterogeneity of Beijing urban planning implementation effectiveness based on five urban master plans [39]. However, there are fruitful research results on planning implementation performance evaluation, including Faludi's presentation of four types of "effective" planning [40], Yu Li's proposal of establishing planning performance evaluation theory based on urban planning uncertainty analysis [41], Peng Kuntao and Zhao Min's discussion on the urban planning from the inner mechanism of urban spatial performance [42], Wu Yizhou's research on spatial-temporal evolution and its mechanisms for urban planning control performance [43], Cai Keguang's evaluation and measurement of urban master planning performance [44], Yan Wentao's analysis of urban-rural planning regulations' environmental performance [45], and Sun Shiwen's research on the main methods of implementing an urban master planning performance evaluation [46], laying the foundation to explore the planning implementation effectiveness evaluations.

The concept of effectiveness originated from physics, and was later introduced into social disciplines such as management and administration, to evaluate how much the functions or objectives of social activities are achieved under certain conditions. In terms of word formation, it can refer to efficiency, effect, benefit, productivity and energy, etc., externally including the output efficiency, effect and benefit, and internally function, ability and potential. The planning implementation evaluation of COCZs should include the sustainable development concepts, methods, tools, etc., to assess both the external output and the internal capacity. The planning implementation effectiveness can be deconstructed into four dimensions: efficiency, effect, benefit and capacity—that is, "Effectiveness = Efficiency + Effect + Benefit + Capacity", to build a logical framework of planning implementation effectiveness evaluation methods for COCZs (Figure 1).

The construction of specific evaluation methods should give priority to determining the technical standards for evaluation, and the selection of evaluation standards should be determined according to the evaluation content [33]. An efficiency evaluation is based on execution and cost. The former emphasizes the time effect of planning implementation and execution, where the compliance and adherence of the planning administration to the planning is one of the essential conditions for planning to function and produce some output, and it evaluates how well the planning translates into decisions or actions based on its completion rate—for example, whether it is lagging, moderate or

advanced [47–49], etc.—while the latter gives prominence to the analysis of input–output effectiveness or total factor productivity, measured by means of the input–output method or DEA(Data Envelopment Analysis) model [50,51]. An effect evaluation is based on consistency and satisfaction. The former employs evaluation techniques such as a spatial overlay analysis and goal-achievement analysis of the “planning-status quo” consistency, to analyze the fit between the implementation results and the planning [52–56], while the latter adopts qualitative analysis methods, such as questionnaires and interviews, to study and judge the satisfaction of stakeholders of the planning implementation on the improvement of well-being [57–59]. A benefit evaluation is based on value and effect, for measuring the combined influence of wholeness and macroscopicity planning implementation, covering economic benefits, social benefits, environmental benefits, management benefits and political benefits, etc., with an emphasis on the analysis and evaluation of how well the planning intention is achieved [60,61]. Focused on analyzing the applicability of planning for continuous implementation, a capacity evaluation is for a comprehensive analysis of planning implementation prospects and intentions by means of an environmental adaptability analysis of planning implementation and analysis of the intentions of the planning implementers [62,63]. The planning implementation effectiveness of COCZs is a converging compound of the output efficiency, effect and benefit of the practical planning implementation and the expected planning implementation capacity. The key to improving the planning implementation efficiency improvement is emphasizing the efficiency, effect, benefit and capacity.



**Figure 1.** Logical framework of planning implementation effectiveness evaluation methods (self-drawn).

## 2.2. Indication System

Different overseas industrial parks vary in development periods of a life cycle, and also in data and data richness. Based on the previous analysis, as well as public policies [64,65], urban planning [66–69], land-use planning [70] and other experiences in implementation evaluations, this paper constructs an indication system for evaluating the planning implementation effectiveness indexes of COCZs, and gets the weight parameter of each index through the Delphi method (Table 1) in accordance with the requirements of data availability, comparability, accuracy and authenticity, with a sustainable development of the economy, society, environment and culture taken into full account. Scholars, researchers, planners, operators and entrepreneurs who know COCZs well, a total of 20, were invited to assign values to indexes 1, 3, 5, 7 and 9, with the average value as the weight. Planning implementation

effectiveness indexes represent how well the planning is implemented or its implementation probability. By 20, 40, 60, 80, planning implementation effectiveness indexes are classified into five levels: worse, poor, average, good, excellent. From a sustainable development perspective, the purpose of planning implementation is to achieve a high effectiveness, which requires the planning implementation process to harvest as much of the current output as possible, while maintaining sustainable production capacity for the future. The staff association and local community residents constitute major stakeholder groups in the implementation of LJIP planning. However, limited by the difficulty in data acquisition, we regretfully failed to find appropriate representatives of social groups for the Delphi analysis in this exploratory research. We will make up for it in further research.

**Table 1.** Indication system for evaluating the planning implementation effectiveness indexes of COCZs.

Target Layer	Criterion Layer	Index Layer	Interpretation of Indexes	Weight
Indication system for evaluating the planning implementation effectiveness indexes	Efficiency	Plan implementation rate	Proportion of the planning implemented	6.0
		GDP/ total investment amount	Analysis of planning input and implementation output	7.2
	Effect	Output value target achievement rate	Analysis of planning objective achievement rate based on statistical data	8.2
		Employment target achievement rate		4.9
		Investment promotion achievement rate		6.3
		Consistency rate of spatial development results/planning	Spatial overlay analysis of planning and results	5.9
		Equipment rate of environmental protection facilities	Consistency analysis of planning objectives and construction results	5.2
		Planning implementation satisfaction	Planning implementation satisfaction questionnaire	6.6
	Benefit	Investment, current park/parks in the location	Analysis of the effect of planning implementation results on regional development results	6.2
		Economy GDP, current park/parks in the location		7.0
		Society: employed population, current park/parks in the location		5.6
		Ecology: wastewater treatment rate, current park/parks in the location	Analysis of the influence of planning implementation on the upgrading of the park level	5.1
		Politics: park level (value assignment)		6.6
		Management: regional effects of planning rules		4.2
	Capacity	Planning environmental adaptability index	Questionnaire analysis of technology spillover of planning implementation and its promotion for and influence on local innovation	7.6
		Willingness index of the planning implementer		7.4

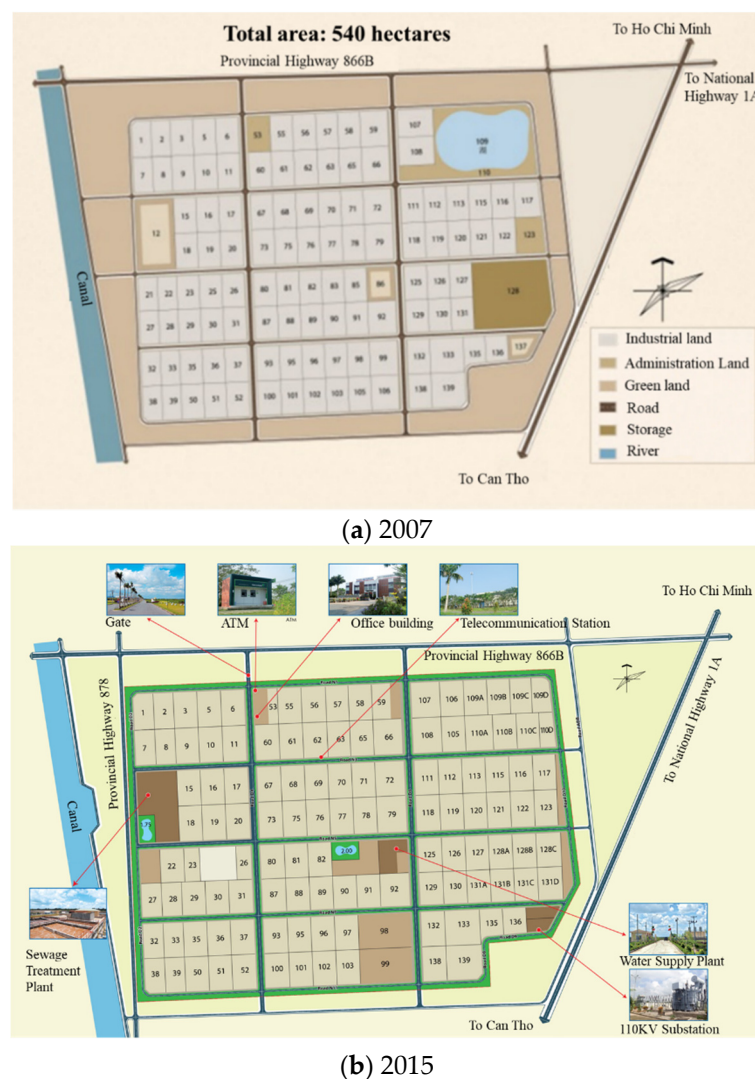
Note: For the park level value assignment, the national level is assigned a value 100, the provincial level 70, the prefectural and municipal level 50, well-known enterprise level (top 500 in China or the world) 30, other levels 10.



### 3. Empirical Research

#### 3.1. Overview of Research Objects

As of November 2018, according to the data released by the Investment Promotion Office of China's Overseas Economic and Trade Cooperation Zone, a total of 103 overseas industrial parks were counted statistically, including 20 assessed and confirmed by China. LJIP is an overseas economic and trade cooperation zone, a typical representative of COCZs. According to the Report on the Construction and Development of China Overseas Industrial Parks under the "Belt and Road Initiatives" (2018), LJIP gets a comprehensive evaluation score of 88.21, ranking first. Located in the Tan Lap 1 commune, Tan Phuoc District, Tien Giang, Vietnam, LJIP covers an area of 600 hm<sup>2</sup> and has a construction period of 50 years. It is planned, developed and operated by Zhejiang Qianjiang Investment Management Co., Ltd. In 2007, the Detailed Construction Plan of LJIP in Tien Giang–Tan Phuoc–Tan Lap 1 by 1/2000 (detailed construction plan of LJIP) was approved by the People's Committee of Tien Giang, Vietnam, and revised in 2015. Since the planning objectives and general plan (Figure 2) have changed greatly after revision, this paper mainly evaluates the 2015 version.

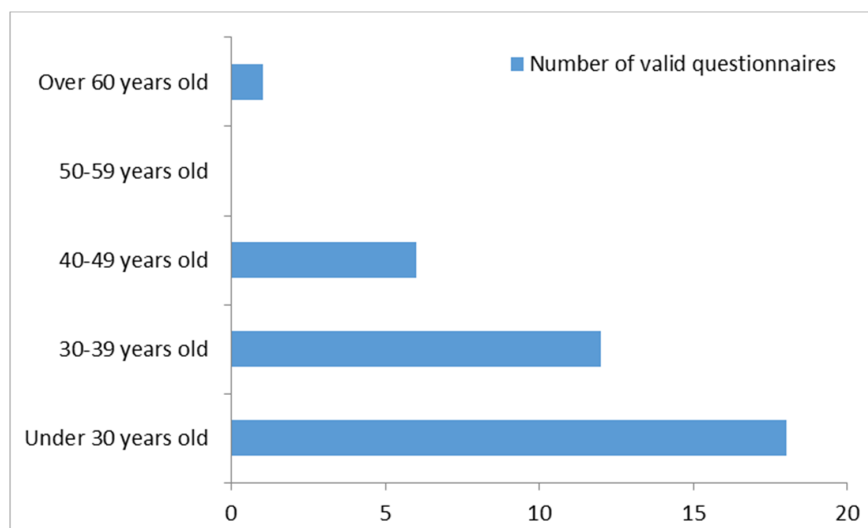


**Figure 2.** Comparative analysis of the general plan between two editions of Longjiang Industrial Park (LJIP) planning (self-drawn).

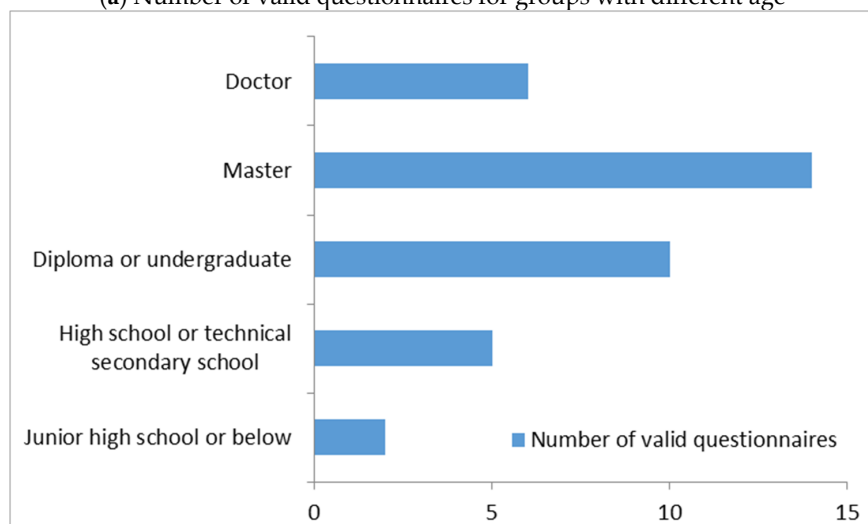
According to the 2007 version of the plan, the park occupies an area of 600 hm<sup>2</sup>, including a total plan of 540 hm<sup>2</sup> for the industrial and 60 hm<sup>2</sup> for residential service areas. The LJIP is dominated by industrial land, which covers 357.36 hm<sup>2</sup>, accounting for 66.18% of the park. The industrial land is planned based on the road network, and the park is divided into 12 large industrial plots with three horizontal and two vertical main roads. It is planned to build infrastructure and public services with “nine supplies and one level”, equipped with ATM (Automatic Teller Machine), a telecommunication station, substation, water supply plant, sewage treatment plant and other facilities, to ensure the orderly and efficient operation of the park. After the 2007 version of the plan was approved by Vietnam’s Ministry of Construction, it encountered many difficulties in land acquisition, leading to its adjustment and the introduction of the 2015 version. The differences between the two versions mainly show in three areas. First of all, the land-use structure has undergone significant changes. In the 2015 version, the land for trees, areas of water, warehouses, wharfs and roads was reduced, while that for industry, technical engineering, centers and services was increased. Secondly, major changes have taken place regarding the spatial pattern, manifested in the relocation of the park entrance from the northeast of the park to the northwest, and the removal of the pool square at the entrance. Thirdly, the space for production land was divided into small patches instead of large plots, changing from 12 large industrial plots to 139 small patches, to enhance the adaptability of investment attractions and enterprise settlements.

### 3.2. Data Source and Processing

The data mainly come from the official website of Vietnam LJIP, the statistics bureau of Tien Giang, questionnaires, field research and the information collected. Data collection and analysis were mainly performed by the following process: the first step is to, via the Internet and the visit to the headquarters of the operators in China, collect documents and statistics of LJIP according to the needs of Table 1, including the text of its overall planning and detailed planning, research reports and news reports, as well as the data of total investment, GDP, output value, enterprises and the number of the employed population. The second step is to design the questionnaire and interview outline according to the needs of Table 1 and get the weight data by a Delphi analysis. The third step is to carry out field research in LJIP in June 2018. We conducted questionnaire surveys on park managers, entrepreneurs, staff, Vietnamese government officials, and interviewed key personnel. We collected relevant documents and statistics on GDP, the employed population, development planning and current situation of the industrial parks in Tien Giang from the visit to Vietnamese officials. The fourth step is to conduct a questionnaire survey using other stakeholders by means of online questionnaire, email and telephone counseling from October 2018 to April 2019, including scholars who have visited the park and scholars who are familiar with the park (not visited), and members of the public who are familiar with the park. The fifth step is to collect and process the questionnaires. A total of 50 questionnaires were issued and 42 were collected, including 37 valid from respondents at 62:38 male-to-female ratio, dominated by young people in terms of age, those with bachelor’s and master’s degrees in terms of the educational background, and the social public familiar with the park, the experts and scholars who have visited the park, and the park staff in the park in terms of identity (Figure 3). The sixth step is to analyze the current situation and changes of land use in LJIP by means of Google Earth and based on the field investigation report produced in the third step. The seventh step is to import the data obtained from the first step, the fifth step and the sixth step into Table 1, and enter the calculation results in Table 2. The data and materials not directly used in Table 1 and interview records were selectively used as supporting arguments and supplementary explanations in the result analysis as needed.



(a) Number of valid questionnaires for groups with different age



(b) Number of valid questionnaires for groups with different educational background



(c) Number of valid questionnaires for groups with different identity

**Figure 3.** Analysis of age, educational background and identity in valid questionnaires (self-drawn).

**Table 2.** Data processing results of planning implementation effectiveness index of LJIP.

Index	Index Value	Index Layer Score	Criterion Layer Score	Target Layer Score
Plan implementation rate	70	4.20	9.42 (71.38)	71.3
GDP/ total investment amount	72.53	5.22		
Output value target achievement rate	24.18	1.98		
Employment target achievement rate	66	3.23	26.89 (72.47)	
Investment promotion achievement rate	86	5.42		
Consistency rate of spatial development results/planning	98	5.78		
Equipment rate of environmental protection facilities	106.67	5.55		
Planning implementation satisfaction	74.59	4.92		
Investment, current park/parks in Tien Giang	82.42	5.11	22.90 (66.01)	
GDP, current park/parks in Tien Giang	30.28	2.12		
Employed population, current park/parks in Tien Giang	22.34	1.25		
Wastewater treatment rate	100	5.10		
Politics: park level	100	6.60		
Management: regional effects of planning rules	64.86	2.72	12.08 (80.55)	
Planning environmental adaptability index	77.84	5.92		
Willingness index of the planning implementer	83.33	6.17		

Note: Data come from the official website of LJIP [71], the statistics bureau of Tien Giang [72] and questionnaires; figures in brackets are subject to the hundred-mark system.

For an accurate understanding of the attitude of stakeholders, we selected 9 groups of people for the questionnaire survey, including: ① park planners, ② government officials in the park management departments, ③ park managers, ④ park entrepreneurs, ⑤ park staff, ⑥ residents around the park, ⑦ scholars who have visited the park, ⑧ scholars familiar with the park (not visited), and ⑨ publics familiar with the park. As this paper is an exploratory study, the questionnaires must be allocated reasonably according to some principles due to the limited number. After discussion by the research group and by referring to the opinions of experts participating in Delphi analysis, we adopted the following principles to allocate questionnaires. For the interest subjects of groups ① and ②, a small proportion of questionnaires was distributed due to the small number of participants. For the interest subjects of groups ③ and ④, a medium proportion of questionnaires was distributed besides interviews with some key personnel due to their great impact but small number. For the interest subjects of groups ⑤ and ⑥, a large proportion of questionnaires was distributed due to their great impact and large number. It is worth noting that due to language differences and other reasons, the survey questionnaires for the interest subjects of group ⑥ showed a low effective rate, so they seemed to be a small proportion in the total of effective questionnaires. For group ⑦, the interest subjects had a more objective and profound understanding of the park in spite of the relatively small number, so a

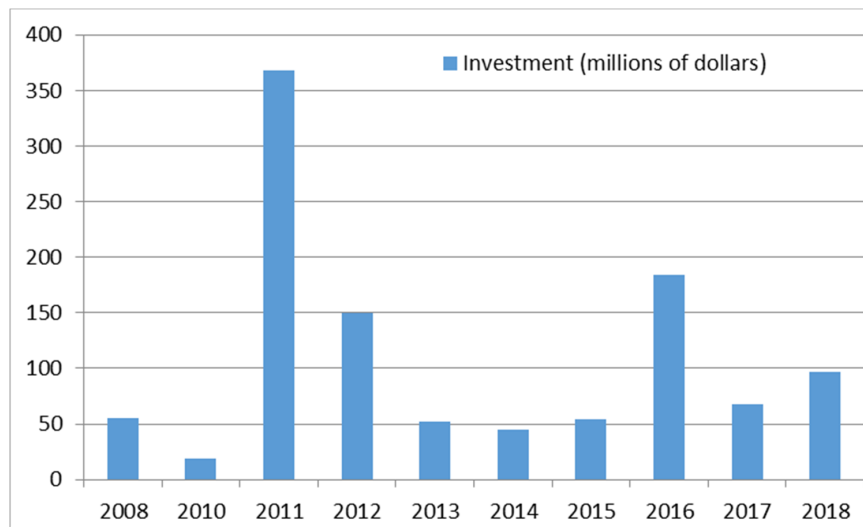
large proportion of questionnaires were distributed and efforts were made to contact them as far as possible with the help of operators for the survey. There were a large number of interest subjects in group ⑧, but they had a limited understanding of the park with no field investigation in person, so a small proportion of questionnaires was arranged for supplementary explanations in some areas. The interest subjects of group ⑨ were in a large number and they had a more objective and profound understanding of the park, so a large proportion of questionnaires were distributed to them.

### 3.3. Result Analysis

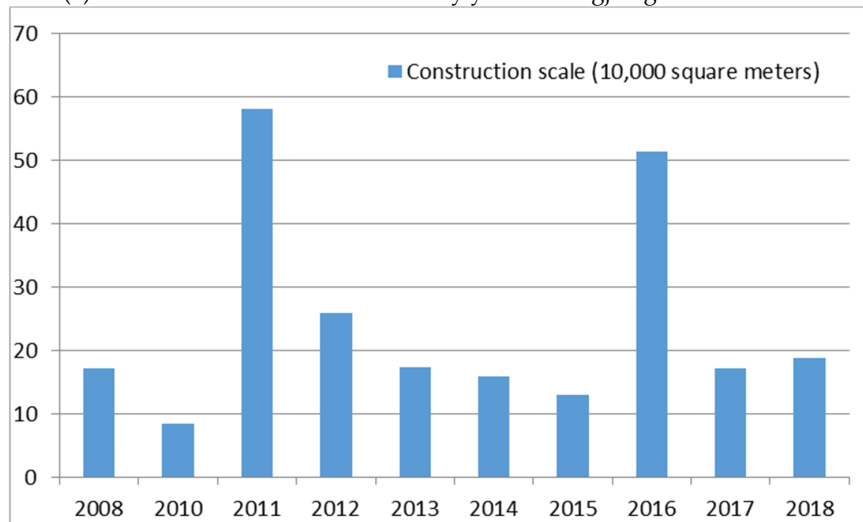
For the Detailed Construction Plan of LJIP, its implementation effectiveness index is 71.3, efficiency index is 9.42 (71.38, subject to the hundred-mark system, the same below), effect index is 26.89 (72.47), benefit index is 22.90 (66.01), and capacity index is 12.08 (80.55) (Table 2), indicating that the planning implementation effectiveness, efficiency and effect are good with an excellent production capacity. It reflects that the planning has guided the development and construction of the park well as well as the investment promotion, and basically balanced the output and capacity of the planning implementation. However, there is still room for improvement in the overall planning implementation time schedule and cost benefits, as well as economic, social, ecological, political and other comprehensive benefits. The planning implementation has a high spatial consistency and public satisfaction, and the planning has a good environmental adaptability and a promising prospect for continued implementation.

#### 3.3.1. Efficiency Evaluation: Time Lagging, Unbalanced in Profit and Loss, Good on the Whole

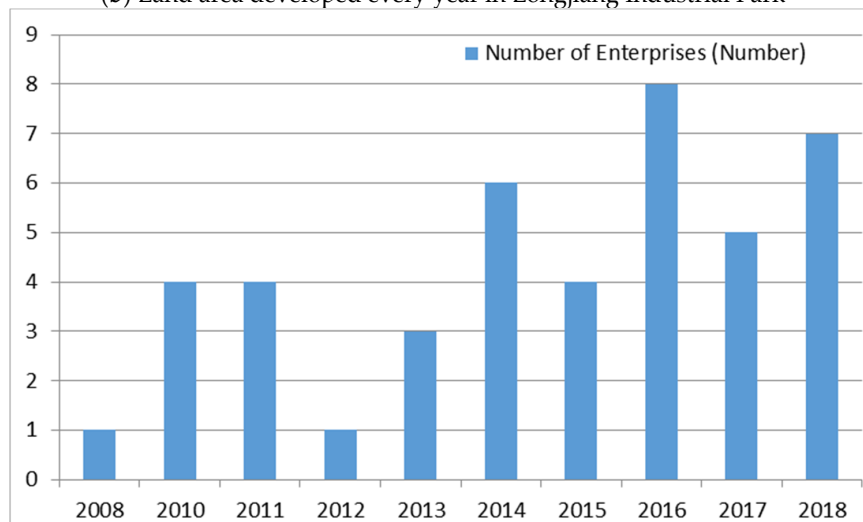
LJIP was planned to be completed in three phases by 2018. The park is implemented on schedule in accordance with the planning for the common aspiration of sustainable development between China and Vietnam. In 2018, the total area of the land used to start development of LJIP was about 420 hm<sup>2</sup> (excluding areas that have been leased or licensed but have not yet been put under construction). The planning implementation rate is about 70%, lagging behind the planning expectations. The lag in planning implementation is mainly affected by the international economic situation and Sino–Vietnamese relations, leading to the tortuous fluctuation of planning implementation, and significant changes in the scale of investment attraction and the number of enterprises stationed (Figure 4). Affected by the 2008 international financial crisis, the planning implementation lagged behind the expectations in the first phase and, especially in 2009, no new enterprises set up presence in the park; the second phase was well under way in general, but, affected by “5.13 Vietnam’s Attacks on Chinese-funded Enterprises” [73], the planning implementation was frustrated in 2014–2015 with hardship in investment attraction, in view of which, coupled with difficulties in park-land acquisition and demolition, the management committee started planning a revision and completed the 2015 version of the planning, benefiting from the “Belt and Road Initiatives” and the in-depth implementation of China’s international capacity cooperation strategy in the third phase. The planning implementation went well and a large number of Chinese enterprises settled in the park, driving the enterprises from Vietnam, Japan, South Korea, Malaysia, Switzerland, Singapore and other countries to gather in the park. The inconsistency between the actual time series of land development and the planning hinders the establishment of a centralized, continuous and progressive development pattern (Figure 5). In 2018, LJIP received an investment reaching up to USD 1.5 billion and created GDP worth USD 1.088 billion, with an economic return rate of 72.53%. However, an input–output balance was not yet achieved, due to the main reason that about 50% of the enterprises in the park were stationed within three years and they were still under construction. Overall, in spite of ups and downs in the planning implementation and many other problems such as time lag and unbalanced profits and losses, after more than 10 years’ of effort, the three phases of development and construction have been basically completed, and the park as a whole has moved from its planning and construction stage to the operation and management-oriented development stage.



(a) Construction funds invested every year in Longjiang Industrial Park



(b) Land area developed every year in Longjiang Industrial Park



(c) Number of Enterprises every year in Longjiang Industrial Park

**Figure 4.** Time series analysis of enterprise investment in LJIP (self-drawn).



Figure 5. Spatiotemporal series analysis of land development in LJIP (self-drawn).

### 3.3.2. Effect Evaluation: Varying Objectives Achieved, Consistency and Satisfaction High

(1) Evaluation of the achievement of planning objectives: there are good employment and investment results and a great gap of output value and performance.

The planning objective calls for a GDP worth USD 4.5 billion, employment of about 30,000 local workers, and admission of 40 to 50 businesses. In 2018, the park brought in a GDP of USD 1088 million, with the output value target achieved by only 24.18%, created safe and decent jobs for 198,00 local people with the employment target achieved by 66%, and ushered in 43 enterprises to settle, with the target of investment attraction and enterprise settlement achieved at 86%. The planning calls for a focus on developing new materials, fine chemicals, biomedicine, electromechanical manufacturing, agricultural and forestry products processing and other industries. In 2018, apart from fine chemicals and biomedicine in the planning meeting difficulties in development, other industrial chains and clusters were taking shape and integrated into the industrial chain and value chain of Tien Giang, Vietnam. The planning also proposes to build a “Travel to Vietnam” corporate public service platform of China. In 2018, a “one-stop” and “one-package” service system was built for enterprises in the park, helping enterprise development transform from “individual combat” to “group cooperation”, which has obviously improved the survival rate and anti-risk ability of Chinese-funded enterprises abroad, and brought the scale effect and cluster effect into full play.

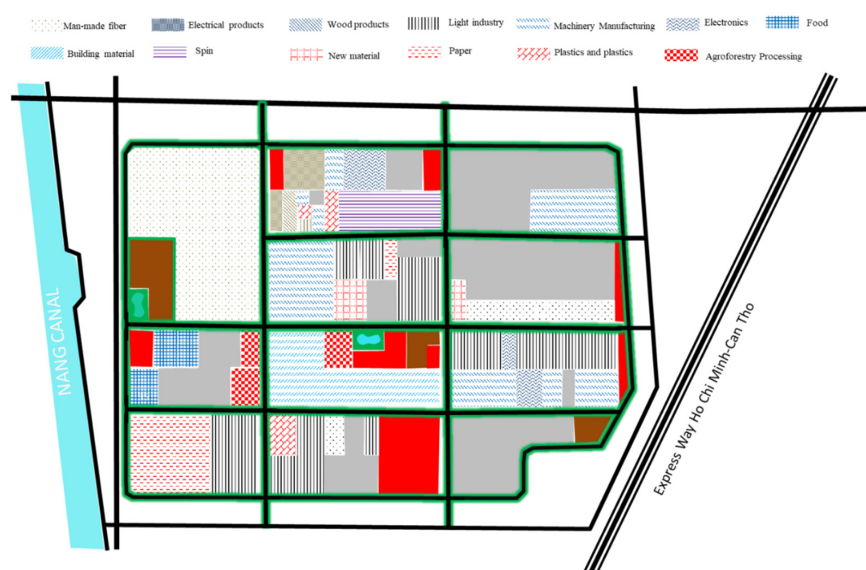
(2) Consistency evaluation of the spatial planning/development results: the land layout is largely consistent, and industrial functions and supporting facilities are finely tuned.

The implementation rate of all kinds of land-use planning is generally over 67% (Table 3), but the consistency of land-use nature varies. The industrial layout planning for industrial land is not completely consistent with the results; the planned clustered industrial zoning has not yet come into being, contiguous industrial land plots show a low concentration ratio, and the industrial spatial functions are more mixed. For example, there are rubber and plastic products, agricultural and forestry product processing and light industry enterprises arranged in the planned machinery manufacturing industrial zone, machinery manufacturing and electromechanical enterprises in the planned light textile industrial zone, and only machinery manufacturing, new materials and paper-making enterprises in the planned biomedicine and fine chemical industry zone (Figure 6). Facilities for production, living and ecology are constructed with a high consistency. Production-supporting facilities—such as the power supply, water supply and drainage, communication, living service facilities, housing and apartments, supermarkets, banks, training centers, management centers, parking lots, eco-environmental protection facilities such as sewage treatment plants, industrial solid waste and residue treatment, and the actual road networks except for four sections—are largely in line with the planning (Figure 7). The main

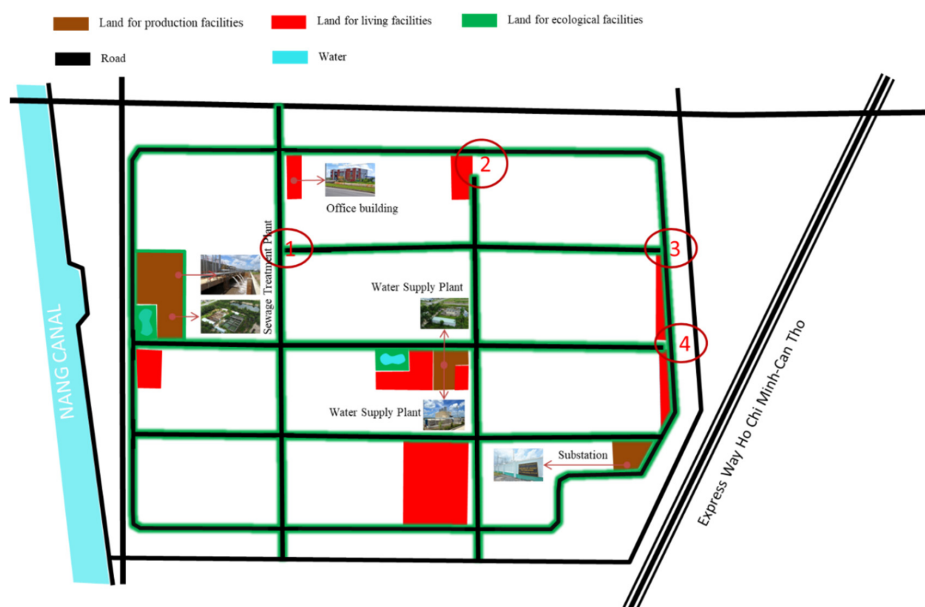
reasons for the inconsistency between the actuality and the planning include: ① the cancellation of branch roads due to the integrated development of multi-plots with the settlement of large enterprises; ②③④ difficulties in land acquisition and demolition as well as the effect of changes in development thinking in the outlying areas of the park.

**Table 3.** Analysis of land-use structure planning and actuality in LJIP.

Land Type	Planning	Actuality in 2018	Achievement Rate
Industrial Land	70	48.7	69.9
Warehousing land	3	2	66.7
Administration office land	5	4	80
Green land	12	8	66.7
Land for municipal facilities	1	0.8	80
Land for traffic	9	6.5	72.2



**Figure 6.** Present industrial layout in LJIP (self-drawn).



**Figure 7.** Planning implementation analysis of main facilities in LJIP (self-drawn).



From a macro perspective of the region, LJIP is about 50 km away from the center of Ho Chi Minh City, but commuting is rare as only some mid-to-top-level managers in the park live in the city. The business passenger flow of LJIP relies on Tan Son Nhat International Airport, and the container trade relies on Saigon Port. Now LJIP connects with Ho Chi Minh City International Airport and Saigon Port via the Ho Chi Minh–Trung Luong expressway and QL1A national highway. From the micro perspective of the region, to support the planning and construction of LJIP, Tien Giang has prepared and implemented a plan for San Fuk's (Vietnam) southeast industrial city, covering an area of 3620 hm<sup>2</sup>. The planning focuses on the construction of industrial parks and the government administrative center, and promotes the integrated development of education, business, residence and entertainment. The current implementation of Sinbog's southeast industrial city plan has not achieved ideal results. Except LJIP and major roads (lines in red represent main roads and those in purple represent secondary roads), the construction of other industrial parks has not been started, nor has the government administrative center been built. Most of the land in the planned area is still farm fields, and the agricultural land in reality has not been transformed for industrial uses as directed by the planning. LJIP has a close commuting relationship between place of work and place of residence with Tan An in the northeast and Mỹ Tho in the south. The two communities are also the most important leisure and entertainment destinations for employees in the park on weekends or evenings.

(3) Satisfaction evaluation of planning implementation: the land-use structure is relatively consistent, the industrial functions are inconsistent, and the road layout is finely tuned.

The analysis in this section was based on 37 effective questionnaires, which have been completed very well. For an exploratory survey, 37 questionnaires were less than enough. To minimize the error, we tried to maintain a relatively balanced number of questionnaires among all the surveyed groups. Satisfaction with the planning implementation scored 74.59 in questionnaires, where 59.46% of respondents chose "Satisfied" and no one chose "Very Unsatisfactory". There was a high satisfaction with the planning implementation. The cross-analysis of identity satisfaction shows that the park planning makers, government officials of corresponding functional departments for park management (Vietnam) and entrepreneurs stationed in the park were 100% satisfied with the implementation of the park planning; the residents around the park, experts and scholars who have a good knowledge of the park, whether they have visited or not, were relatively satisfied with the planning implementation results; park managers, staff and the public who knew the park well were satisfied with the planning implementation results on the whole, except a small proportion who were not (Table 4).

**Table 4.** Cross-analysis of identity-satisfaction in the planning implementation of LJIP (self-drawn).

	Very Unsatisfactory	Unsatisfactory	General	Satisfied	Very Satisfied
Park Planners	–	–	–	100	–
Government official	–	–	100	–	–
Park Managers	–	25	–	50	25
Park entrepreneurs	–	–	–	100	–
Park staff	–	14.29	–	57.14	28.57
Residents around the park	–	–	50	50	–
Scholars who have visited the park	–	–	–	85.71	14.29
Scholars familiar with the park (not visited)	–	–	66.67	33.33	–
Publics familiar with the park	–	12.5	50	37.5	–

Note: the numerical value in the table represents the percentage of five evaluations selected by the respondents of each identity; "–" indicates that no one chooses this evaluation.

### 3.3.3. Benefit Evaluation: A Growth Nucleus of the Economy, Society Converged, Comprehensive Benefits Significant

(1) Economic benefit evaluation: a growth nucleus of the local economy, a new platform for cluster development.

Before the construction of LJIP, the area was a state-owned farm in Vietnam, abounding with pineapples. Since the transformation of agricultural land for industrial use, the development performance of more than ten years has proved that the development of LJIP effectively gives rise to the local economy and plays a positive role in the real estate development of the surrounding communities. LJIP also drives the local urbanization, and promotes the development and appreciation of real estate. Many mentioned in the survey interviews that since the construction of LJIP, the park has witnessed an increase in peripheral real estate development, significant asset appreciation, an increase in non-Vietnamese home buyers and non-self-occupied house purchases, and a rise of annualized returns up to 15–20%, and a higher proportion of investment buyers (increased to 80%).

At present, four of the seven industrial parks approved by Tien Giang are in operation, and LJIP is the only large-scale industrial park in Tien Giang which is basically completed. In 2018, LJIP accounted for more than 80% of the total investment of all industrial parks in Tien Giang. Its total industrial output value accounted for 30.28% of the total created by all industrial parks in Tien Giang and about 20% of the total of Tien Giang. It has grown into a new engine for the transformation and development of Tien Giang from an agricultural economy to industrial economy, having injected tremendous impetus into the development of regional economy and the modernization of urban and rural areas. There are five of COCZs in Vietnam in different stages of development. According to the overall planning implementation results, LJIP, ranked second, next only to Linh Trung Export Processing Zone, has become a model of a “cluster-type entry to Vietnam” for Chinese enterprises in the process of jointly building the “Belt and Road” to promote production capacity cooperation between China and Vietnam.

(2) Social benefit evaluation: the innovative localization model, integrating into local social development.

In implementing the plan, the park actively promotes the localization of employees (talents), products, investment attraction and social services. Local residents are the major beneficiaries of LJIP construction. According to the official website of LJIP, the employed population increased from 507 in 2010 to 2400 in 2019, with an average annual growth of about 47%, playing an important role in solving the local unemployment problem. The employment training organized by the park and the enterprises settled has improved the quality of local labor force in an all-round way. At the time of investigation, the minimum wage of Tien Giang, where LJIP is located, was about 112 US dollars, the average income of residents in the surrounding communities of the park was about USD 150–200, and the average wage of workers in the park was about USD 290–350. The park has provided opportunities for local residents to engage in a stable and decent job. LJIP and the enterprises in the park have offered more than 500 technical and management positions for local residents, whose income is generally 1.5–2 times that of ordinary employees in the local area, and mid-to-top-level managers and technicians may receive up to 3 times or more. In 2018, the park created jobs for 22.34% of the employed population in all the industrial parks in Tien Giang, playing an active role in solving local employment, changing livelihood channels, improving living standards and achieving poverty alleviation. While making good use of local resources, LJIP and the enterprises in the park have been active in raising the income of the local poor farmers to help them out of poverty. Sichuan Tongwei Group, for example, produces livestock feed needed locally with local raw materials such as fishmeal and corn and sells it on the local market, bringing in a considerable income for poor fishermen and corn farmers.

The construction of LJIP has driven the population to gather and created new business opportunities for the residents in the surrounding communities. During the field investigation in Vietnam, we found that a large number of shops, restaurants, trade and logistics companies clustered around the park and along both sides of the main road leading to the park with the completion of LJIP. These private companies are mainly founded by residents in the surrounding communities, and they have significantly improved the living conditions of local residents and business operations. Besides, many residents in the surrounding communities have replaced their temporary huts with solid brick houses, which are being rented out to those coming from remote parts of Tien Giang and working in LJIP. To cope with the

difficulties of land expropriation and relocation along roads in the north and east of the park, and after rounds of consultation with the local government and the surrounding residents, the management committee finely tuned the planning by retreating the park along the main road 100–200 m to retain farmers' land, guiding surrounding residents to do business between the park border and the outer roads to help neighboring residents get rid of poverty and become rich, and creatively integrate into the local society. The implementation of the changed planning has driven a higher social satisfaction.

Moreover, the park attaches great importance to fulfilling its social responsibility, gets involved in public welfare and charity events actively, interacts with the surrounding communities or villages and towns in different ways, donates funds to build schools, roads and bridges, sponsors associations and supports poor families in the local place. The park has won honors such as "Prize for Excellent Completion of Economic Tasks" and "Award for Outstanding Contributions to Social Philanthropy" successively, widely praised by the local society and people. The park and the enterprises settled are actively involved in the local area, participate in local social charities, and fulfill their social responsibilities, while focusing on their own development. In the survey interview, the person in charge of LJIP said that in the past ten years, the park has donated a total of about USD 650,000 to public welfare establishments, which have contributed to the win-win development between the park, the enterprises and local residents.

(3) Evaluation of other benefits: ecological protection, political cooperation, technology communication benefits highlighted.

Planning implementation adheres to ecological priority and attaches importance to the construction of environmental management system and the application of environmental protection technology. Therefore, the park has developed Sewage Discharge Standards of LJIP. LJIP has built a plant for the centralized treatment of sewage, leading all the industrial parks in Tien Giang in the field of sewage treatment. LJIP has established a recycling and reuse system for waste resources, such as plastics, rubbers and metals. For example, Ningbo Yongfeng Packaging Company in Zhejiang produces woven bags using waste plastic caps collected locally, which has pushed the development of a circular economy in the park. With the implementation of the planning, the park was recognized as a state-level overseas economic and trade cooperation zone by the Ministry of Commerce of China in 2011, in 2013 was included as a model of Sino–Vietnamese investment cooperation in the Joint Statement between China and Vietnam, and in 2016 was included in the Guidelines for the Development and Distribution of Overseas Economic and Trade Cooperation Zones (2016–2025) of China, gradually upgraded from the enterprise level to national level. In this process, it has boosted and deepened economic, trade, investment and international political cooperation between China and Vietnam. Planning implementation has promoted the spread and dissemination of China's industrial park planning and construction experience in Vietnam and 64.86% of the respondents believed that there were different degrees of "Planning Law" (Faludi A, 2009) (Table 5).

**Table 5.** Cross-analysis of identity-planning law in the planning implementation of LJIP (self-drawn).

	Very Small	Small	General	Large	Great
Park Planners	–	50	50	–	–
Government official	–	100	–	–	–
Park Managers	–	–	50	50	–
Park entrepreneurs	–	–	100	–	–
Park staff	–	14.29	42.86	42.86	–
Residents around the park	–	–	50	50	–
Scholars who have visited the park	–	14.29	42.86	42.86	–
Scholars familiar with the park (not visited)	–	–	66.67	33.33	–
Publics familiar with the park	–	12.5	50	25	12.5

Note: the numerical value in the table represents the percentage of five evaluations selected by the respondents of each identity; "–" indicates that no one chooses this evaluation.

The Vietnamese government and enterprises have organized many visits to the park, and improved the park planning technology and methods, theoretical knowledge, and management concepts in Tien Giang, providing a reference for the improvement of the park planning system, planning regulations and planning technology in Vietnam. Here are two examples that relate to industrial planning technology and the idea of city and industry integration. Before the construction of LJIP, there was no detailed industrial planning for the industrial parks in Vietnam, and any enterprise could move into the park. According to the industrial planning of LJIP, the space is divided into three phases and four zones, including land development of 100 hm<sup>2</sup> in the first phase, 200 hm<sup>2</sup> in the second phase and 240 hm<sup>2</sup> in the third phase; it plans to develop mechanical, electronic and electrical industries in the first zone, wood products, textile, plastic rubber and light industry in the second zone, drugs, medical equipment, food and fine chemical industry in the third zone, and building materials, agricultural products and the paper industry in the fourth zone. During the implementation of the planning, operators select the appropriate industrial type of enterprises and settle in the corresponding zone space in the park, helping realize the stable and orderly development of the park. By referring to LJIP, other industrial parks in Tien Giang have developed their own industrial plans in the later development process. A 60-hectare supporting living quarter has been planned in LJIP, covering residential, office, retail, school, hospital, sports and entertainment functions, which is of great enlightening value for industrial parks in Tien Giang and even Vietnam to explore the coordinated development of industrialization and urbanization.

### 3.3.4. Capacity Evaluation: Adaptability and Willingness of Continued Implementation Are Both High

Adaptability of the planning implementation is scored 77.84 in questionnaires, where 51.35% of respondents chose “Large” and no one chose “Very Small”. The cross-analysis of identity applicability shows that 100% of the plan-makers and residents around the park think that the adaptability of continued planning implementation is high, while a small number of park managers and the public familiar with the park think that the planning is less adaptable to the future development environment and it should be modified or revised appropriately (Table 6). The willingness to implement the planning scored 83.33 in questionnaires, and 50% of the respondents showed a “Great (Very Strong)” willingness to continue the implementation of the planning. However, according to the field investigation, interviews and questionnaire feedback, the planning implementation is also faced with many problems, such as a lack of a fine planning control system, poor coordination with urban planning, insufficiency implementation of city-industry integration, Smart Parks and other new ideas in the park planning.

**Table 6.** Cross-analysis of identity-applicability in the planning implementation of LJIP (self-drawn).

	Very Small	Small	General	Large	Great
Park Planners	–	–	–	100	–
Government official	–	–	100	–	–
Park Managers	–	25	–	–	75
Park entrepreneurs	–	–	–	66.67	33.33
Park staff	–	–	14.29	42.86	42.86
Residents around the park	–	–	–	100	–
Scholars who have visited the park	–	–	42.86	42.86	14.29
Scholars familiar with the park (not visited)	–	–	33.33	66.67	–
Publics familiar with the park	–	12.5	25	62.5	–

Note: the numerical value in the table represents the percentage of five evaluations selected by the respondents of each identity; “–” indicates that no one chooses this evaluation.

#### 4. Conclusions and Discussion

With the in-depth implementation of the “Belt and Road Initiatives”, more than 100 COCZs have been built, and the demand for planning formulation and implementation of effectiveness evaluations is becoming increasingly urgent. Restricted by state and social institutions, difficulties in information and data acquisition and other factors, quantitatively applicable planning implementation effectiveness evaluations have become an important issue to be addressed for the scientific management and sustainable development of COCZs. By constructing a method system for planning implementation effectiveness evaluations of COCZs from the perspective of sustainable development based on the concept of “Effectiveness = Efficiency + Effect + Benefit + Capacity”, this paper takes LJIP in Vietnam as an example to carry out empirical research and the results show that the planning implementation effectiveness of COCZs represented by LJIP is good on the whole, featuring the continuous profitability of operators, sustained taxation received by host governments, continued protection and improvement of the regional environment, and sustained employment and income for local residents. It brings remarkable comprehensive benefits, and largely achieves balance between planning implementation output and capacity. However, it also faces the problems of a time lag, unbalanced profit and loss, varying objectives achieved, lack of a refined planning control system, and poor coordination between park planning and urban planning. To improve the sustainability of the development and planning of COCZs, from the perspective of national control, it is suggested that China speed up the establishment of a normal and institutionalized evaluation mechanism for the planning implementation of its overseas industrial parks, introduce management methods or guidance on planning formulation and implementation evaluations, and incorporate sustainable development concepts, methods and tools into the management requirements. From the perspective of the healthy development of the park, it is suggested to bring the planning implementation effectiveness evaluation into the periodic assessment to have the parks with a lower effectiveness index drive the revision of the park planning from “function and scale orientation” to “quality and effectiveness orientation”, guide the creation of a model for sustainable development and the planning of COCZs, encourage the parks and their enterprises to attach more attention to the economic development, social progress and environmental protection in the location, making greater contributions to help countries or regions along the belt and road achieve the development goals of Agenda 2030.

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## Article

# The United States' Clothing Imports from Asian Countries along the Belt and Road: An Extended Gravity Trade Model with Application of Artificial Neural Network

Danny Chi Kuen Ho <sup>1,\*</sup>, Eve Man Hin Chan <sup>2</sup>, Tsz Leung Yip <sup>3</sup> and Chi-Wing Tsang <sup>4</sup>

<sup>1</sup> Department of Supply Chain and Information Management, The Hang Seng University of Hong Kong, Hong Kong 999077, China

<sup>2</sup> Faculty of Design and Environment, Technological and Higher Education Institute of Hong Kong (THEi), Hong Kong 999077, China; evechan@vtc.edu.hk

<sup>3</sup> Department of Logistics and Maritime Studies, The Hong Kong Polytechnic University, Hong Kong 999077, China; t.l.yip@polyu.edu.hk

<sup>4</sup> Faculty of Science and Technology, Technological and Higher Education Institute of Hong Kong (THEi), Hong Kong 999077, China; ctsang@vtc.edu.hk

\* Correspondence: dannyho@hsu.edu.hk

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**Abstract:** In 2013, China announced the Belt and Road Initiative (BRI), which aims to promote the connectivity of Asia, Europe, and Africa and deepen mutually beneficial economic cooperation among member countries. Past studies have reported a positive impact of the BRI on trade between China and its partner countries along the Belt and Road (B&R). However, less is known about its effect on the sectoral trade between the B&R countries and countries that show little support of the BRI. To address that gap, this study examines the changing patterns of clothing imports by the United States (US) from China and 14 B&R countries in Asia. An extended gravity model with a policy variable BRI is built to explain bilateral clothing trade flow. A panel regression model and artificial neural network (ANN) are developed based on the data collected from 1998 to 2018 and applied to predict the trade pattern of 2019. The results show a positive effect of the BRI on the clothing exports of some Asian developing countries along the B&R to the US and demonstrate the superior predictive power of the ANN. More research is needed to examine the balance between economic growth and the social and environmental sustainability of developing countries and to apply more advanced machine learning algorithms to examine global trade flow under the BRI.

**Keywords:** clothing trade; Belt and Road initiative; gravity trade model; panel data regression; artificial neural network

## 1. Introduction

Textiles and clothing industries have been driving the economic growth and development of low-income and developing countries like Bangladesh and Cambodia through improved trade, gross domestic product (GDP), employment, and foreign currency receipts [1]. As the United States (US) is the world's second biggest clothing market, any major changes in its GDP and trade policy would significantly affect clothing trade flows. In parallel, China, as the world's biggest clothing supplier, has a key role in shaping global clothing trade patterns. Worth noting is the roll-out of China's Belt and Road Initiative (BRI). It is a development strategy proposed by China in 2013 that aims to promote the connectivity of Asia, Europe, and Africa and to deepen mutually beneficial economic cooperation among member countries [2].

Despite the lack of US support and commitment to the BRI, any study of recent US–Asia bilateral clothing trade should not ignore the influence of this initiative, as promotion of unimpeded trade is a priority for the BRI. Given China’s dominant role in the production and export of clothing products, major changes brought by the BRI will shape the sources of supply and patterns of global trade over time. With the establishment and improvement of trade-supporting infrastructure like power plants, highways, ports, and industrial and logistics parks in developing countries along the Belt and Road (B&R), new sources of clothing supply would emerge. Relocation of clothing factories from China to these countries could grow to take advantage of the relatively lower labor costs and improved infrastructure for trade facilitation. In this way, a win-win situation may be achieved. On one hand, developing countries could benefit from the expansion of their clothing sector, which contributes to export-led economic growth. On the other hand, countries with a large demand for clothing products could have more choices of supply. It is thus important to examine how clothing supply from China and other Asian countries has changed in the US market in the context of the BRI.

The current study’s objectives are to (1) develop an extended gravity model to predict clothing imports of the US from China and 14 Asian countries under the BRI and to (2) compare the model’s predictive power by panel data regression and artificial neural network (ANN) in the US’s clothing imports from 1998 to 2019. This study is valuable as it contributes to the literature on global trade on two fronts. First, it addresses an important yet under-researched area of bilateral trade under the BRI. Although more empirical studies have focused on trade along the B&R, they tend to examine trade flows between China and its trading partners at the country level (e.g., [3–5]) and not trade between B&R and non-B&R countries at the sectoral level. As the BRI aims to promote unimpeded trade through better connectivity of infrastructure and facilities across geographical boundaries, developing countries that have joined the BRI would have a chance to build stronger links to global value chains that connect to high-profit markets that do not necessarily have to be part of the B&R region (e.g., the US). Improving trade not only within but also beyond the B&R region is particularly important for labor-intensive sectors like clothing because more jobs could be created for female workers and their welfare could be improved. Moreover, the entry barriers to the market are relatively lower than those of the industries that demand high-skill labor, advanced technologies, and large capital investment (e.g., new energy automobile). Despite the importance of integrating into global value chains and getting more orders from foreign buyers, little is known about the potential impact of the BRI on improving developing countries’ exports to high-profit markets. The current study aims to fill this gap.

Second, this study applies a novel approach to ANN to analyze bilateral trade flows and demonstrates how ANN complements the conventional econometric approach. The gravity trade model is frequently used to explain global clothing trade patterns [6], and econometric models are built to fit the data. Most often, multiple linear regression of panel data is applied to examine the relative influence of various economic factors, such as a country’s GDP and trade policy, on bilateral trade. More recently, advances in big data availability and affordable high computing power and online platforms have made ANN more accessible for researchers. The use of ANN in this study is relevant and useful not only because of its higher predictive power but also because of its ability to estimate complex trade relationships [4,7]. Although more Asian developing countries have joined the BRI, India is an exception as it has concerns about the expansion of Chinese political influence and interests across South Asia through the BRI [8]. The official Indian narrative of the BRI is not positive, and India’s perceptions have been mainly shaped by geopolitical dimensions of the BRI rather than broader developmental aspects [9]. Moving beyond this one-sided view, it would be helpful to explore the BRI’s effect on India’s clothing exports if India would become a B&R country. To achieve the second objective, the study will develop a model of ANN based on the results of panel regression analysis and evaluate the two approaches based on the unseen data of 2019 exports values. Their predictive performance will be compared with reference to the models’ forecast errors. Furthermore, a country’s clothing exports can be estimated by the ANN when its B&R membership is changed (e.g., India

becomes a B&R country). This helps to explore the potential impact of the BRI on the exports of B&R and non-B&R countries.

The paper is structured as follows. Section 2 discusses Asia's clothing exports to the US under the BRI. Section 3 presents a literature review with a focus on a gravity model for trade estimation. Section 4 presents the methodology. Sections 5 and 6 present the findings and discuss the panel data regression model and ANN results, respectively. Finally, Section 7 concludes the study with implications for policymakers and future research directions.

## 2. The BRI and Clothing Trade

### 2.1. Asia's Clothing Exports under the BRI

Among Asian countries, China has been a leading clothing manufacturer and exporter since the nineties [10]. However, rising production costs and labor shortages in China have led many clothing manufacturers to relocate their labor-intensive production facilities from China to other, lower-cost, countries in the region such as Vietnam [11], Bangladesh [12], Cambodia [13], and the Philippines [14]. The BRI may present opportunities for many businesses to overcome some of the barriers to and risks of relocation. One of the BRI's major outcomes is infrastructure development across the "Silk Road Economic Belt" and "21st Century Maritime Silk Road", which helps to speed up product flows and provide efficient allocation of resources across markets. Improved connectivity of infrastructure and facilities can promote unimpeded trade across geographic boundaries, which are two cooperation priorities of the BRI.

Taking inspiration from the name and purpose of the ancient Silk Road connecting China and Europe for silk trading, the proposed economic corridors of BRI could bring opportunities and challenges to China, developing countries along the B&R, and their trading partners. In the six years since the launch of the BRI, China has signed 171 cooperation documents with 29 international organizations and 123 countries, and the total trade value between China and the B&R countries and regions has exceeded \$6 trillion USD from 2013 to 2018 [15]. In Asia, a growing number of countries have officially pledged support to the BRI by memorandums of understanding (MoU) or joint statements/communiqués since 2013 (See Table 1 for the sampled countries).

**Table 1.** The year that the sampled countries joined the Belt and Road Initiative (BRI).

Year	B&R Country *
2013	China, Cambodia, and Pakistan
2014	Bangladesh and Thailand
2015	Indonesia
2016	Myanmar
2017	Philippines, Malaysia, Nepal, Sri Lanka, and Vietnam
2018	Brunei, Laos, and Singapore

\* Source: Belt and Road Portal (eng.yidaiyilu.gov.cn).

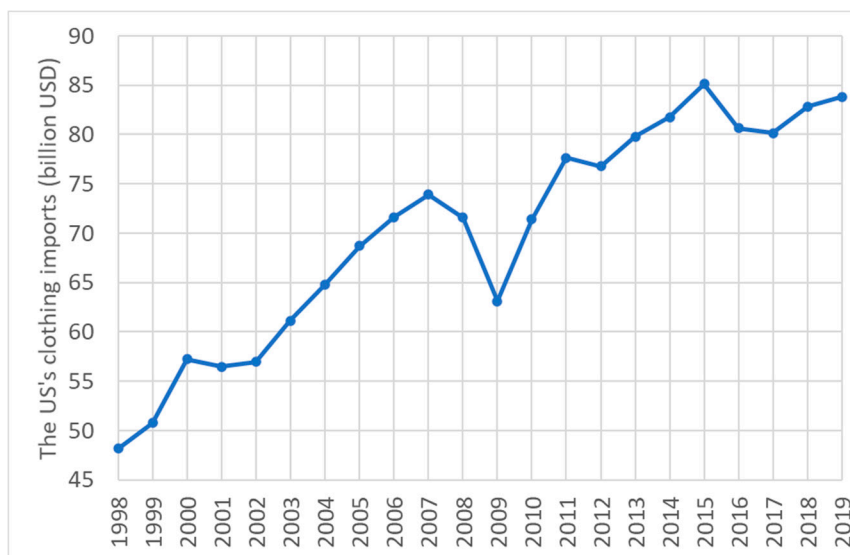
China has been investing heavily in some mega infrastructure projects under the BRI, such as the Bangladesh-China-India-Myanmar Economic Corridor, a Sri Lankan port city, and an Indonesian high-speed railway, which are all designed to facilitate international trade. In 2020, China signed a number of new BRI infrastructure projects across Asia, including the construction of a railroad and deep-water port in Myanmar, a wind power plant in Vietnam, a biomass plant in Indonesia, and several railway projects across Africa [16]. With its implementation in full swing since 2015 [17] and as an ongoing endeavor, the BRI will continue shaping the global trade of different commodities and products including textiles and clothing.

It appears that the BRI benefits not only China but also developing countries that get the most inflows from foreign direct investment (FDI). For the clothing industry in Asia, the BRI could offer potential trading and expansion opportunities, where businesses with production facilities in China

could be relocated to lower-cost B&R countries in Asia. It is worth mentioning that, since 2015, Vietnam's textile and clothing industry has witnessed a significant increase in FDI from South Korea (a B&R country) and the Greater China region (China, Hong Kong, and Taiwan), which injected more than tens of billions dollars in total to expand the production capacity in Vietnam [18]. The establishment of clothing production facilities in the regional B&R countries could boost their economic development by creating more jobs and improving labor welfare. Most importantly, these B&R countries could take the opportunity to build stronger links to global clothing supply chains and pursue export-led economic growth.

## 2.2. The US's Clothing Imports under the BRI

The US is the world's second largest clothing importer after the European Union (EU). The US's clothing imports have been growing overall, reaching a record high of 85.2 billion USD in 2015 (see Figure 1) [19]. In 2019, the US imported 83.8 billion of USD clothing products from the world, representing a 74% increase from 48.2 billion USD in 1998. Asia has been a major clothing supplier for the US market by value, with China as the biggest exporter, followed by Vietnam, Bangladesh, Indonesia, and India (see Figure 2).



**Figure 1.** The US's clothing imports from the world.

Although China has outranked Mexico since 2003 and become the biggest clothing supplier in the US market, its export started to fall after attaining a record high of 30.5 billion USD in 2015. A closer examination of the annual change of US clothing imports (see Figure 3) reveals that despite this, 2016 witnessed a 5.3% reduction in the US's annual clothing imports from the world and China's exports to the US dropped significantly by 8.7%. This pattern is also observed in 2017, where the US experienced a very small drop of 0.6% in its total clothing imports but China's exports to the US dropped by 3.2%. This pattern is in sharp contrast to Vietnam's clothing exports to the US. In 2016 and 2017, even when the US's total clothing imports dropped, Vietnam still attained an annual growth of 2.2% and 7% in its exports, respectively. This shows that Vietnam is able to expand its production capacity and capture a higher market share in the US, while China's clothing exports have been reducing from 2015 onward.

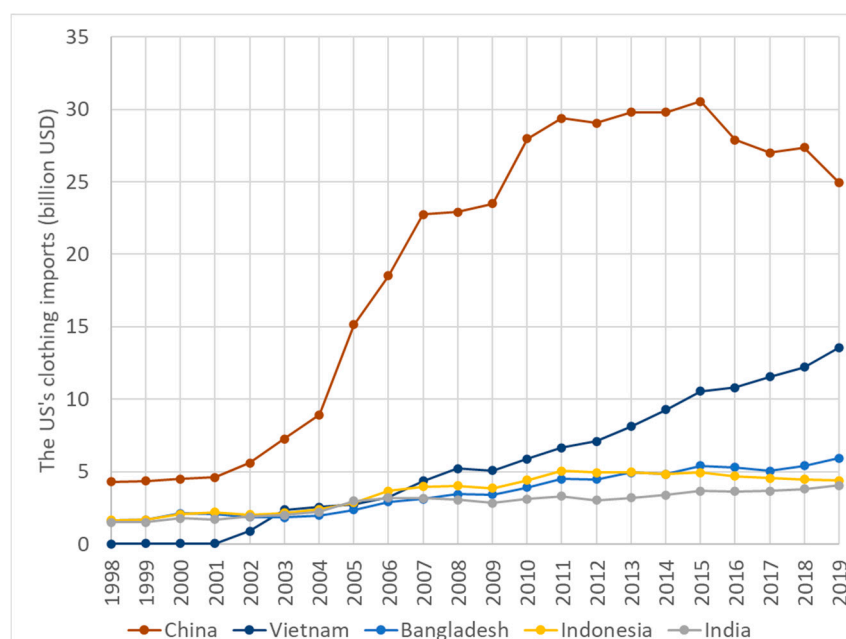


Figure 2. The US's clothing imports from the top five Asian suppliers.

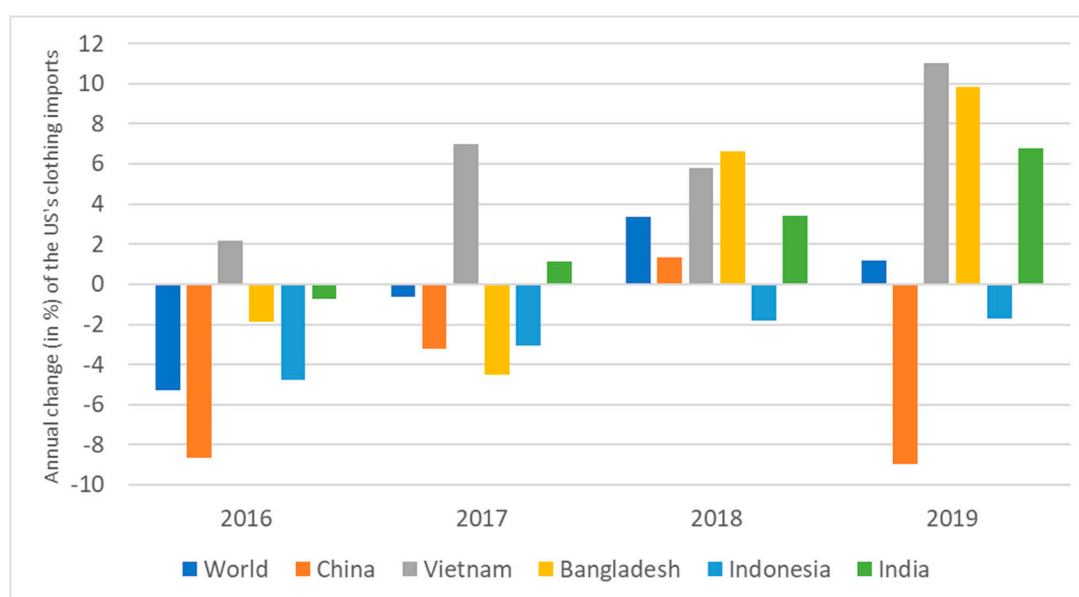


Figure 3. Annual change (in percentage) of the US's clothing imports from the world and the top 5 Asian suppliers.

### 3. Literature Review

In this section, the theoretical framework of the gravity model for trade, recent studies using the gravity model for analysis of developing countries' textiles and clothing trade, and the configuration of an extended gravity model for clothing trade under the BRI are presented.

#### 3.1. Theoretical Framework of Gravity Trade Model

The gravity model is the workhorse of the applied international trade literature. It has been frequently used to evaluate the impacts of various trade-related policies and factors [20], starting with Tinbergen [21] and Poyhonen [22], who found that the volume of trade between two countries is directly related to their economic size and inversely related to the geographical distance between them. In other words, countries with a larger economy tend to trade more, and greater distance, which is a

proxy of transportation costs, hampers bilateral trade. The basic gravity model is represented by the following equation:

$$Y_{ij} = A \frac{X_i \times X_j}{D_{ij}} \quad (1)$$

where

$Y_{ij}$  = Total value of trade between countries  $i$  and  $j$

$A$  = Constant

$X_i$  = GDP of country  $i$

$X_j$  = GDP of country  $j$

$D_{ij}$  = Distance between country  $i$  and country  $j$ .

Anderson [23] provided a theoretical explanation for the gravity equation applied to commodities using a trade-share-expenditure system model. Later, Bergstrand [24] developed a microeconomic foundation for the gravity model and found empirical evidence supporting the proposition that the gravity equation is a reduced form of a partial equilibrium subsystem of a general equilibrium model with nationally differentiated products. Deardorff [25] showed that the gravity equation can be derived from the classic Heckscher–Ohlin model and is consistent with other trade models such as the Ricardian model. Evenett and Keller [26] evaluated gravity equations based on the imperfect specialization of production and found support from the increasing returns theory and Heckscher–Ohlin model. With solid theoretical foundations, the gravity model has been applied extensively in empirical studies of international trade.

### 3.2. Empirical Studies of Gravity Model for Developing Countries' Textiles and Clothing Trade Analysis

In the literature of sectoral trade, the gravity model has been applied to examine bilateral trade of textiles and clothing (e.g., [6,20,27–31]). The results of these studies support the proposition that greater GDP facilitates trade, whereas longer distance reduces trade. Depending upon the research objectives, past studies have developed extended (also called augmented) gravity models [32], which include (1) economic variables like the gross national product (GNP), per capita GDP, per capita GNP, consumer price index, FDI, rate of inflation, exchange rate, and membership in a free trade area; (2) geographical variables like common borders, landlocked, remoteness, land area, transport time, time difference, population size, and population growth; (3) social variables like common language, religion, and literacy rate; and (4) political variables like colonial link and political stability, among others [33].

As the textiles and clothing trade represents a major driver of economic growth for developing countries, a growing number of gravity trade model studies have focused on export countries like Bangladesh, India, Indonesia, and Pakistan. For example, Rahman et al. [34] examined a panel gravity model of Bangladeshi textiles and clothing export flows to 40 trade partners from 1990 to 2017 and found that GDP, per capita GDP, and real exchange rate of the importers as well as Bangladesh's WTO membership have a strong effect on Bangladesh's textile exports. Majeed et al. [35] found a positive impact of the EU's and the US's generalized system of preferences on Pakistan's exports of cotton and textile products to these markets from 2003 to 2014. Irvansyah et al. [36] examined Indonesian's exports of textiles and clothing products in key markets like the US, Japan, South Korea, and Turkey, whereas Chakrabarty et al. [37] focused on knitwear clothing exports from India to the US.

### 3.3. Configuration of an Extended Gravity Model for Clothing Trade under the BRI

Empirical studies that apply the gravity model to examine trade at product and sectoral levels under the BRI are growing. For example, based on the estimation of an extended gravity model using trade data at product-level during 2002–2016, Liu et al. [5] reported that cultural distance and institutional distance inhibit China's bilateral trade with the B&R countries. Zhang et al. [38] found positive impacts of trade facilitation on China's forest product exports to 13 B&R countries using transnational panel data from 2007 to 2016. Leng et al. [39] reported that China's wind energy product

trade with the B&R countries has grown rapidly. Shahriar et al. [40] applied a commodity-specific gravity model to study China's meat exports to 31 trading partners from 1997 to 2016 and found a positive impact of the BRI on China's exports. Despite these studies having examined different products, they have the same focus on China's trade with the B&R countries. Less is known about the trade of B&R countries (other than China) with non-B&R countries like the US. To address this research gap, this study develops an extended gravity model featuring a policy variable BRI, which is expressed as the following log-linear equation:

$$\log(USimport_{ijt}) = \alpha + \beta_1 \log(GDP_{it} \times GDP_{jt}) + \beta_2 \log(D_{ij}) + \beta_3 \log(Exrate_{it}) + \beta_4 Landlock_i + \beta_5 WTO_{it} + \beta_6 BRI_{it} + \varepsilon_{ijt} \quad (2)$$

where

$\alpha$  is the intercept;

$USimport_{ijt}$  is the value of clothing (in USD) imported from country  $i$  (i.e., exporting country) by country  $j$  (i.e., the US) at time  $t$ ;

$GDP_{it}$  is GDP in USD of country  $i$  at time  $t$ ;

$GDP_{jt}$  is GDP in USD of country  $j$  (i.e., the US) at time  $t$ ;

$D_{ij}$  is geographical distance (in km) between the capitals of countries  $i$  and  $j$  (i.e., the US);

$Exrate_{it}$  is official exchange rate of country  $i$  relative to the USD at time  $t$ ;

$Landlock_i$  is a dummy variable with a value of 1 if country  $i$  does not have direct access to sea, otherwise 0;

$WTO_{it}$  is a dummy variable with a value of 1 if country  $i$  has joined the World Trade Organization (WTO) at time  $t$ , otherwise 0;

$BRI_{it}$  is a dummy variable with a value of 1 if country  $i$  has joined the BRI at time  $t$ , otherwise 0;

$\varepsilon_{ijt}$  is the error term.

In the extended gravity model, four explanatory variables, official exchange rate, landlock, WTO membership, and BRI, are included in addition to GDP and distance. The dependent variable is the US's clothing imports (in USD) from Asian countries. Exchange rate is a key factor affecting clothing trade. In general, a weaker domestic currency stimulates exports. Depreciation of the domestic currency of Asian clothing suppliers against the USD is reflected by a higher value of  $Exrate_{it}$ . That is, it requires more domestic currency to exchange one USD. It is expected that the sign of this variable is positive. Landlocked countries like Laos are constrained by their geographical limitations, i.e., no direct access to sea. Higher international trade costs are incurred because they normally depend on their transit neighbors' infrastructure for getting access to foreign markets. This problem is more acute when the cargos for external trade have to transit through neighbors' seaports. It is expected that the sign of the variable  $Landlock_i$  is negative. WTO membership is of particularly importance to the growth of Asian countries' clothing exports because all quota restrictions on textiles and clothing products among WTO members were scheduled to be removed completely by 2005, as set out in the WTO's Agreement on Textiles and Clothing (ATC). It is expected that the sign of the variable  $WTO_{it}$  is positive. Given that the BRI was proposed in 2013, Shahriar et al. [40] created a dummy policy variable with a value of one assigned from 2013 onward and zero otherwise. Different from their approach, the dummy variable of BRI is assigned a value of one for the export country from the year it joined the BRI and onward and zero otherwise in this study. This coding method can better capture the BRI influence on the bilateral trade of individual countries over time. It is expected that the sign of the variable  $BRI_{it}$  is positive. For the variable of GDP ( $GDP_{it} \times GDP_{jt}$ ), the expected sign is positive, whereas distance ( $D_{ij}$ ) is negative.

## 4. Methodology

### 4.1. Dataset

Using the proposed extended gravity model, this study estimates the value of the US's clothing imports between 1998 and 2019 from 15 countries in South/Southeast Asia including Bangladesh, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Nepal, Pakistan, Singapore, Sri-Lanka, Thailand, the Philippines, and Vietnam. Despite the fact that Timor-Leste is also a Southeast Asian country, it does not trade in the clothing industry and therefore is not analyzed. In contrast to other Asian countries, Myanmar is a special case that deserves examination in isolation because of trade sanctions imposed by the US during the study period. From 2004 to 2012, no clothing imports were recorded by the US from Myanmar. Myanmar is excluded from the sample. Since China initiated the BRI in 2013, the remaining 14 Asian countries joined the BRI at different times since then except India. The data are collected from multiple sources (see Table 2). There is no missing data or trade value with zero in the dataset. The values of dependent and four continuous independent variables are log-transformed and then standardized in the pre-processing stage such that their means become zero and standard deviations become one, as these variables have different units of measurement. No transformation is performed on the dummy variables.

**Table 2.** Data source.

Variable	Unit	Data Source
$USImport_{ijt}$	USD	The US's Office of Textiles and Apparel (Category 1: Apparel)
$GDP_{it}, GDP_{jt}$	USD	The World Bank
$Exrate_{it}$	Local currency	The World Bank
$D_{ij}$	Kilometer	SeaRates Website ( <a href="http://www.searates.com">www.searates.com</a> )
$Landlock_i$	0 or 1	World Atlas Website ( <a href="http://www.worldatlas.com">www.worldatlas.com</a> )
$WTO_{it}$	0 or 1	The World Trade Organization
$BRI_{it}$	0 or 1	Belt and Road Portal ( <a href="http://eng.yidaiyilu.gov.cn">eng.yidaiyilu.gov.cn</a> )

### 4.2. Panel Data Estimation Approach

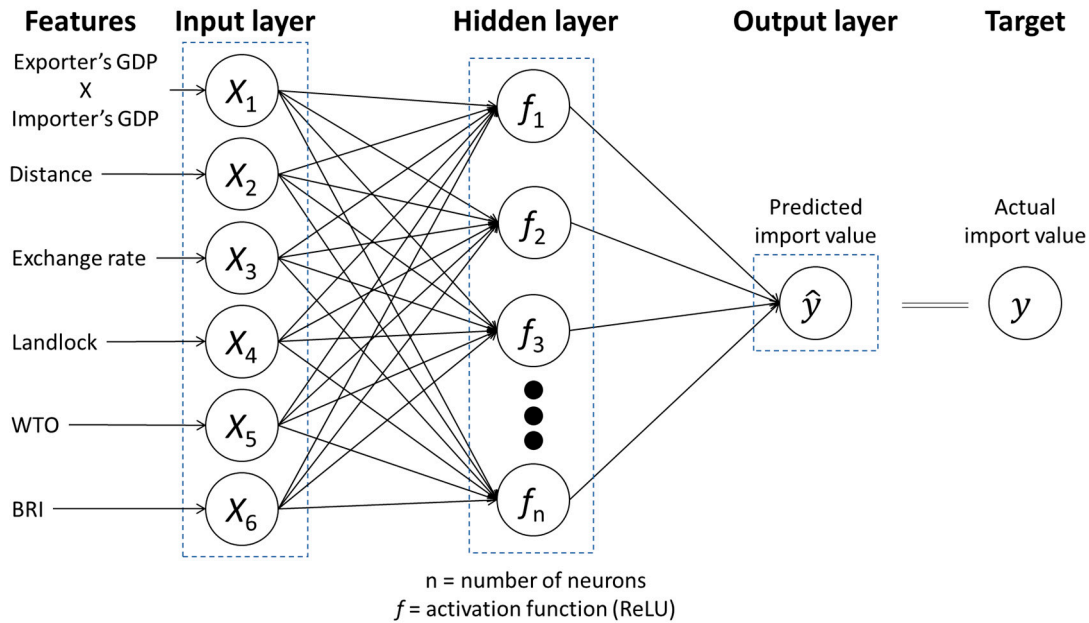
This study conducts a regression analysis with panel data through econometric and statistical software—EViews 10. Cross-sectional or pooled ordinary least squares (OLS) regression is often used to estimate the gravity trade model. Yet, biased results may be created by these estimation approaches [41]. This is because heterogeneity is not allowed in the error term for standard cross-sectional regression equations, thus yielding overestimated results. A panel estimation method with fixed effects (FE) and random effects (RE), on the other hand, could overcome the problems created by using the OLS approach. An advantage of using the panel data estimation method is that it can increase the volume of informative data in variability with less collinearity among the variables [42], which allows more degrees of freedom and efficiency. In this study, the panel data from 1998 to 2018 is analyzed to estimate the regression coefficients with pooled OLS, FE, and RE models. Poolability F test is performed for choosing between the pooled OLS and FE models. Hausman test is performed for choosing between FE and RE models. The best regression model is then used to predict the US's clothing imports in 2019. The out-of-sample forecast error of root mean squared error (RMSE) is computed and compared with that of the best ANN.

### 4.3. The Configuration and Implementation of ANN

The proposed ANN has three layers: input, hidden, and output. In the input layer, there are six features (the product of exporter's GDP and importer's GDP, distance between exporter and importer, official exchange rate, landlock, WTO, and BRI), whereas there is one target (prediction of clothing imports) in the output layer. The features of ANN are selected after panel data regression analysis is completed. Predictors that are not statistically significant at  $p \leq 0.05$  are excluded. The number of



neurons in the hidden layer (i.e., hidden neurons) is optimized by building various ANNs with hidden nodes of 3 to 15 (see Figure 4). The ANN with the best predictive ability is identified by comparison of RMSE of the testing dataset with unseen data across different networks. Similar to Dumor and Yao [4], this study uses Rectified Linear Units (ReLU) as the activation function. The ANNs are trained using the stochastic gradient descent optimizer with mean squared error (MSE) as the loss function.



**Figure 4.** The proposed artificial neural network (ANN) structure.

Instead of dividing the dataset into training and validation sets in one go (e.g., [4,7]), this study applies K-fold cross-validation for training and validation of each ANN. This method provides more robust models and combats over-fitting the model [43]. The 1998–2018 dataset with 315 observations is split randomly into five groups (folds) of equal size. One group is taken as a hold-out or validation set, whereas the remaining four groups form a training set. The model is fit on the training set and the fitted model is evaluated on the validation set. The evaluation score of RMSE is retained, and the model is dropped. This process is repeated five times. The mean of the five RMSEs are calculated for each trained ANN. The 2019 dataset with 15 unseen observations is used for testing of each trained ANN. That is to predict out-of-sample observations. The training dataset is divided into 32 batches, and 200 epochs are set to train each ANN with a learning rate of 0.01. The Keras Sequential model is used to implement the proposed ANNs in Python. The ANNs are created and trained in the Jupyter notebook environment on Google platform.

#### 4.4. Measures of the Model's Predictive Ability

To examine the predictive power of gravity trade model, the conventional econometric analysis and the new approach of ANN are applied. Consistent with past studies (e.g., [4,7]), the prediction accuracy of regression model for panel data is measured by two metrics in this study: the coefficient of determination ( $R^2$ ) and the RMSE. The magnitude of  $R^2$  indicates the proportion of the variance in the clothing imports that is predictable from the independent variables. The higher the  $R^2$ , the better the model fits the data. RMSE is the square root of the MSE, which is the average of squared errors between the predicted values and the actual values of clothing imports:

$$RMSE = \sqrt{MSE} = \sqrt{\frac{\sum_{i=1}^n (\hat{Y}_i - Y_i)^2}{n}} \quad (3)$$

where  $\hat{Y}_i$  is the predicted export value,  $Y_i$  is the actual export value, and  $n$  is the number of predicted export values. A smaller RMSE indicates higher predictive power of the model. This study compares the prediction performance of regression analysis and ANN by RMSE.

## 5. Findings

### 5.1. Results of Panel Data Regression Models

The results of the pooled OLS and year-FE models are shown in Table 3. The result of poolability test favors the year-FE model over the pooled OLS model ( $F(20, 288) = 4.29, p < 0.0001$ ). And the result of Hausman test favors the year-FE model over the year-RE model ( $\chi^2(4) = 28.6, p < 0.0001$ ). The year-FE model explains 74.01% of variance of the US's clothing imports.

**Table 3.** Results of panel data regression models.

The US's Clothing Imports	Pooled OLS	Year-FE
Constant	0.1103	−0.2916 *
Exporter's GDP × Importer's GDP ( $\beta_1$ )	0.3967 ***	0.5256 ***
Distance ( $\beta_2$ )	−0.1740 ***	−0.1307 ***
Exchange rate ( $\beta_3$ )	0.3772 ***	0.4048 ***
Landlock ( $\beta_4$ )	−1.5181 ***	−1.1717 ***
WTO ( $\beta_5$ )	0.1162	0.4038 ***
BRI ( $\beta_6$ )	−0.0723	0.6539 ***
R <sup>2</sup>	0.6627	0.7401
Adjusted R <sup>2</sup>	0.6561	0.7166
F statistic	100.8355 ***	31.5366 ***

Note: \*\*\*  $p < 0.001$  and \*  $p < 0.05$ .

The sign of predictor coefficients of the year-FE model is consistent with expectation. The six predictors contribute significantly to the model, as the  $p$ -value of regression coefficients is smaller than 0.0001. As expected, larger GDP of both the US and Asian countries contribute to higher bilateral clothing trade ( $\beta_1 = 0.5256$ ), whereas longer distance between them hampers the bilateral clothing trade ( $\beta_2 = -0.1307$ ). Depreciation of domestic currency of Asian countries against USD promotes their clothing exports to the US ( $\beta_3 = 0.4048$ ). However, the landlocked country (Laos in the sample) is disadvantaged in its clothing exports to the US ( $\beta_4 = -1.1717$ ). The clothing exports of Asian countries grow more after they have joined the WTO ( $\beta_5 = 0.4038$ ). The same pattern is observed after the Asian countries have joined the BRI ( $\beta_6 = 0.6539$ ). The year-FE regression model attains the RMSE of 20.85 billion USD in the prediction of out-of-sample clothing imports in 2019.

### 5.2. Results of ANNs

As shown in Table 4, the mean values of RMSE decrease in the training and validation sets as expected when the number of neurons in the hidden layer (i.e., hidden neurons) increases. However, when the hidden neurons exceed 10, the predictions in the testing set become less accurate, as indicated by the rise of RMSE ( $>0.1824$ ). The best model is identified when the ANN has 10 hidden neurons because it has attained the best prediction of out-of-sample clothing imports in 2019 with RMSE of 0.1824 (i.e., z-score on the transformed scale) or 2.29 billion USD.

**Table 4.** Results of ANNs.

	Number of Neurons in the Hidden Layer					
	3	5	9	10	11	15
Mean RMSE (training)	0.4332	0.3232	0.2873	0.2800	0.2706	0.2535
Mean RMSE (validation)	0.4537	0.359	0.3314	0.3193	0.3088	0.2871
RMSE (testing)	0.5705	0.4634	0.3944	0.1824	0.2733	0.2848

## 6. Discussion of Results

The regression result shows a significant positive association between the BRI and Asian countries' clothing exports to the US. With the BRI as an ongoing endeavor in which more infrastructure projects are launched and completed and business opportunities continue to materialize, developing countries along the B&R can enhance their attractiveness for FDI in trade-led manufacturing and improve their competitiveness in global trade. The past few years have witnessed a growth in FDI from China injected into the textile and clothing industry in Asian countries including Cambodia, Bangladesh, and Vietnam [32,44]. This trend of relocation of clothing production has driven higher exports from these countries to the US.

Worth mentioning is the losing out of India to Bangladesh in clothing exports in the US market since 2008. Although India and Bangladesh are neighboring countries, their responses to the BRI are different—India has not signed a B&R MoU, whereas Bangladesh is a signatory country of the BRI. In the sample of this study, India is the only non-B&R export country. It is relevant to examine to what degree India would benefit from joining the BRI and, in particular, whether it would improve its clothing exports. The results of the ANN and panel regression analysis show that ANN has higher predictive power, as reflected by their RMSE (2.29 vs. 20.85 billion USD). ANN is applied to examine the change of India's clothing exports if it becomes a B&R country. That involves three steps. The first is to estimate India's exports value based on the unseen, real data of the six features (independent variables) in 2019. The policy variable BRI is coded as zero because India has not joined the BRI. The second step is to estimate India's exports value using the same dataset except that the value of the BRI variable is changed from zero to one. That is to reflect the change of India's B&R membership. The last step is to compare the two forecasted exports values. If there is an increase in exports, there is a potential for India to catch the trade development opportunity after joining the BRI. The ANN predicts that there is a 13.27% increase in India's clothing exports to the US when India becomes a B&R country.

To gather further support for the potential effect of BRI on trade development, the same analysis is performed on three key Asian clothing exporting countries, Bangladesh, Vietnam, and Indonesia. The unseen, real data of 2019 is used. In step one, the value of the BRI policy variable is coded as one because these countries have joined the BRI, whereas in step two, that value is changed from one to zero to reflect the disconnection of these countries with the BRI. In step three of the forecasts comparison, we see that if there is a reduction in exports, these countries would be economically disadvantaged if they cancel the B&R membership. The ANN results show a reduction of 5.38% in Bangladesh's clothing exports to the US when Bangladesh is no longer a B&R country. Similarly, if Vietnam and Indonesia drop the BRI, the reduction in their clothing exports is predicted to be as high as 40.58% and 30.37%, respectively, by the ANN.

Although the above scenarios are hypothetical, both ANN and regression results indicate the potential positive effect of the BRI on clothing exports of some Asian developing countries in the US market. To fully realize the BRI's potential in improving economic growth, developing countries need to enhance geographic, social, and economic factors for trade facilitation. For example, the distance between China and 62 B&R countries in geography (relative geographic distance), factor endowment (capital-to-labor ratio), culture (power distance, uncertainty avoidance, individualism-collectivism, and masculinity-femininity), and institution (measured by the World Bank's Worldwide Governance Indicators) have been found to affect China's exports from 2007 to 2016 negatively [45]. China's trade

agreement partnership and the BRI improve China's exports to 216 partner countries from 2010 to 2015 [46]. The connectivity of 30 B&R countries with China in policy coordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bonds have been found to contribute to their economic growth [47].

Future studies should expand their focus from the bilateral trade between China and the B&R countries to how developing countries can harness the BRI fully to pursue sustainable development through improving exports to high-profit markets in non-B&R countries like the US and Japan. In these studies, key issues of social and environmental sustainability should be addressed. Of particular importance is that the infrastructure projects funded under the BRI for trade facilitation should not be used intentionally or unexpectedly to fuel South-South competition, driving a new race to the bottom among developing countries along the B&R. That is, to attract FDI in labor-intensive manufacturing industries through improved trade-supporting infrastructure on one hand, and to secure orders from foreign buyers at the expense of local labor welfare through inadequate labor protections on the other hand [48,49]. More research on effective policies and measures, such as trade agreements with social clauses or provisions, that improve labor well-being of developing countries in the B&R context is needed.

Environmental degradation in the form of consumption of dirty energy, release of toxic chemical waste during production, and greenhouse gas emissions, among others, have been major concerns of buyers in developed countries and have growing impacts on the restructuring and operations of global clothing supply chains [50]. Developing countries along the B&R should be cautious about adopting the "pollute first, clean up later" growth strategy [51], which could result in permanent damage made to the natural environment and society that cannot be recovered fully even at high costs. A study of carbon emissions induced by exports and imports between B&R countries shows that China has become a pollution haven for 22 developed countries, and 19 developing countries have become China's pollution havens [52]. Future studies should identify a role model and examine effective mechanisms that developing countries along the B&R can follow and apply to strike a balance between economic growth and environmental sustainability.

Regarding the application of ANN on sectoral trade analysis, unlike past studies that have employed a large dataset (e.g., 4536 observations in Dumor and Yao [4] and 91,094 observations in Wohl and Kennedy [7]), only 315 observations (15 countries  $\times$  21 years) are used for the training and validation of ANNs in this study. Despite that, ANN has outperformed linear regression model in predictive performance of the US's clothing imports and corroborated results of past studies. ANN has great potential for use as an alternative method to predict bilateral trade. Without doubt, training a neural network with large datasets helps to avoid overfitting and generalize better. Yet, in some cases, due to various constraints, only a small dataset can be obtained. Future studies should explore using advanced algorithms of machine learning to achieve more accurate predictions with small datasets.

## 7. Conclusions

This study has expanded the empirical literature of global trade under the BRI. Different from past research that examined bilateral trade between China and the B&R countries, this study focuses on bilateral clothing trade between the US and 15 Asian countries along the B&R. An extended gravity model with a policy variable of BRI has been established to explain the clothing trade pattern from 1998 to 2019. Drawing upon the results of panel data regression and ANN, this study has two conclusions. The first is that there is a positive effect of the BRI on the clothing exports of some Asian developing countries in the US market. This finding is important because it supports the notion that the BRI could bring trade opportunity to developing countries not only by improving their bilateral trade with China, which has been revealed by past studies, but, more importantly, by enhancing the B&R countries' exports to non-B&R countries, such as the US, as shown in this study.

The second conclusion is that ANN outperforms a regression model in the prediction of the clothing exports of some Asian developing countries to the US. ANN also complements the regression

model in analyzing the potential impact of policy change. As shown by the ANN results, there is a potential for India to improve its clothing exports to the US by joining the BRI. Moreover, there is a chance for some B&R countries, including Bangladesh, Vietnam, and Indonesia, to experience a reduction in clothing exports to the US to varying degrees if they drop their B&R membership.

The implication of these findings for policymakers is that developing countries in Asia could improve exports performance through participating in the BRI, which brings FDI to enhance trade-supporting infrastructure and expand and upgrade local production capacity so as to build stronger and deeper connections with global value chains and secure orders from foreign customers in high-profit markets. To fully realize the BRI's potential, policymakers need to identify country-specific barriers for building links to global value chains, which could be high costs and unstable supply of energy and key natural resources, insufficient high-skill workforce, weak labor rights protection, loose enforcement of environmental regulations, inefficient customs operations, outdated transport systems, inadequate information and communication technology infrastructure, poor governance and corruption, among other factors. Policymakers need to devise appropriate policies and measures to address the problems and work in close collaboration with other B&R countries and key stakeholders to co-create value for all in the pursuit of sustainable development.

This study is limited to analyzing conventional economic factors in the gravity model. Other factors that bring uncertainty, such as trade protectionism, unstable geopolitics, and social and environmental sustainability, and dynamics that shape global clothing production and trade should be examined in future research. Researchers are advised to employ more advanced machine learning methods in tandem with the conventional econometric approach to examine theoretical models that account for global trade flows at country and sectoral levels under the BRI. That helps to enhance our understanding of the BRI's role and impact on improving connectivity and promoting trade within and beyond the B&R region.

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## Article

# Big Data-Based Assessment of Political Risk along the Belt and Road

Xiaohui Sun <sup>1</sup>, Jianbo Gao <sup>1,2,\*</sup>, Bin Liu <sup>3</sup> and Zhenzhen Wang <sup>4</sup>

<sup>1</sup> Center for Geodata and Analysis, Faculty of Geographical Science, Beijing Normal University, Beijing 100875, China; xxs793@hotmail.com

<sup>2</sup> Institute of Automation, Chinese Academy of Science, Beijing 100190, China

<sup>3</sup> Business School, Guangxi University, Nanning 530004, China; binliu.sxs@gmail.com

<sup>4</sup> Department of Geography and Resource Management, The Chinese University of Hong Kong, New Territories, Hong Kong 999077, China; zhenzhen\_jane@link.cuhk.edu.hk

\* Correspondence: jbgao.pmb@gmail.com

**Abstract:** Political risk assessment has become increasingly important in recent years, especially with the launch of the Belt and Road Initiative (BRI) and with Covid-19 still ravaging the world. This study aims to assess systematically the political risk of BRI countries during the period from 2013 to 2019 based on three big data sets, the Global Database of Events, Language, and Tone (GDELT), China Global Investment Tracker (CGIT), and Armed Conflict Location & Event Data Project (ACLED). It is found that to properly quantify the political risks for BRI countries, the type of events, “Material Conflict”, and a variable characterizing the degree of cooperation/conflicts of the events, the Goldstein Scale, are of critical importance. Based on the chosen type of events and variable, we design a normalized variable to assess political risk of any country in any year so that comparison among different countries can be meaningfully made. By decomposing political risk into two components, domestic and international, and examining the spatiotemporal evolution of political risk along the Belt and Road, we find that the sum of the number of BRI countries with the extremely high level and the high level of domestic, international, and (overall) political risk all reached the peak in 2015, and decreased thereafter, and that often the level of domestic political risk along the Belt and Road was higher than the international political risk. It is also found that a strong positive correlation exists between political risk and China’s total investments and construction contracts along the Belt and Road during this period. The implications of this positive correlation are discussed. The analysis presented here may help to promote the sustainable development of BRI, and be extended to examine the risks associated with foreign investments other than BRI projects.

**Keywords:** political risk; assessment; big data; GDELT; Belt and Road Initiative (BRI); China



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## 1. Introduction

Being a critical issue of business environment, risk assessment has been a hot research topic in recent decades. Especially with the launch of the Belt and Road Initiative (BRI) in 2013 by the Chinese President Xi Jinping, a subset of the issue, political risk assessment, has become increasingly important [1–5]. BRI is also known as One Belt One Road (OBOR), aiming to increase cooperation among participating countries [6]. As of Jan 2020, 138 countries and 30 international organizations have signed BRI cooperation agreements with China [7]. China’s accumulated direct investment to BRI countries has reached USD 117.31 billion during the period from 2013 to 2019 [8], accounting for 11.60% of gross flow of China’s outward foreign direct investment.

Since the launch of BRI, much research has been done to properly interpret BRI [9–12], carry out case studies of international projects instigated by BRI [13,14], study China’s outward foreign direct investment to BRI countries [15–17], and study the influence of BRI on concerned countries or regions [18–25]. However, research into the political risk

facing the many countries along the Belt and Road, especially China, has not gained sufficient attention. Understandably, political risks may impact on the sustainability of BRI and cause substantial loss of investment [26,27], and thus constitute a major challenge for any country which has investments abroad. As an example, Teheran-Qom-Esfahan high-speed railway project was terminated indefinitely as a result of the sanction on Iran's nuclear program in 2013 (from the USA, Europe, and the UN), which led to a tremendous economic loss of up to EUR 8.4 billion investment from China [28]. While many countries and regions around the world are still recovering from the global financial crisis of 2008 and adjusting to changed international investment patterns, the outbreak of COVID-19, which began in early 2020 and has intensified in recent months, has tremendously exacerbated the risk of instability. Indeed, tensions, mass protests, social unrest, economic collapse, and humanitarian crises have been reported in many countries and regions around the globe [29,30], and the global GDP growth has been forecasted to drop 4.4% in 2020 [31]. These issues may have a tremendous adverse effect on the sustainability of BRI. Therefore, systematic study of political risk along the Belt and Road has not only been important, but also pressing. Since a main component of BRI can be regarded as overseas investments and cooperation in this world, thus, systematic study of political risks for BRI countries may also shed light on general overseas investments. However, quantifying political risks is a difficult issue, as political risks have many manifestations, such as social unrest, civil disturbance, riots, political instability, terrorism, and even wars [32–34]. This difficulty motivates us to explore a big data-based assessment of political risk for BRI.

There is a vast literature on the assessment of political risk. While most research in the field focused on conceptual thinking [35,36], developing some rating indices [37,38], and quantifying risks based on small data [5,39–42], major efforts have yet to be made to use big data for assessment of political risk. Recently, an important and illuminating step has been taken from a research group based on big data using spatial statistical analysis [43]. The big data they have used is called the Global Database of Events, Language, and Tone (GDELT), one of the most comprehensive data set regarding news report in the world. GDELT has many advantages to make it valuable for analyzing political risk. In particular, GDELT has been covering almost all news about the events occurring in the world since 1979, in over 100 languages. By now, the number of events covered has exceeded 600 million, and the database is updated every 15 min. Each event has two actors, such as country A and country B (for example, the Nagorno-Karabakh Conflict between Azerbaijan and Armenia which started in 1988 and recurred recently). One of the most important and interesting attributes of the GDELT event data is that each event is assigned a number, called Goldstein Scale, which is in the range of  $-10$  and  $10$  and quantifies the degree of conflict or cooperation between the two actors of the event. In Zhang et al.'s work [43], they basically used the number and location of four types of events, assault, protest, coerce, fight, as the proxy of political instability, social unrest, lack of democracy, and external conflict, to assess political risk of BRI countries. While enlightening, they produced some intriguing results, such as the level of political risk in Russia (particularly in Moscow and North Caucasus) is almost as high as that in Syria in recent years (more precisely, from Oct 2013 to May 2018). Is the political risk in Russia really this high, or the observation is due to some factors, such as Russia has been active in world affairs in recent years, and is thus rich in news?

To resolve the above and other issues, we will consider systematically how to assess political risk by using GDELT and other big data. More concretely, we aim to assess systematically the political risk along the Belt and Road during the period from 2013 to 2019, based on big data comprising GDELT, the China Global Investment Tracker (CGIT), and the Armed Conflict Location & Event Data Project (ACLED). We will focus on two important questions: (i) How can political risk of BRI countries be properly assessed? (ii) Are China's BRI investments and construction contracts largely in BRI countries with low levels of political risk? If not, what are the general characteristics of political risks associated with China's BRI investments and construction contracts?

In making efforts to answer the above questions, we made six contributions: (1) In trying to resolve why political risk measured by the number of events for “Protest”, “Coerce”, “Assault” and “Fight” in Russia is so high, we find that the basic reason is that the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number of events can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval. For example, when international affairs are concerned, the more active a country is, the more news reports the country will get. In GDELT, the number of events is roughly proportional to the number of news reports. Realizing this, one can readily understand why Russia has the large number of events belonging to “Protest”, “Coerce”, “Assault” and “Fight”—this is because Russia has been very active in world affairs in recent years; in fact, Russia has the largest number of events among all the BRI countries. (2) Aiming to represent more pertinently and more comprehensively the events that may directly affect foreign investment, we select a new class of events called “Material Conflict” coded in GDELT, which consists of “Exhibit Force Posture”, “Reduce Relations”, “Coerce”, “Assault”, “Fight” and “Use Unconventional Mass Violence”. (3) To facilitate comparison among countries that may have vast differences in national capabilities, geographical characteristics, cultural background, etc., we design a normalized quantify, the ratio between the sum of the Goldstein Scale of “Material Conflict” events and the sum of the Goldstein Scale of all the events. Clearly, using the Goldstein Scale of the events is more advantageous than directly using the number of events, since an event with the Goldstein Scale of  $-10$  amounts to 10 events with the Goldstein Scale of  $-1$ . (4) To assess which type of political risk a BRI country is facing, we study domestic and international political risk which are two components of the political risk. (5) We examine the spatiotemporal evolution of political risk along the Belt and Road during the period from 2013 to 2019. (6) We find a strong positive correlation between the political risk and China’s investments and construction contracts along the BRI during the period from 2013 to 2019. While this is quite the opposite of the ideal case that investment goes to countries or regions with as low political risk as possible, it nevertheless corroborates a general saying that chances are often associated with risks.

The remainder of the paper is organized as follows. Section 2 contains the literature review. Section 3 explains the data and methods. Section 4 presents the assessment results about the political risk along the BRI, and examines the correlation between the political risk and China’s total investment and construction contracts in a period from 2013 to 2019. Sections 5 and 6 contain the conclusions and discussions, respectively.

## 2. Literature Review

Since multiple risks are involved in investments by multinational firms and international projects [44], in recent years, study on the correlation between the political risk and foreign investments [4,40,45–50] and the relevance of political risk to multinational firms [51–53] and international projects [37,54,55] are gaining increasing attention. These studies are especially important for the study of China’s investments in BRI countries [56]. While much research on BRI has been done, including interpretation of BRI [9–12], case studies of international project [13,14], analyses of various risks (e.g., environmental risk, energy investment risk, investment risk etc.) [5,57,58], China’s outward foreign direct investment to BRI countries [15–17], the influence of BRI on concerned countries or regions [18–25], and energy efficiency and environmental quality along BRI [59–61], recently, attention has also been paid to the analysis of political risk along the Belt and Road [3,5,43]. In particular, Morris [3] has provided three dimensions for the analyses of political risk, including geopolitical level, country level, and project level, and has called for a comprehensive understanding of political risk along the Belt and Road. Hussain et al. [5] considered political risk as part of challenges that China has to consider for its investment in a host country. To assess the risks facing China’s investment to BRI countries, they employed the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method and proposed an

indicator system. Zhang et al. [43] combined big data sets and spatial methods to analyze political risk of BRI countries and China's investment and construction projects.

While interesting, existing studies on big data-based assessment of political risk along the Belt and Road are limited. In fact, as many countries and regions along the BRI are unstable and vulnerable, such as Yemen, Iraq, and Afghanistan, which have been struggling with social unrest, political conflicts, terrorism and even wars, China's foreign investment towards these BRI countries surely needs serious consideration, especially the factors that could impact greatly on the business environment along the Belt and Road and the sustainability of BRI. Indeed, many overseas projects by China have not been successful. For example, the Myitsone Dam in Myanmar, which is one of China's largest electricity infrastructure projects, was terminated by Myanmar's former military government [62]. As another example, the Hambantota Port project in Sri Lanka also highlighted the importance of political risk study [63].

Although the study of the political risk along the Belt and Road is important, relevant literature however is limited, therefore, in this section, we will take a review of the general studies on political risk that may not target BRI. This general literature is quite rich, and may be divided into two lines. One line has focused on conceptual discussion of political risk [35,64], which can be classified into two clusters [35,36,65]. One cluster has emphasized government interferences with business operations in different scenarios. Robock [66] has considered "government in power and its operating agencies" as one of groups which could generate political risk, such as confiscating certain properties of international operations. Similarly, Butler and Joaquin [67] indicated political risk is unexpected changes on the "rules of game" of business operate by sovereign host government, and this government action may cause more uncertain investment consequences. Besides the element of causing political risk, government intervention in business is regarded as one of the most serious political risk effects as well [1,68]. The other cluster has considered political events as generators of political risk in international business. Adverse outcomes may arise from political events, such as wide-scale strikes, bombings, riots, violence, changes in government [35,65,66]. As political risk may affect the outcome of foreign direct investments, Clark [40] has considered "the probability of politically motivated change". Likewise, Khattab et al. [36] proposed political risk to be regarded as the probability that a political event will occur, which may cause loss for companies and other investors. Consequentially, if political risk is considered as the probability that political events will result in loss of investment, the degree of political risk will be determined by the "size" of this probability [56].

The other line of research on political risk has focused on empirical analyses of political risk. Along this line, much effort has been made to develop proper indicators for political risk. As examples, Hussain et al. [5] proposed an indicator system for environment risk based on the "Technique for Order Preference by Similarity to Ideal Solution" (TOPIS) method, which contains four sub-indices for political risk. Chang et al. [55], based on a comprehensive review of literature, identified nine categories of political risks which contain a total of 29 political risk factors and three political risk consequences. Furthermore, efforts have also been made to develop several rating indices to address political risk through multifarious variables, such as International Country Risk Guide (ICRG) model [37], and the Fragile States Index (FSI) [38]. ICRG model, launched online by the Political Risk Services (PRS) group, has built a political risk rating system comprising 12 components of political risk with different ranges of values, as a means of assessing political stability in 166 countries [37]. These 12 components of the ICRG model, including the government instability, internal and external conflict, corruption and ethnic tension, law and order, democratic accountability of government, and quality of bureaucracy, were used by Busse and Hefeker [39] to examine their effects on foreign direct investment. Another rating index, FSI, uses a three-layer system to define "Political Indicator", where the 2nd layer uses by 4 groups of variables and the 3rd layer contains 12 detailed indicators to rank countries around the world [38]. Clark [40] proposed assessing political risk as a

cost in capital budgets, to value impacts of political risk on consequences of foreign direct investment. Butler and Joaquin [67] developed a model to isolate diversifiable and non-diversifiable sources of political risk, and analyzed the effects of political risk on returns and cost of capital. In contrast to developing a model, Howell and Chaddick [49] evaluated three political risk assessment models, the Economist Method, Business Environment Risk Intelligence (BERI), and Political Risk Services, with actual losses.

While literature on the assessment of political risk is rich, major efforts have yet to be made to assess political risk based on big data. Recently, an important and illuminating step has been taken by a research group based on big data using spatial statistical analysis [43]. The significance of this work is that it showed the potential of associating political events reported in mass media with risk. This potential lines well with many earlier studies showing that political events are often associated with political risk [1,50,65,69]. As event data can now be readily generated through machine-reading from texts, such as news reports, intelligence reports, press conferences, etc., we can hope that factors relevant to political risks will be more comprehensively identified in the future. Along this line, however, it is important to be reminded of a complexity emphasized by Clark [40] that the evolution of political risk may be involved in reaction to countless events.

Therefore, systematic assessment of political risks along the Belt and Road on China's foreign investment using big data has become increasingly important.

### 3. Data and Methods

#### 3.1. Data

GDELT is the major data to be used here. It includes more than 600 million distinct events across all countries, during the period from 1979 to the present, covering 20 categories and over 300 subcategories. GDELT events are drawn from a wide variety of news media, both in English and non-English, from across the world, ranging from local to international sources in nearly every country, based on the Conflict and Mediation Event Observations (CAMEO) event coding ontology [70,71]. Each event has two actors (Actor1 and Actor2), such as country A and country B (for example, the Nagorno-Karabakh Conflict between Azerbaijan and Armenia which started in 1988 and recurred recently). One of the most important and interesting attributes of the GDELT event data is that each event is assigned a set of attributes, including the interval-level Goldstein conflict-cooperation scale value [72], called Goldstein Scale, which is in the range of  $-10$  and  $10$  and quantifies the degree of conflicts or cooperations between the two actors of the event. GDELT can be downloaded from <https://www.gdeltproject.org/> (accessed on 16 September 2020). To compute political risks using GDELT for countries along the Belt and Road during the period from 2013 to 2019, we use the computing platform provided by the Center for Geodata and Analysis, Faculty of Geographical Science, Beijing Normal University. We use the MATLAB-R2019b and Python to identify the time, Actor1, Actor2, types of events, number, and Goldstein Scale for the events covered by GDELT, and then compute variables of interest.

CGIT is used here for the purpose of examining the correlation between the political risk of the BRI countries and China's investments and construction contracts, covering 52 BRI countries. CGIT is the only open data set covering China's global investment and construction contracts comprehensively, and has covered 3400 large transactions and 300 troubled transactions [73]. These transactions are in the areas of energy, transportation, real estate, and other industries, and contain information about Chinese parent company, host country, and sector to which the investment or project belongs.

Besides, we shall also use a database called ACLED to better determine the risks a BRI country faces. ACLED is a conflict data set which records information of internal political conflict events with dates, geographical locations, types, actors, fatalities, etc. [74], which has recorded in real-time, covering almost a million unique events in over 150 countries during a period from 1997 to 2020. As only in 2018 and 2019 ACLED covers all BRI countries, we consider a country to have fatalities of more than 10,000 caused by armed conflicts

during the period from 2018 to 2019 to be war-torn. By this criterion, Afghanistan, Yemen, Syria and Iraq are war-torn. Investments to them, and to Syria (which is not covered by CGIT), will not be considered in the correlation analysis of this study.

While 138 countries signed BRI cooperation agreements with China as of Jan 2020 [7], we select the initial 63 countries along the Belt and Road since the launch of BRI in 2013 that have news reports covered by GDELT, so that their spatial evolution of political risks in the whole period from 2013 to 2019 can be examined. According to the official website of BRI (<https://www.yidaiyilu.gov.cn/jcsjpc.htm> (accessed on 16 September 2020)), these 63 countries belong to 6 major regions: Northeast Asia, Southeast Asia, South Asia, West Asia and North Africa, Central and Eastern Europe, and Central Asia. They are listed in Table 1. The country codes referred to here follow those of GDELT.

**Table 1.** Regions and corresponding countries along the Belt and Road.

Regions	Countries (Country Codes)
Northeast Asia	Mongolia (MNG), Russia (RUS)
Southeast Asia	Singapore (SGP), Indonesia (IDN), Malaysia (MYS), Thailand (THA), Vietnam (VNM), Philippines (PHL), Cambodia (KHM), Myanmar (MMR), Laos (LAO), Brunei (BRN)
South Asia	India (IND), Pakistan (PAK), Sri Lanka, (LKA), Bangladesh (BGD), Nepal (NPL), Maldives (MDV), Bhutan (BTN)
West Asia and North Africa	United Arab Emirates (ARE), Kuwait (KWT), Turkey (TUR), Qatar (QAT), Oman (OMN), Lebanon (LBN), Saudi Arabia (SAU), Bahrain (BHR), Israel (ISR), Yemen (YEM), Egypt (EGY), Iran (IRN), Jordan (JOR), Syria (SYR), Iraq (IRQ), Afghanistan (AFG), Palestine (PLE), Azerbaijan (AZE), Georgia (GEO), Armenia (ARM), Bahrain (BHR)
Central and Eastern Europe	Poland (POL), Albania (ALB), Estonia (EST), Lithuania (LTU), Slovenia (SVN), Bulgaria (BGR), Czech (CZE), Hungary (HUN), Macedonia (MKD), Serbia (SRB), Romania (ROU), Slovakia (SVK), Croatia (HRV), Latvia (LVA), Ukraine (UKR), Belarus (BLR), Moldova (MDA), Greece (GRC), Cyprus (CYP)
Central Asia	Kazakhstan (KAZ), Kyrgyzstan (KGZ), Turkmenistan (TKM), Tajikistan (TJK), Uzbekistan (UZB)

### 3.2. Methods

#### 3.2.1. Choosing the Proper Type of Events—"Material Conflict"

We believe choosing pertinent types of events to evaluate political risk is of critical importance. While Zhang et al. used four types of events: "Protest", "Coerce", "Assault", and "Fight" [43], we will show in the Results Section that the type "Protest" is inappropriate to be included for evaluating political risk—the simplest reason one can immediately think of is that the nature of a protest in a democratic country or a non-democratic country is completely different, and thus including "Protest" will make comparison among BRI countries that are full of democratic and non-democratic countries impossible. Besides the remaining three types of events used by Zhang et al. [43], namely, "Coerce", "Assault", and "Fight", we will also include "Exhibit Force Posture", "Reduce Relations", and "Use Unconventional Mass Violence". These six types of events constitute one of the Quadclasses, "Material Conflict", in GDELT. The other three Quadclasses are "Verbal Cooperation", "Verbal Conflict", and "Material Cooperation" [71]. "Material Conflict" contains six groups of events, "Exhibit Force Posture", "Reduce Relations", "Coerce", "Assault", "Fight" and "Use Unconventional Mass Violence". The major characteristics of these 6 groups are summarized in Table 2.

**Table 2.** The Specific elements of “Material Conflict” covered by GDELT.

Exhibit Force Posture	Reduce Relations	Coerce	Assault	Fight	Use Unconventional Mass Violence
Demonstrate military or police power	Reduce relations	Coerce	Use unconventional violence	Use conventional military force	Use unconventional mass violence
Increase police alert status	Reduce or break diplomatic relations	Seize or damage property	Abduct/hijack /take hostage	Impose blockade /restrict movement	Engage in mass expulsion
Increase military alert status	Reduce or stop material aid	Impose administrative sanctions	Physically assault	Occupy territory	Engage in mass killings
Mobilize or increase police power	Impose embargo/boycott/sanctions	Arrest/detain/charge with legal action	Conduct suicide/car/other non-military bombing	Fight with small arms and light weapons	Engage in ethnic cleansing
Mobilize or increase armed forces	Halt negotiations	Expel or deport individuals	Use as human shield	Fight with artillery and tanks	Use weapons of mass destruction
Mobilize or increase cyber-forces	Halt mediation	Use tactics of violent repression	Attempt to assassinate	Employ aerial weapons	
	Expel or withdraw	Attack cybernetically	Assassinate	Violate ceasefire	

### 3.2.2. Choosing the Proper Variable—Goldstein Scale

Choosing the proper variable to assess political risk is also important. Zhang et al. [43] directly used the number of events to measure political risk. While this seems to be a viable choice, it is far from optimal, since different events have different degrees of importance. As we will show in the Results Section, using this variable could lead to hard to interpret results, such as the level of political risk in Russia (particularly in Moscow and North Caucasus) to be almost as high as that in Syria in recent years (more precisely, from Oct 2013 to May 2018). Recognizing this, here we choose Goldstein Scale of an event as the basis of our analysis. As we mentioned, Goldstein Scale is in the range of  $-10$  and  $10$  and quantifies the degree of conflicts or cooperations between the two actors of the event—the score of  $-10$  and  $10$  represent the strongest conflict and cooperation. Clearly, using the Goldstein Scale of the events is more advantageous than directly using the number of events, since an event with the Goldstein Scale of  $-10$  amounts to 10 events with the Goldstein Scale of  $-1$ .

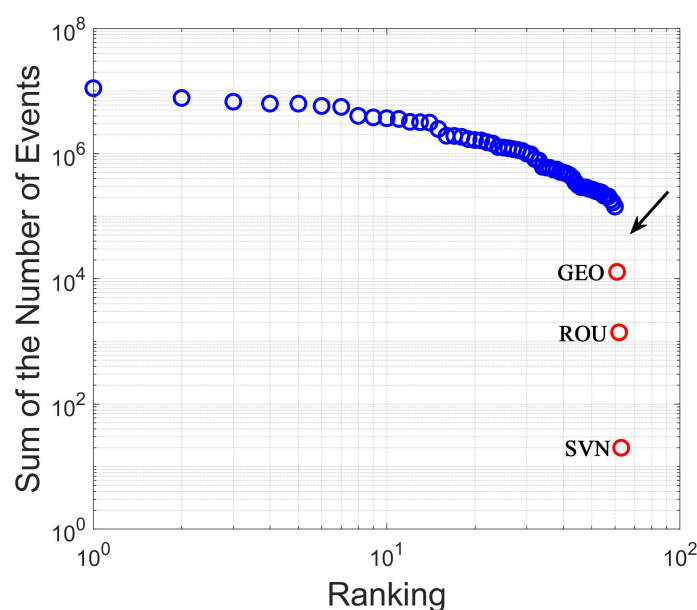
### 3.2.3. Designing the Proper Measure for Assessing Political Risk

Based on the chosen type of events and variable, we design a normalized variable to assess the political risks of any country in any year so that comparison among different countries can be meaningfully made. Without normalization (which is the case when the number of events is directly used for evaluating risks), comparison among countries with vast differences in national capabilities, activities in international affairs, geographical characteristics, cultural background, etc., is essentially impossible. Our normalized variable is the ratio between the sum of the absolute value of the Goldstein Scale of “Material Conflict” events representing political risk and the sum of the absolute value of the Goldstein Scale of all the events:

$$PR_t^i = \frac{|GS(M)_{it}|}{GS_{it}^{(+)} + |GS_{it}^{(-)}|} \quad (i = 1, 2, \dots, 63; t = 2013, \dots, 2019) \quad (1)$$

In the formula,  $t$  is the specific year belonging to the period from 2013 to 2019, and  $i$  is a BRI country.  $PR_t^i$  is an abbreviation of the level of political risk for BRI country  $i$  and year  $t$ .  $GS(M)_{it}$  is the sum of Goldstein Scale of “Material Conflict” events for BRI country  $i$  and year  $t$ .  $GS_{it}^{(+)}$  is the sum of the Goldstein Scale values of all the events with positive Goldstein Scale for BRI country  $i$  and year  $t$ , and  $GS_{it}^{(-)}$  is the sum of the Goldstein Scale

values of all the events with negative Goldstein Scale for BRI country  $i$  and year  $t$ . There are 63 BRI countries so that  $i$  is in the range from 1 to 63. We neglect three BRI countries, Georgia (GEO), Romania (ROU), and Slovenia (SVN), as they have too small number of events during the period from 2013 to 2019. In fact, they are in the exponential cut-off range in terms of number of events collected by GDELT, as is clearly shown in Figure 1. In our actual analysis, we will focus on the political risk of the remaining 60 BRI countries (that is,  $i$  will run from 1 to 60 in contrast with the specification in Equation (1)).



**Figure 1.** Sum of the number of events covered by GDELT vs. the ranking (in log-log scale) for BRI countries during a period from 2013 to 2019, where the countries are ordered according to the descending sum of number of events. Red dots are BRI countries with the sum of the number of events less than 13,000, which are Georgia (GEO), Romania (ROU), and Slovenia (SVN) respectively.

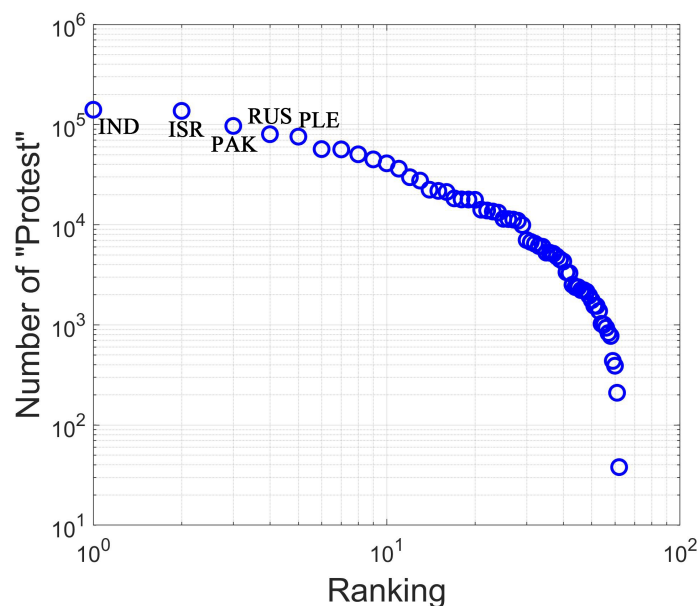
It is often thought that political risk may be better considered from external and internal perspectives [56], since countless events associated with political risk can be classified into international and national levels [40]. This is implemented by checking the actors of the events. Based on this rationale, we will also consider political risk in two components, international and domestic political risk. We hope such an approach can help better assess which type of political risk a BRI country is facing.

#### 4. Results

##### 4.1. The Type of Events “Protest” Is Inappropriate to Be Included for Assessing Political Risk

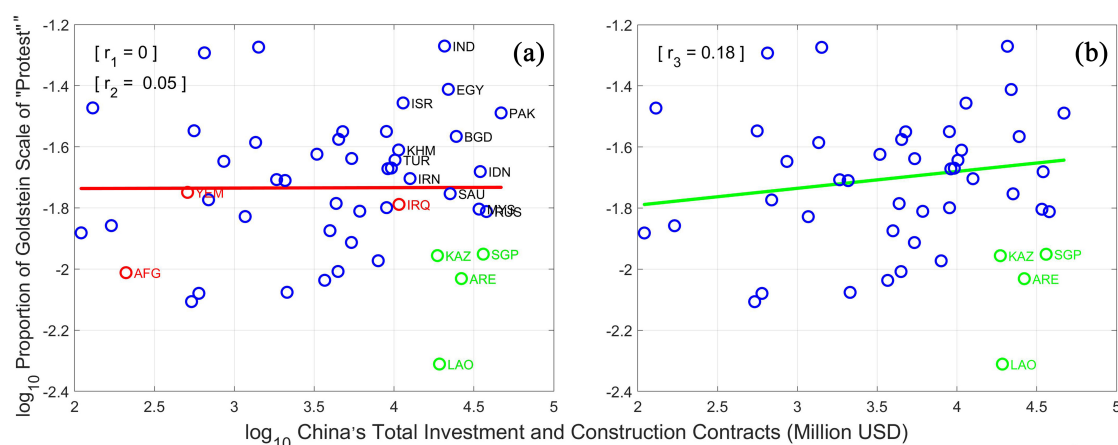
As we mentioned, the nature of protest in a democratic country is entirely different from that in a non-democratic country, since protest has become a mode of public participation, a regular and even desired feature of politics in established democracies [75]. Considering that BRI countries are full of democratic and non-democratic countries, including events of protest when evaluating political risk therefore will make comparison among BRI countries impossible. This realization can be better appreciated by the following two straightforward analyses. First, India has the largest number of “Protest” events covered by GDELT among BRI countries during the period from 2013 to 2019, as is presented in Figure 2. Thus, including this type of event may lead one to mis-conclude India (and other, especially democratic countries with a lot of protests) to be in turbulent and even risky situations.





**Figure 2.** Number of “Protest” covered by GDELT vs. the ranking (in log-log scale) for BRI countries during a period from 2013 to 2019, where the countries are ordered according to the descending number of “Protest”. The top5 countries are India (IND), Israel (ISR), Pakistan (PAK), Russia (RUS), and Palestine (PLE).

Second and more relevant to general overseas investments, we find that there is no correlation between the “Protest” and China’s investments during the period from 2013 to 2019, as is shown in Figure 3. This highlights that the event type “Protest” is not correlated with China’s investments at all. Please note that even if we measure political risk by Equation (1), the correlation between the “Protest” and China’s investments during the period from 2013 to 2019 is still basically zero.

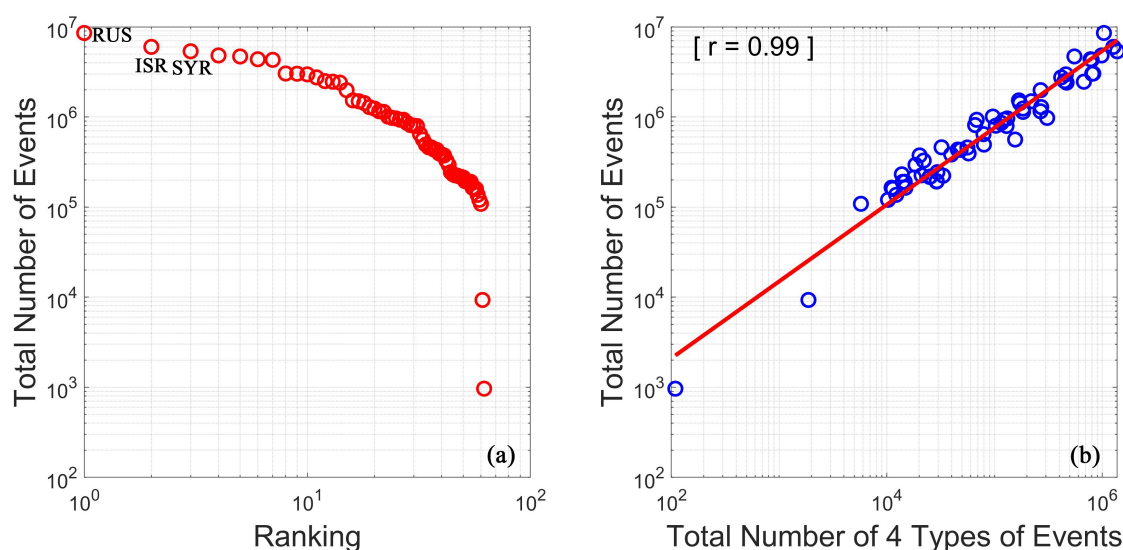


**Figure 3.** Scatter-plots between the proportion of Goldstein Scale of “Protest” and China’s total investments and construction contracts for BRI countries during the period of 2013–2019, where (a) shows that the correlation coefficient for all BRI countries is only  $r_2 = 0.05$  ( $p = 0.736$ ), while the coefficient is decreased to  $r_1 = 0$  ( $p = 0.977$ ) when the war-torn countries, Yemen (YEM), Afghanistan (AFG), and Iraq (IRQ) (which were denoted by red), were excluded. The red regression line refers to  $r_1 = 0$ . The correlation coefficient was increased to  $r_3 = 0.18$  ( $p = 0.264$ ) but still almost zero, when four more countries, the United Arab Emirates (ARE), Lao (LAO), Singapore (SGP), and Kazakhstan (KAZ), which were denoted by green, were also removed; this is shown in (b), with the green regression line referring to  $r_3 = 0.18$ .

#### 4.2. Using the Number of Events for Assessing Political Risk Is Inappropriate

We mentioned that using the number of events for evaluating political risk may not be appropriate. The basic reason is that the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number of events can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval. If this is the case, then a country with a large number of events covered by GDELT may be mis-classified as having high risks. To appreciate the idea, we show, in Figure 4, the total number of events BRI countries have and scatter plots between the number of the four types of events used by Zhang et al. [43] and the total number of events of the BRI countries. We observed that the number of events in Russia from Oct 2013 to May 2018 is the largest among all the BRI countries, reaching 8,554,758. The underlying reason must be that Russia has been very active in world affairs in recent years, and thus must have had huge number of events reported in the news media, which in turn have been collected by GDELT. In general, we can conclude that the more active a country is, the more events the country will generate, and the more news reports it will get.

More importantly, Figure 4b showed that the number of the four types of events chosen by Zhang et al. [43] to evaluate risks is strongly correlated with the total number of events (in log-log scale). These analyses clearly indicate that directly using the number of the four types of events shown in Figure 4 is not optimal for evaluating risks. In fact, one can readily see that even if one uses other types of events to assess political risks, directly using the number of events will still be far from optimal for evaluating risks.



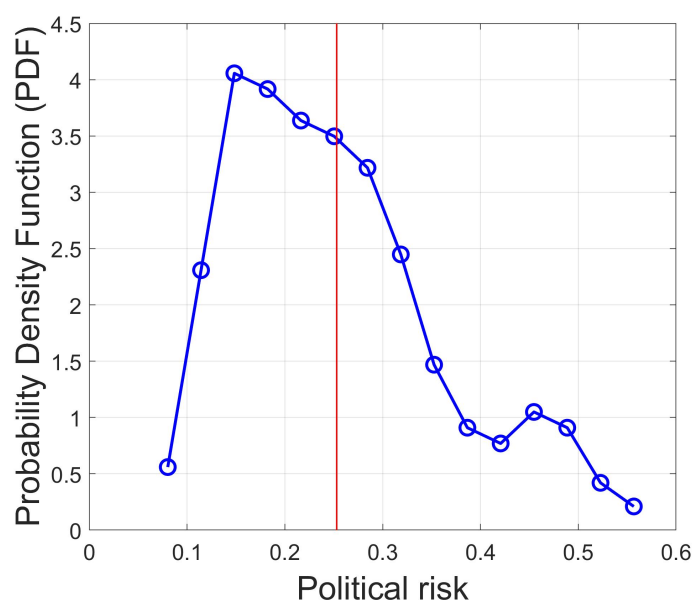
**Figure 4.** (a) Ranked total number of events covered by GDELT during the period from Oct 2013 to May 2018 for BRI countries, where the countries are ordered according to the descending total number of events, with the top3 countries being Russia (RUS), Israel (ISR), and Syria (SYR); and (b) scatter plots between the total number of events and total number of 4 types of events (in log-log scale), including “Coerce”, “Assault”, “Fight” and “Protest”, with the correlation coefficient  $r$  being as large as 0.99 and the  $p$ -value being less than  $10^{-6}$ .

#### 4.3. Spatiotemporal Evolution of Political Risk Along the Belt and Road

We first discuss the temporal evolution of the political risk along the Belt and Road, then examine its two components, domestic and international political risk, and finally study the spatial evolution.

By computing the political risk defined in Equation (1) and the Probability Density Function (PDF) of the political risk during the period from 2013 to 2019, Figure 5 shows that the PDF of political risk, where a mean of 0.25 is indicated by a red vertical line. The PDF suggests us to define political risk in 4 levels. Concretely, the interval  $0.2 < PR \leq 0.3$ , which contains a large probability when the political risk falls within this interval, is defined

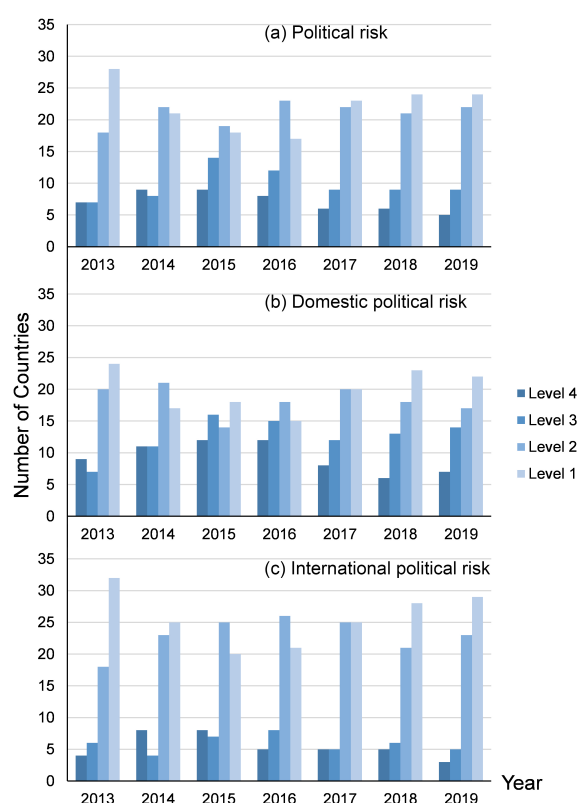
as the moderate level of political risk for BRI countries during the period from 2013 to 2019. The interval  $PR \leq 0.2$ , which also contains a large probability similar to that for the interval  $0.2 < PR \leq 0.3$ , is defined as the negligible level of political risk. Two other intervals,  $0.3 < PR \leq 0.4$  and  $PR > 0.4$ , both above average but containing much smaller probabilities than other two levels, are defined as high and extremely high level of political risk, respectively. This ensures that most countries along the Belt and Road are peaceful. Therefore, we find it appropriate to divide the political risk into 4 levels, including  $PR > 0.4$ ,  $0.3 < PR \leq 0.4$ ,  $0.2 < PR \leq 0.3$ , and  $PR \leq 0.2$ . These 4 levels are called *Level 4*, *Level 3*, *Level 2*, *Level 1*, which represents extremely high, high, moderate, and negligible level of political risk, respectively. This classification will also be used when discussing domestic and international political risk below.



**Figure 5.** Probability Density Function (PDF) of political risk along the Belt and Road during the period from 2013 to 2019, where the mean value of 0.25 is indicated by the vertical red line.

It is instructive to examine the temporal evolution of the number of BRI countries at different risk levels from 2013 to 2019. This is depicted in Figure 6. For the extremely high level of (overall) political risk, the number of BRI countries is 7, 9, 9, 8, 6, 6, and 5, from 2013 to 2019, respectively. For the high level of political risk, the number of BRI countries is 7, 8, 14, 12, 9, 9, and 9, from 2013 to 2019, respectively. These numbers sum to 14, 17, 23, 20, 15, 15, and 14, from 2013 to 2019, respectively. Therefore, the sum of the number of BRI countries with the extremely high and the high level of (overall) political risk reaches the peak in 2015, and decreases thereafter.

For domestic political risk, the number of BRI countries with the extremely high level is 9, 11, 12, 12, 8, 6, and 7, from 2013 to 2019, respectively, and the number of BRI countries with the high level is 7, 11, 16, 15, 12, 13, and 14, from 2013 to 2019, respectively. These numbers sum to 16, 22, 28, 27, 20, 19, and 21, from 2013 to 2019, respectively. For international political risk, the number of BRI countries with the extremely high level is 4, 8, 8, 5, 5, 5, and 3, from 2013 to 2019, severally, and the number of BRI countries with the high level is 6, 4, 7, 8, 5, 6, and 5, from 2013 to 2019, severally. These numbers sum to 10, 12, 15, 13, 10, 11, and 8, from 2013 to 2019, severally. It is thus clear that the sum of the number of BRI countries with the extremely high and the high level of political risk either for domestic or for international political risk increases to the maximum in 2015, and falls from then on. This is similar to the temporal evolution of the sum of the number of BRI countries with the extremely high and the high level of (overall) political risk.



**Figure 6.** The temporal evolution of (a) political risk, (b) domestic political risk, and (c) international political risk along the Belt and Road from 2013 to 2019.

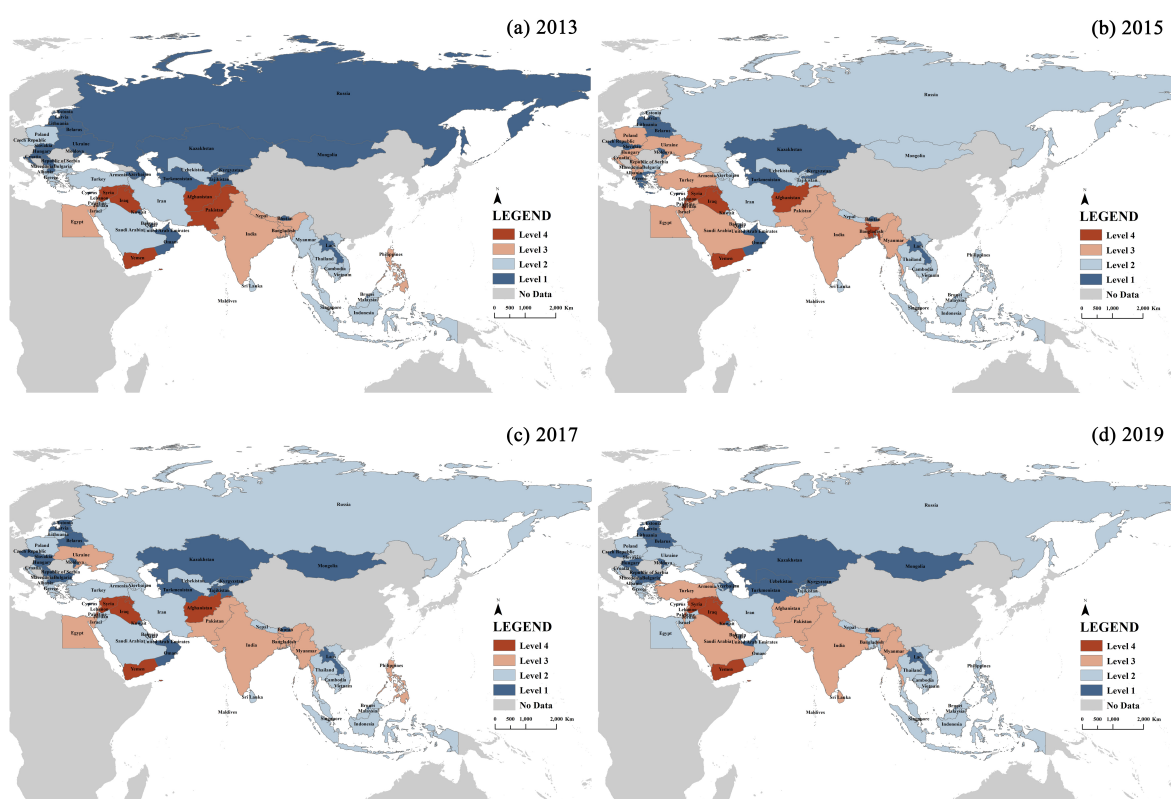
As the above discussions on the temporal evolution of the sum of the number of BRI countries with the extremely high and the high level of political risk all show that the number reaches maximum in 2015 for domestic, international, and (overall) political risk, it is instructive to explore the spatial evolution of political risk along the Belt and Road by focusing on 2013, 2015, 2017 and 2019. We first study the (overall) political risk along the Belt and Road, then analyze domestic and international political risk.

The spatial evolution of the political risk along the Belt and Road is shown in Figure 7. We find that Syria, Iraq, Yemen and Palestine exhibited the extremely high level of political risk in all these four years. They are followed by Afghanistan, Lebanon, and Israel, which exhibited the extremely high level of political risk in at least two of these four years. It should be emphasized that the nature of risks these countries faced was quite different. For example, Syria's risk has been mainly caused by the continued Syrian Civil War and attacks from the Islamic State of Iraq and the Syria (ISIS, a terrorist organization designated by the United Nations). The spillover of Syrian Civil War into Lebanon (2011–2017) impacted Lebanon greatly. In Iraq, the ISIS is also the main cause of risks, which even caused the Iraqi Civil War (2014–2017) with the Iraqi Forces. In contrast, Yemen has been struggling with the Yemeni Crisis (2011–present) and the Yemeni Civil War (2014–present). In fact, when the Yemeni Civil War erupted, Saudi Arabia made an armed intervention in Yemen. As for Afghanistan from 2001 to the present, there have been many wars and attacks, such as the assaults by Taliban and the Kabul attack. Palestine has been mainly struggling with the ongoing Israeli-Palestinian conflict.

For the high level of political risk, we find that Pakistan and India of South Asia, and Myanmar of Southeast Asia showed this level in all these four years, and the political risk of Pakistan even reached the extremely high level of political risk in 2013. Saudi Arabia, Egypt, Turkey, and Ukraine showed the high level of political risk in at least two of these four years. The high level of political risk exhibited by them were also mainly caused by religious conflicts, terrorist organizations, and complex relationships between them, including other

countries' interventions. For example, the loggerheads between Saudi Arabia and Iran and the Egyptian Crisis (2011–2014) were significant causes of the high level of political risk in this region. The Internal Conflict in Myanmar since 1948 has been the longest ongoing civil war in the world, which causes a series of insurgencies. For Pakistan and India, the India-Pakistan border skirmishes (2016–2018) and the India-Pakistan standoff in 2019 were the causes of the turbulent situations.

Please note that some sudden changes in the levels of political risk occurred in the following countries, with causes readily identifiable. In 2015, the level of political risk in Central and Eastern Europe was higher than in other times. This was caused by the European Refugee Crisis which was thought to have started in 2014 and reached the peak of crisis in 2015. Moreover, the Russo-Ukrainian War since 2014, which has been a protracted conflict between Russia and Ukraine mainly in the Ukraine regions of Crimea and Donbas, has caused a high level of political risk in Ukraine. Involved in this war, Poland made military responses, while Turkey encountered military actions by Russia. In Bangladesh around the same time, the political risk level not only became higher in 2015, but reached the extremely high level. This was a manifestation of the Bangladesh political crisis in 2015, a political turmoil between the Awami League (AL) and the Bangladesh Nationalist Party (BNP), a terrorist organization considered by AL. The crisis had led to many violent and even fatal attacks on the public. As in Philippines, the high level of political risk in 2017 was mainly due to an armed conflict between Philippine government security forces and the ISIS (more precisely, the Battle of Marawi).

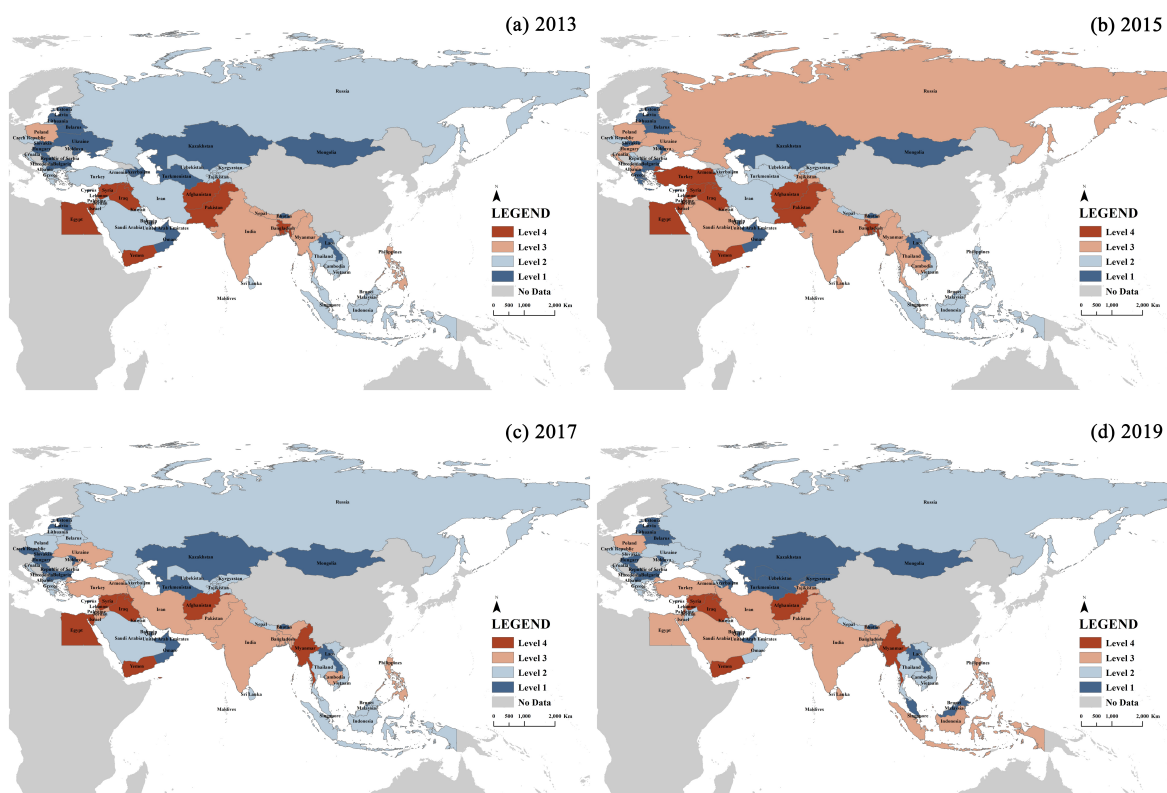


**Figure 7.** The spatial evolution of the political risk along the Belt and Road.

Next, let us decompose political risk into domestic and international components. The spatial evolution of domestic political risk along the Belt and Road is presented in Figure 8. We find that the extremely high level of domestic political risk showed in Syria, Iraq, Afghanistan, and Yemen in all these four years. They are followed by Myanmar, Palestine, Lebanon, Israel, Egypt, and Pakistan, which showed the extremely high level of domestic political risk in at least two of these four years. The high level of domestic



political risk often exhibited in Iran, India, Myanmar, Philippines, Bangladesh, Turkey, and Saudi Arabia in at least two of these four years. Besides, sudden changes in the level of domestic political risk also appeared in 2015, with the political risk in Russia and many BRI countries of Central and Eastern Europe increasing to the high level. Major causes of domestic political risk in these BRI countries are thought to include conflicts due to religions, terrorism, civil wars and conflicts, actions by anti-government forces, social unrest, and the refugee problem. Besides, it is important to realize that some of the causes for the high level of domestic political risk are due to interplay between domestic and international events, such as the European Refugee Crisis.



**Figure 8.** The spatial evolution of domestic political risk along the Belt and Road.

The spatial evolution of international political risk along the Belt and Road is presented in Figure 9. Comparing with the domestic political risk along the Belt and Road shown in Figure 8, we find that the color becomes much lighter, meaning that overall the international political risk along the Belt and Road is much lower than the domestic political risk. While the extremely high level of domestic political risk showed in four countries, Syria, Iraq, Afghanistan, and Yemen, in all these four years, we find only one country, Yemen, reached the extremely high level of international political risk in all these four years. Besides Yemen, Iraq, Syria, Palestine, Israel, and Lebanon also exhibited the extremely high level of international political risk in at least two of these four years. The lesser level of international political risk, the high level, was found in Saudi Arabia and Afghanistan in at least two of these four years, followed by Pakistan, India, Turkey, Ukraine, and Bangladesh, which showed this level in only one of these four years.

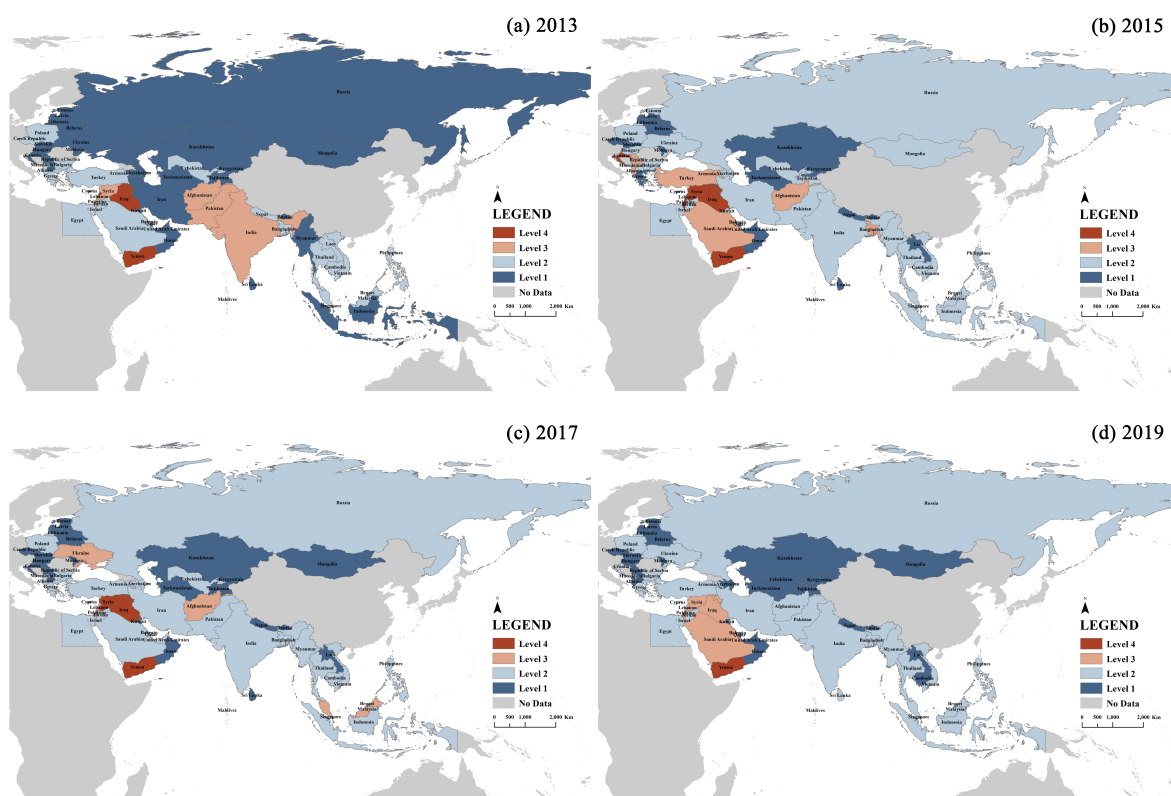
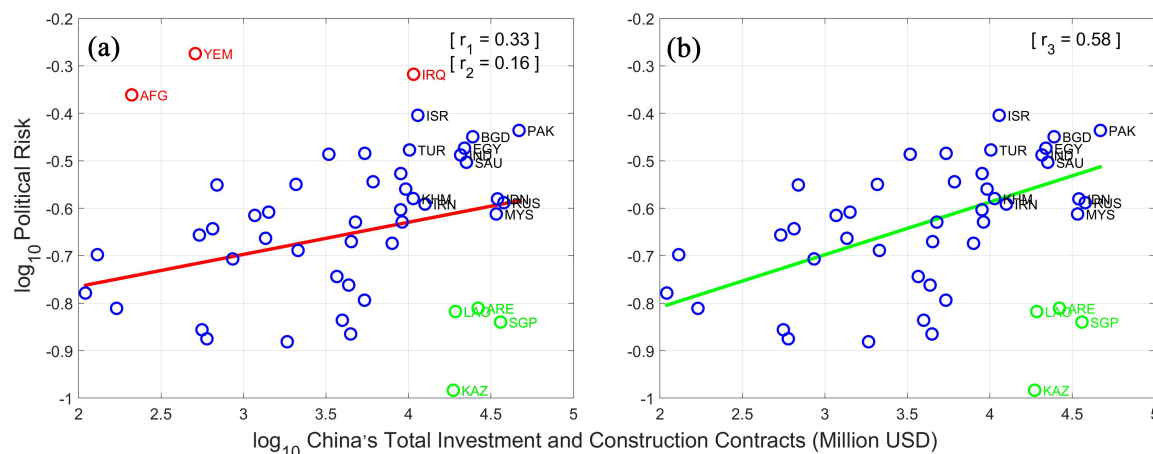


Figure 9. The spatial evolution of international political risk along the Belt and Road.

#### 4.4. the Correlation between Political Risk and China's Foreign Investments and Construction Contracts

To examine the correlation between political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019, it is instructive to construct scatter plots between political risk and China's total investments and construction contracts for BRI countries during this period. This is shown in Figure 10. We find in Figure 10a that the correlation coefficient for all BRI countries is only  $r_2 = 0.16$  ( $p = 0.28$ ); it is increased to  $r_1 = 0.33$  ( $p = 0.026$ ) when the war-torn countries, Yemen, Afghanistan, and Iraq (which were denoted by red), were excluded. The correlation coefficient is further increased to  $r_3 = 0.58$  ( $p < 10^{-6}$ ) when four more countries, the United Arab Emirates, Lao, Singapore, and Kazakhstan, which were denoted by green, were also removed; this is shown in Figure 10b. Since the correlation coefficient is quite positive, by large, we can say that political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019 are strongly positively correlated. With investment, one certainly wishes substantial reward. The positive correlation between risk and investment thus highlights that reward and risk are highly entangled. As this is not ideal, we can ask, is there any way for us to break the "curse" of always accompanying investment with risk? The answer lies in excluding the four countries the United Arab Emirates, Lao, Singapore, and Kazakhstan. The risk levels in these four countries are rather low. However, China's investments and construction contracts in these four countries are quite heavy. One can readily perceive that if the number of such countries, i.e., low risk countries with substantial investments from China increases (for example, China's investments to low-risk countries such as Cyprus, Brunei, Moldova, Oman, Turkmenistan, and Belarus greatly increases), then the correlation between political risk and China's total investments and construction contracts for BRI countries may not only weaken, but becomes negative altogether. This would be the ideal case. Unfortunately, along the Belt and Road, the correlation between political risk and China's total investments and construction

contracts will basically remain positive, since there are a lot of high-risk countries but with heavy investments from China, including Pakistan, Indonesia, Malaysia, Bangladesh, Saudi Arabia, Egypt, India, Russia, Iran, Israel, Cambodia, and Turkey.



**Figure 10.** Scatter-plots between political risk and China's total investment and construction contracts for BRI countries during the period of 2013–2019, where (a) shows that the correlation coefficient for all BRI countries is only  $r_2 = 0.16$  ( $p = 0.28$ ), while the coefficient is increased to  $r_1 = 0.33$  ( $p = 0.026$ ) when the war-torn countries, Yemen (YEM), Afghanistan (AFG), and Iraq (IRQ) (which were denoted by red), were excluded. The red regression line refers to  $r_1 = 0.33$ . The correlation coefficient was further increased to  $r_3 = 0.58$  ( $p < 10^{-6}$ ) when four more countries, the United Arab Emirates (ARE), Lao (LAO), Singapore (SGP), and Kazakhstan (KAZ), which were denoted by green, were also removed; this is shown in (b), with the green regression line referring to  $r_3 = 0.58$ .

## 5. Conclusions

We aimed to gain insights into two important questions, (i) How can political risk of BRI countries be properly assessed? and (ii) Are China's BRI investments and construction contracts largely in BRI countries with low levels of the political risk? If not, what are the general characteristics of political risks associated with China's investments and construction contracts? In trying to resolve these two questions, we used a few big data sets, including GDELT, CGIT, and ACLED, to systematically assess the political risk along the Belt and Road during the period from 2013 to 2019. We made several findings: (1) the type of events, "Protest", is inappropriate to be included for assessing political risk, because the nature of protest in a democratic country is entirely different from that in a non-democratic country; (2) choosing the type of events, "Material Conflict", which includes "Exhibit Force Posture", "Reduce Relations", "Coerce", "Assault", "Fight" and "Use Unconventional Mass Violence", is more appropriate for evaluating the political risk; (3) using the number of events for assessing political risk is also inappropriate, since the number of the type of events that are chosen for evaluating risks may be correlated with the total number of events that is covered by GDELT for a country, and the number can vary substantially for a country over time and among different countries around the globe in a fixed (short) time interval; (4) using the Goldstein Scale of events is more advantageous than directly using the number of events, because an event with the Goldstein Scale of  $-10$  amounts to 10 events with the Goldstein Scale of  $-1$ ; (5) it is of importance to design a normalized variable to assess the political risks of any BRI country in any period of time, to facilitate comparison among different countries; (6) it is beneficial to decompose political risk into two components, domestic and international political risk, and then to assess which type of political risk a BRI country is facing.

By examining the spatiotemporal evolution of political risk along the Belt and Road during the period from 2013 to 2019, we observed that the sum of the number of BRI countries with the extremely high level and the high level for domestic, international, and (overall) political risk all reached the peak in 2015, and decreased thereafter, and that



overall the international political risk along the Belt and Road was much lower than the domestic political risk.

We found a strong positive correlation between political risk and China's total investments and construction contracts for BRI countries during the period from 2013 to 2019. While this is quite the opposite of the ideal case that investment goes to countries or regions with as low political risk as possible, it nevertheless suggests that if we want to achieve the ideal case, it would be necessary for China to choose to invest in countries and regions with low or even negligible political risks along the Belt and Road.

## 6. Discussions

While various kinds of traditional economic data will remain critical for assessing risks, it has become increasingly clear that big data, including massive media reports, offer an unprecedented opportunity to help to evaluate, manage and control risks. Yet, the challenge for achieving this goal is also enormous. To better know the potential of this viewpoint, in this paper, we tried to provide a new approach to assess political risk along the Belt and Road using GDELT. We showed that the "Material Conflict" types of events can represent pertinently and comprehensively the events that may directly affect foreign investment. Furthermore, we showed that the contribution of events in this category to risk is better quantified by the summation of the Goldstein Scale rather than by the number of events. These provisions, while simple, enable reasonable comparison among BRI countries. Clearly, the usefulness of these insights may not be confined only with BRI projects, but extended to general overseas investments.

Before pondering the potential future research topics, let us first discuss the caveats of the present study. There are quite a number. First, GDELT has under-reported a lot of interesting events, including those related to risks, in remote regions of the globe [76]. Unfortunately, this limitation is not a unique trait of GDELT. Rather, it is shared by all big databases based on news reports, and it does not appear that there is any way this limitation will go away soon. Second, it is very difficult to track future evolutions of an event or a cluster of events covered in GDELT, and thus it is not easy to evaluate long-time impacts of a specific event or a cluster of events. Third, this study only focuses on the national-level analyses of political risk. Fortunately, the last problem can be readily solved, since GDELT has provided geo-coordinates for each event, and thus in principle allows one to look into political risk associated with specific locations. The difficulties one may envision with a localized study is whether data for a chosen interested region may be large enough for meaningful statistical analysis.

Let us now ponder interesting future research topics that may be solved by analyzing GDELT. First, clearly it is interesting and worthwhile to extend the current study to assess risks associated with general overseas investments rather than just BRI projects. Second, it appears interesting and feasible to carry out a coupled study of politics and economics. Third, it may be useful to further divide the events chosen here for assessing political risk into a few different categories, then evaluate risks for each category, and finally synthesize the risks into a single risk index. Third, it may be interesting to use the risks along the BRI countries computed here as a reference to further study the spatial correlation of political risk among different countries, in the sense that many BRI countries may be bundled together due to a single event, such as the India-Pakistan border skirmishes (2016–2018).

Finally, we emphasize that the political risk identified here may not be equated to the actual risk a foreign investment may face. The risk identified here is better considered as the nominal risk. Part of this risk will be absorbed by a country because of its national collective power including the level of its economic development, research and development capability of its science and technology, government capacity, and resilience of its citizens. This calls for a completely new scheme to determine the actual risk by studying how the collective power of a nation affects the nominal political risk for a country identified here.

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## Article

# Towards Local Sustainability of Mega Infrastructure: Reviewing Research on the New Silk Road

Hannes Thees 

Center for Entrepreneurship, Catholic University Eichstaett-Ingolstadt, 85072 Eichstaett, Germany;  
hannes.thees@ku.de

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**Abstract:** The Belt and Road Initiative is the leading project in the regions along the ancient Silk Road. This aims to revive the New Silk Road (NSR) as a transnational space towards an era of new regional integration and globalization. Despite the potential economic effects on a global scale, local sustainability remains questionable. Building upon the central engagement in infrastructure improvements, this article aims to investigate the role of local sustainability in research along the New Silk Road. Starting with 597 scientific articles, this article conducts a systematic literature review on four levels of concretization to characterize the research field of the New Silk Road, and to develop in-depth insights systematically. The results reveal a research focus on economic growth, which is lacking in environmental considerations and especially the socio-cultural dimension of sustainability on a local scale. Future directions in local sustainability should therefore include local stakeholders to build a joint understanding of sustainability by recognizing the characteristics of regionalism upon which manifold local support of mega infrastructure can evolve. Given these findings, the New Silk Road emerges as a field of study that calls for interdisciplinary research on different spatial levels.

**Keywords:** New Silk Road; local sustainability; mega infrastructure; systematic literature review; Belt and Road; sustainable development; local impact

## 1. Introduction: The NSR and the Challenge of Sustainability

The “Belt and Road” initiative is the largest development and globalization program worldwide [1]. In 2013, the People’s Republic of China launched the initiative, which includes several overland corridors (Silk Road Economic Belt) and a maritime route (Maritime Silk Road). Connecting with the Ancient Silk Road, the Belt and Road aims to develop trade networks between Asia and Europe, but also towards Southeast Asia, Australia, Africa, and the Middle East. By 2019, 123 countries had officially joined the initiative [2]. Therefore, China promotes investments in different kinds of infrastructure in an export-led growth model, through various financial instruments. The countries or locations that are the focus of the Belt and Road investments are often involved in various global and local initiatives, and thus receive financial support from different countries. Therefore, here I apply the term “New Silk Road” (NSR) as a container for investments and developments in the respective regions that support international trade infrastructure.

Through the years of its operation, the Belt and Road has been subjected to various optimistic scenarios, but also criticism, as nowadays globalization is being challenged. People all over the world are critically assessing globalization because of protectionism, trade wars, or immigration stops, challenging the idea of globalism and a global community. This is combined with a shift in the political world order, wherein China is pursuing more integrated and inclusive globalization [3]. Beyond this, 2020 and the following years will challenge global connectivity and trade within the Belt and Road, as the global slowdown [4] during COVID-19 [5,6] could lead to a renationalization of value chains [7].

The impacts of globalization on local economies and societies are spatially different and influenced by local initiatives [8]. Although countries along the NSR see potential for economic development [9,10], the unclear local effects, a lack of transparency, fears around Chinese dominance, and the role of transit countries offer space for improvement [11–16]. Especially from a European perspective [17], the Chinese role in investments, infrastructure construction, and trade operations could hinder sustainable development. The considerable extent of infrastructure investments raises the complexity of the Belt and Road in the countries along the NSR; a complexity that requires us to steer between the Belt and Road, other international development projects, and local interests. Together with the need to balance infrastructure and its impetus for sustainability, the question arises:

*How Has the NSR Been Researched with Special Consideration to Local Sustainability and What Are the Future Directions of Mega Infrastructures in This Context?*

Given this question, the NSR serves as an exemplary research field. Regional studies, as well as multi-disciplinary research, should assist in finding pathways towards sustainability. Recent research on the NSR has been influenced greatly by edited volumes, for instance on globalization [18], transformation in Central Asia [19], financial implications [20], and geopolitics [21]. Within the many book publications, there has only been a little research on local or regional matters [22]. With the growing number of journal publications, the NSR is emerging as a diverse field of research.

Given the above local sustainability challenge of the NSR, this study aims to capture current research on the NSR and to gain insight into the discussion of local sustainability (Figure 1). First, the theoretical background addresses the importance of sustainability, within the specialties of mega infrastructure. Second, the methodology of this article is a systematic literature review [23,24], which is then also discussed in light of theoretical considerations. Finally, the study derives research pathways within the NSR to further shape local sustainability.

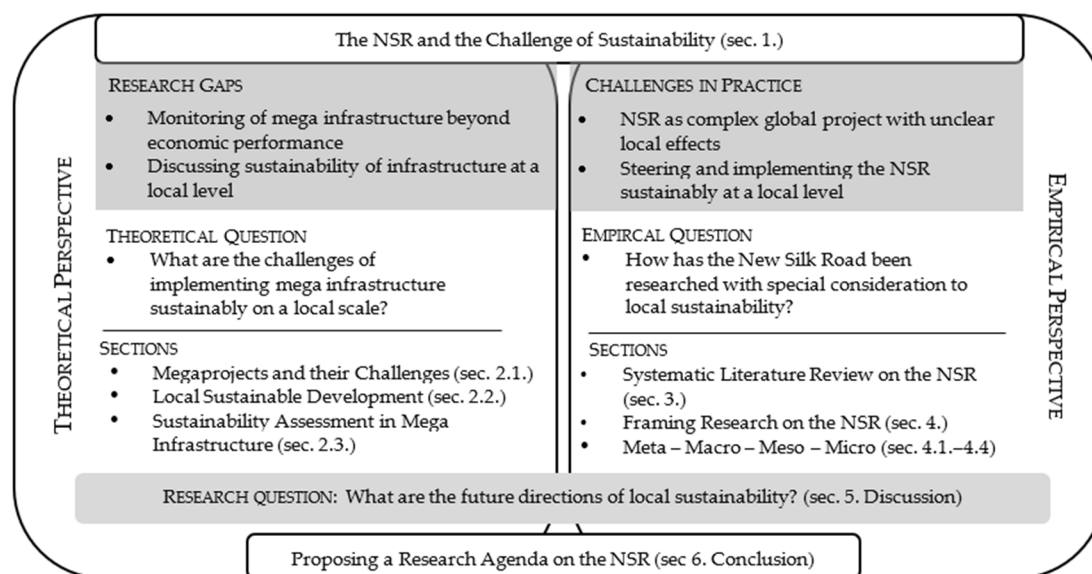


Figure 1. Research framework. Source: Own elaboration.

## 2. Theoretical Background: Sustainable Implementation of Mega Infrastructure

The conceptual options for the NSR are various. A range of concepts, theories, and disciplines are relevant as the NSR influences nearly all dimensions of life—including technology, economics, the environment, geography, businesses, politics, information and knowledge management, and socio-cultural aspects [1]. Such a holistic understanding meets the principles of sustainable development, even more so when the NSR is viewed from the perspective of the participating countries, exceeding the mere allocation of finance and the promotion of trade. In terms of sustainability,

there are a number of linkages to discuss within the NSR. However, as the research field on the NSR is still emerging, this article concentrates on the fundamental linkage between infrastructure and sustainability, and puts the focus on the local scale. This limitation on a central theoretical linkage opens space for future research to occur in a more integrative manner. However, the spatial focus on the local scale determines the disciplinary positioning of this article in local or development studies. Complementary to this, transport geography is the starting point of the theoretical considerations, as the NSR is dominated by mega infrastructure—especially when recognizing the economic size of the receiving countries. This is all the more relevant as the NSR exceeds the perspective of single national infrastructure projects as it is combining a whole set of transnational mega infrastructures.

### 2.1. Megaprojects and Their Challenges

Megaprojects are often perceived as drivers for long-term development, as they allocate capital and workforce, but also technological knowledge. Megaprojects are defined by investments of more than one billion USD, and have a long lifetime of about 50 years [25,26]. Further criteria involve high complexity, specified knowledge, widespread impacts, or multi-stakeholder involvement [27]. Megaprojects may include all kind of projects, but are strongly related to physical infrastructure (mega infrastructure), greater industrial production, or resource extraction (see modernization theory, e.g., [28]). Such physical infrastructure is typically a public good, in which governments are highly involved, and ranges from power supply, telecommunications, water and sanitation supply, education and healthcare, to freight and public transport [29–32]. Transport infrastructure particularly includes high costs and a long duration of construction [33]. By taking a historical perspective, researchers have agreed that infrastructure and specific transport infrastructure enhance performance, accumulate capital, support knowledge creation, create opportunities of production and trade, and serve social and economic development [30,34–36]. This relationship is also stressed as an accelerator of growth in developing countries [29,34,37,38].

Nevertheless, the ongoing hunger to increase economic growth calls for even more massive infrastructure investments, causing significant challenges, leading to questions regarding the overall performance of megaprojects [39]. The risks of megaprojects include cost, demand, the financial market, and political risks [25]. Flyvbjerg [26] extended this categorization by claiming ten challenges, including also conditions such as a high number of participants, multi-nationality, diverging interests, increasing costs over time, and changing regularities. Further, he mentioned weak project leadership, knowledge integration, cultural differences, extraordinary technology implementation, difficulty in performance evaluation and planning, and the occurrence of an external and unplanned crisis. All in all, megaprojects face divergence of desired and realized outcomes, as they are often promoted in an over-optimistic way as political symbols [25,26,39]. This is also reflected by current infrastructure projects that have received criticism, such as the Nord Stream 2 pipeline, the Stuttgart 21 railway station, the Grand Ethiopian Renaissance Dam, the Fehmarnbelt crossing between Hamburg and Copenhagen and Desertec in the Sahara region.

From a theoretical perspective, researchers tend to focus on understanding the dynamics of megaprojects, and are thus addressing multi-disciplinary research agendas “including management and organisation studies, but also history, anthropology, sociology, urban studies, engineering, and economic geography” [39]. From the perspective of development studies, new international economics, according to Krugman [40], are suitable for mega infrastructure. In particular, transaction costs, capability, social conflict theory, handling of the interface, cost theories, power, and innovation theories are addressed [32,39]. Against the background of the high complexity, Söderlund [39] called for increased research on the management and functioning of cooperation and coordination [39]. Although the challenges and the cooperative nature of megaprojects are obvious, research on multi-country cooperation and on interests of private and public actors is limited, with the exception of research from Kardes et al. [32]. For the economic growth of a respective country, foreign aid or development assistance is not a necessary condition, according to several theories. Besides theories

of endogenous growth, development cooperation is connectable to several concepts and theories, such as modernization, Foreign Direct Investments, the reduction of disparities, multiplier and accelerator effects, and Rostow's growth model. Research might still be in the phase of giving economic reasons for megaprojects, which is visible in multiple research works on non-megaprojects and their impact assessment [34,36,41,42], productivity [35], trade relations [43], and performance [31]. However, research has lately engaged more in sustainability [29,44–46] in order to take responsibility for sustainably designing projects that can impact millions of people [26]. Recognizing this need, Söderlund [39] called for the need to rethink why megaprojects exist, and to include also a discussion of their soft effects [39].

## 2.2. Framing Sustainable Development from a Local Perspective

Local development can call on various research agendas and theoretical streams [47,48]. As regional studies are highly context-specific, they vary in terms of their sustainability-definition, which has recently been shaped by questions around inclusive development [49], sustainable development [50,51], and the transition towards sustainability in regions [52]. The manifold conceptual differences in sustainability can follow Sturup [53]: Sustainability is *“the property (a species, a process, a culture, a society etc.) or quality of being able to be sustained”*, which also implies a normative perspective. Sustainability includes a systemic perspective, including environmental, socio-cultural, and economic principles [54]. The term ‘sustainable’ is the *“measure of the degree to which something can be sustained”* [53,55]. Sustainable development follows the Brundtland definition of meeting the *“needs of the present without compromising the ability of future generations to meet their own needs”* [56] (p. 43), which is also based on the scarcity of resources [57,58].

Through its multiple perspectives and disciplines [59], the targets of sustainable development are wide-ranging, starting with environmental protection in the 1990s and moving towards increasing quality of life in the 2000s [60]. Further criteria of sustainable development are justice and equity in terms of recognition, process, procedure, and outcome, as well as respecting the limits of the ecosystem and promoting cultural identities [61]. This is supported by the concept of the triple bottom line, which calls for the harmonization of the environmental, social, and economic perspectives. Although sustainability has been frequently discussed in scientific discourse [54,62,63], it is still contested in its demarcation from sustainable development [50]. This article tries to follow the clear idea that sustainability is the goal in a system integrating economic, social, cultural, political, and ecological factors, and sustainable development is the implementation of measures from a long-term and multi-scale perspective. Practically, this means that local sustainability in mega infrastructure is the quality or goal to be achieved, supported by various development pathways that especially rely on sustaining local interests in a global system.

A significant challenge of sustainable development is its implementation [64]. Although initiatives such as the UN Sustainable Development Goals (SDG) seem to be broadly accepted and widely used, a conflict of interests exists for instance between economic sectors or regions. There are increasing calls for a discussion on regional sustainability, which connects global, regional, and local efforts [50,65] and asks the questions *“what is to be sustained, by whom, for whom”* [61]. Consensus exists about the need to have sustainability strategies at all spatial scales (principle of subsidiarity), and thus they have been implemented in nearly all policy documents [60], but broad stakeholder involvement is still needed in the end. A unique role obtained by residents is civic engagement, and bottom-up processes are central to starting and successfully implementing more sustainable initiatives [66,67]. Such initiatives also relate strongly to the concept of community development and endogenous growth in order to enhance the local culture and environment through sustainable production and consumption, with the target of improving quality of life, which is also accompanied by the empowerment of residents and local decision-making [68,69]. Recognizing the complexity and the multi-level and -disciplinary nature of sustainability, it has become a global focus and requires the joint action of the world community. However, the interventional nature of the concept of ‘global development’ is vivid: local development



itself is embedded in regional, national, or even global factors, and thus relies on joint infrastructure projects, trade, cultural exchange, diplomacy, and cooperation.

### 2.3. Local Sustainability Assessment in Mega Infrastructure

Against the background of increasing spending on megaprojects—specifically mega infrastructure—in order to keep the pace of economic development, solutions need to be found to assess such projects by a number of different dimensions [29,46]. Taking the local scale into focus, mega infrastructure and its impacts need to be evaluated frequently in terms of their local sustainability, and thus the value they bring to society [34], by asking “*Are megaprojects the right solution?*” [39]. This needs to be embedded in different political and developmental approaches; for example, the European nations consider the balance between development models (e.g., modernization or export-based development) more than Asian nations.

In practice, the attitude towards megaprojects is unclear. It remains uncertain, however, to which extent and how infrastructure investments create jobs, generate income, foster economic sectors, and facilitate local development, or even if social exclusion is increased or decreased [70,71]. Reflecting upon and researching the criteria of local, sustainable implementation of mega infrastructure leads towards an endless collection of intervening and loose criteria, of which each has been tested and applied only seldom in practice.

Practical evidence can be found through several infrastructure projects that affect all dimensions of sustainability. For example, there exists valuable international discourse and research on the environmental impact of the Channel Tunnel [72], the climate’s long-term impact on New Zealand infrastructure [73], the impact of the Grand Ethiopian Renaissance Dam on water resources [74], port connectivity between Burgas (Bulgaria) and Alexandroupolis (Greece) [34], land use in the Polavaram River project (India) [75], international security linkages over Turkey’s Ilisu Dam [76], the re-settlement of China’s Three Gorges Dam [77], and the UN on Infrastructure and Human Rights [78]. Some of these projects have been highly criticized for their environmental or social impact. Although the Belt and Road projects are still under construction, criticism can evolve in some projects, leading to calls for learning from previous infrastructure projects and their sustainability assessments.

Central to assessing infrastructure is the analysis of its performance. The performance of mega infrastructure is highly shaped by complexity, time-duration, or its extensive impact on communities or ecosystems on several spatial scales [32,39]. Even during the planning phase, it causes high uncertainties in terms of forecasting potential effects [25]. Approaches to measure those effects have been provided by Dimitriou et al. [34], Fedderke and Bogetic [35], and Shen et al. [29], with special consideration around comparing the invested capital (private and public) and the economic performance. These assessments are in line with theoretical streams, such as modernization or dependences, and a number of theories and concepts that contribute to explaining certain elements of the complex relationships, such as spillover [79], productivity [35], regional cooperation [80], firm births [81], spatial distribution [82], competitiveness [83], local entrepreneurship [84], global production networks [85,86] or knowledge networks [86], and diversification or cluster management [38].

Calls are also increasing to include sustainability considerations in all phases of infrastructure planning, construction, and operation. The responsible parties need to decide how an infrastructure project assists in solving the issues of sustainable development in their related ecosystems [29,53,87]. In general sustainability studies, researchers have engaged in developing indicators, scenarios, and measurements of sustainability, but are still struggling with the availability, evaluation, and aggregation of data in a multi-dimensionality and interdisciplinary setting. Besides macroeconomic analysis, qualitative approaches also try to describe the behavior of actors in their surrounding socio-economic systems [65]. By applying complex measurements, sustainability can be broken up into a number of indicators, which cannot be assessed in their holistic surroundings [53]. In terms of the sustainability of mega infrastructure, evidence from research is fragmented or often missing altogether. An important step to address this was the launch of the Journal of Mega Infrastructure and

Sustainable Development in 2019 to fill this gap. Research from the Journal of Sustainable and Resilient Infrastructure is valuable, as well, but rather specific. On a practical level, institutions are engaged in deriving practical guidelines for project implementation. This practical collection of determinants to promote a more sustainable implementation of mega infrastructure stresses the role of planning and monitoring. The central determinants are:

1. Purpose: Beyond the aim of economic growth, there are many sub-goals to be defined focused around the benefits for local communities at different spatial scales [46,88].
2. Stakeholders: The definition of who is a relevant stakeholder has traditionally been limited to elites that are directly associated with the allocation of capital and power [32,89]. In this vein, Gellert and Lynch [89] explored power issues in displacements and called for the involvement of local communities as key stakeholders, given they are strongly affected by infrastructure but widely excluded in the planning of megaprojects [67].
3. Time and processes: As mega infrastructure tends to have an enormous time horizon, the dynamics of change require a sustainability assessment at all stages of the life cycle [39], starting with pre-evaluation, feasibility, and monitoring [34,65], though it will still be subject to uncertainties [90].
4. Surroundings and extensions: Infrastructure-supportive aspects need to be taken into accounts, such as the construction-environment, including housing or corridors for material transport or all kinds of human activity on and around the project. In addition, megaprojects often involve multiple different sectors, such as railroads and power plants, and lines to support an industrial cluster [53,89].
5. Spatial level and cooperation: In general, sustainability assessment is mostly conducted at the national scale, but for implementing and monitoring specific initiatives, more advanced levels of assessment are needed [59,66]. For example, successful transport corridors call for the harmonization of national systems to provide fast transit systems, but also rely on local gateways, hubs or markets [91]. On the local level, Sturup and Low [53] and the OECD [71] stress the comparison of project goals and local policy, and put local authorities and the representation of their residents into positions of responsibility.

In sum, the above argument follows the idea that mega infrastructure accelerates economic development, which needs to be transformed towards the goals and principles of local, sustainable development. Figure 2, therefore, serves as an exemplary discussion-grid that addresses the specialties of mega infrastructure in terms of sustainability dimensions, context, type of infrastructure, and supplementary determinants.

Type of Infrastructure	Sustainability dimensions					Context	
	Society	Environment	Economy	Politics	Complexity, Risk, Uncertainty		
	Transport	• Accessibility and mobility	• Displacement and land use	• Trade			• Trans-regional cooperation
	Health	• Power supply	• Air and water quality, emissions	• Services			• Transparency
	Education	• Living standards	• biodiversity	• Business opportunities			• Governance model
	Sanitation	• Involvement of periphery	• Resource allocation	• Cost savings in transport			• Territory
Industry	• Technical progress	• Regulations for constructions	• Market access	• Coordination	Determinants		
	• Service standards		• Technology usage	• Involvement,			
	• health		• construction	• Power relations			
	• Employment		• Sector-shift				
			• Local sourcing				
Purpose Stakeholders Time Surrounding and extend Spatial Level and cooperation							

**Figure 2.** Dimensions of local infrastructure assessment. Source: Own elaboration, derived from Shen et al. [29], Ward et al. [92], the OECD [71], and Haughton and Counsell [60].

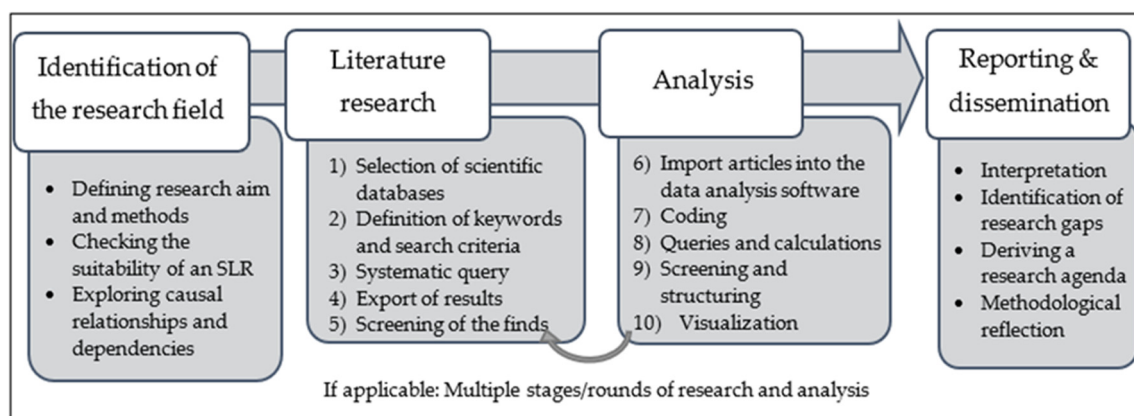
Reflecting upon the theoretical roots in regional studies, sustainability and transport geography, the assessment of the impacts of mega infrastructure on different local dimensions remains fragmented.

There exist practical discourse and research that certainly assist in the planning of mega infrastructure, including within the NSR. Universally valid learnings are hard to find, as all projects are embedded in a unique local setting and are often stuck in a specific sustainability dimension. Future research at this interface of infrastructure and sustainability thus could engage in both integrated development approaches and tools for flexible sustainable planning.

### 3. Methodology: Systematic Literature Review on the NSR

Catching up the challenges of the NSR in its local implementation, research and practice need to develop an understanding of what sustainability along the NSR means, before developing guidelines or monitoring. With the aim of discussing local sustainability within research on the NSR, this systematic literature review (SLR) identifies research articles in a systematic and reproducible way. Consequently, specific search processes and search criteria were implemented (Figure 3, Table 1) and assisted in framing the research field [23,93–99]. Compared to a traditional narrative review, an SLR is less rigid and seeks to answer a specific research question [96,100,101]. There is manifold theoretical support for SLRs; scholars like Cooper [102] and Petticrew and Roberts [95] have explored the conceptual foundation, and Denyer and Tanfield [96] and Kitchenham [23] have provided detailed guidelines for conducting an SLR. There exist different types of systematic reviews [101], which range from explorative to confirming, as well as qualitative and quantitative approaches [103,104]. Qualitative SLRs often use qualitative content analysis for a guided exploration of the literature. In opposition, quantitative SLRs apply statistical methods, namely meta-analysis or bibliometric analysis, to evaluate the structures of a research field [99,101,103].

The increasing interest in SLR studies has promoted the establishment of the SLR as a research method. In terms of sustainability, various SLRs have been conducted; for example, on climate change adaption [104], behavioral patterns in climate change mitigation [105], sustainable tourism [94], sustainability transition [106] and performance [107], sustainable supply chain management [108], local sustainability assessment in forestry [109], green infrastructure [110], city logistics [111], and governance of smart cities [112]. While the SLR is widely accepted in research articles, different steps of analysis are predominant. Figure 3 provides a collection of operation steps that serve a qualitative SLR in a more holistic way, which also include pre- and post-considerations in the analysis [95,99,102,104].



**Figure 3.** The procedure of the qualitative Systematic Literature Review (SLR). Source: Own elaboration as an extension to Snyder [101], O'Neill et al. [24], O'Neill and Booth [113] and Tranfield et al. [99].

This article processes a SLR through NVIVO™ according to the provided steps in Figure 3. NVIVO™ is a software used for the qualitative analysis of data, which supports semi-automated as well as manual coding. Its specialty is the processing of multiple rounds of research and analysis, which is also reflected by different literature samples and levels. Therefore, this SLR begins with the meta-level and then continues to develop deeper insights into the lower levels of analysis (Table 1).

This is why analysis on the micro- and meso-level applies a qualitative exploration of characteristics and sustainability dimensions. The general search criteria are: publications in scientific journals listed in World of Knowledge (WoK) and Science Direct (SD), publication date from 2013 (official start of the Belt and Road), and publication language English.

**Table 1.** Screening stages.

Stage	Starting Point	Analysis	Sec.	Question	n
Meta: Field description	Search query in WoK, SD on titles including 'BRI', 'Belt and Road', 'New Silk Road', 'One Belt One Road', 'OBOR'	Bibliometric: Titles, Keywords, Abstracts	Section 4.1.	Is sustainability of relevance in the research field?	597
Macro: Sustainability clusters	Search query with sub-keywords in titles and article-keywords: 'Sustainability', 'Development', 'Region', 'Local', 'Impact'	Clustering of full texts, Counting	Section 4.2.	Which thematic clusters evolve in sustainability?	162
Meso: Research characteristics	Selection of relevant clusters	Manual coding and queries	Section 4.3.	How is sustainability researched (scales, concepts, methods)?	58
Micro: Local sustainability	Search queries in the set on the linkage between spatial scales and sustainability	Codings and cross tables	Section 4.4.	How is sustainability handled and defined in the local context?	42

Source: Own elaboration.

The first screening stage identified 966 articles on the NSR (Table 2). A correction followed this query to eliminate duplexes, unwanted types of publication (abstracts, editorials, conference proceedings) or thematic misdirection. This correction led to a final meta-sample of 597 articles (Table 3), which represents the starting point for further analysis. The timely distribution of the articles shows the increasing interest in research on the NSR since its announcement (Table 3).

**Table 2.** Search results.

Search Criteria	Belt and Road	BRI	New Silk Road	One Belt One Road	OBOR	n
Science Direct	135	4	7	11	1	158
Web of Knowledge	612	36	52	91	17	808
Sum	747	40	59	102	18	966

Source: Own elaboration.

**Table 3.** Publication dates.

Year	2013	2014	2015	2016	2017	2018	2019	2020	Sum
Number of publications	1	2	9	18	37	67	251	212	597

Source: Own elaboration.

#### 4. Results: Framing Research on the NSR

The SLR had multiple rounds, which represented four levels of concretization. Equally, the presentation of the results starts with the meta-level and continues to explore detailed insights at the micro-level.

##### 4.1. Meta-Level: Is Sustainability of Relevance in the Research Field?

The meta-level reflects a quantitative description of the research field by broadly including all journal publications in the keywords (Table 1). This chapter aims to evaluate the relevance of sustainability in the broad research field by referring to article keywords and abstracts.

The article keywords allowed to obtain a rough overview of thematic focuses. Based on the word stem, the following keywords were used frequently by authors (Table 4). Obvious keywords, such as Belt and Road, were excluded. Consequently, the keywords represent a lively mixture, including terms like *infrastructure* and *investment*, *regional scales* and *cooperation*, but also *sustainability* and *politics*. Nevertheless, the perception of the NSR as an economic development initiative introduced by China prevails.

**Table 4.** Article keywords.

Word	Amount	Word	Amount	Word	Amount	Word	Amount
china	156	internationality	49	global	33	policy	24
development	99	environmental	48	regional	32	corridor	23
economic	86	transport	48	fdi	31	emission	23
trade	71	sustainable	40	countries	30	power	23
model	60	investment	38	relations	28	spatial	23
analysis	56	network	36	risk	26	chinese	22
infrastructure	52	asia	35	carbon	25	factors	21
energy	50	cooperation	35	financial	24	growth	20

Source: Own elaboration, articles = 597, keywords = 997.

Abstracts provide the space to formulate problem statements and research methodology, as well as to indicate the main results of the research. Based on word stems a word cloud was processed (Figure 4). In opposition to the keywords, the abstracts reveal that research on the NSR is often driven by the perspective of the countries along several corridors. *Belt and Road regions* or *Belt and Road countries* are terms which are often used in this regard. Although the term *Asia* is widely used, it is hard to identify a regional focus in these NSR studies. The thematic focus is equal to that of the article keywords: *Development*, as well as *economics*, *trade* and *investment*, play a crucial role. The role of a monitoring or impact assessment of the NSR cannot be neglected, as the keywords *effects* and *impacts* reveal. An additional keyword which is visible in the abstracts is *sustainable*, highlighting that a number of research articles have been concentrated on sustainability lately.



**Figure 4.** Word cloud based on abstracts. Source: Own elaboration, articles = 597, words = 1000.

A large share of journals, such as Sustainability and the Journal of Cleaner Production, also confirm the sustainability orientation. Moreover, the journals reveal a possible focus on Eurasia (Eurasian Geography and Economics), Asia (Asian Education and Development Studies), in the Pacific (Pacific Economic Review), or more generally, emerging markets (Emerging Markets Finance and Trade).

In sum, the meta-analysis confirms the intense focus of the NSR on economic development, along with the countries of the respective infrastructure and trade corridors. The sustainability discussion around the NSR has gained increased attention through impact assessment. Beyond that, the NSR is presented as a project with different spatial layers and a need for international networks, relationships, or cooperation.

#### 4.2. Macro-Level: Which Thematic Clusters Evolve in Sustainability?

The second level of analysis is the macro-level, which should explore clusters in sustainability discussions around the NSR. Therefore, a query with additional keywords (Table 1) represents the thematic focus of this study, and forms a new set of articles.

In general, the keywords of the full texts at the macro-level reveal that *institutions*, *banks*, *finance*, and *world* play a much more dominant role compared to at the meta-level. In more detail, a cluster analysis based on the Pearson Correlation for measuring the word distance in the full texts was conducted (Figure 5).

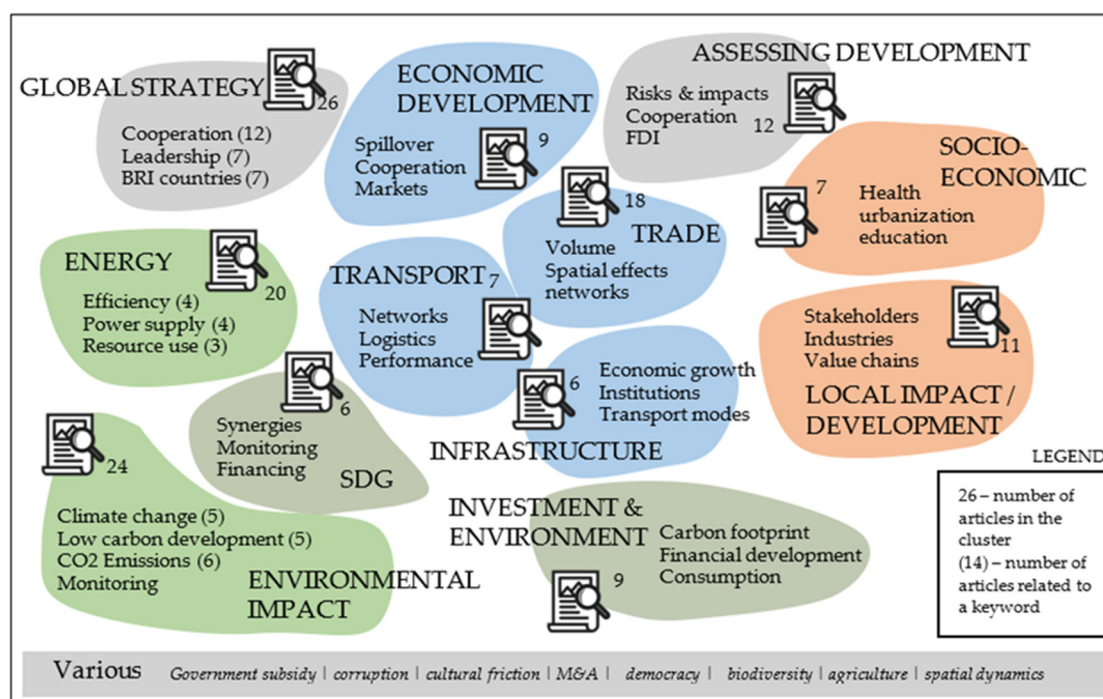


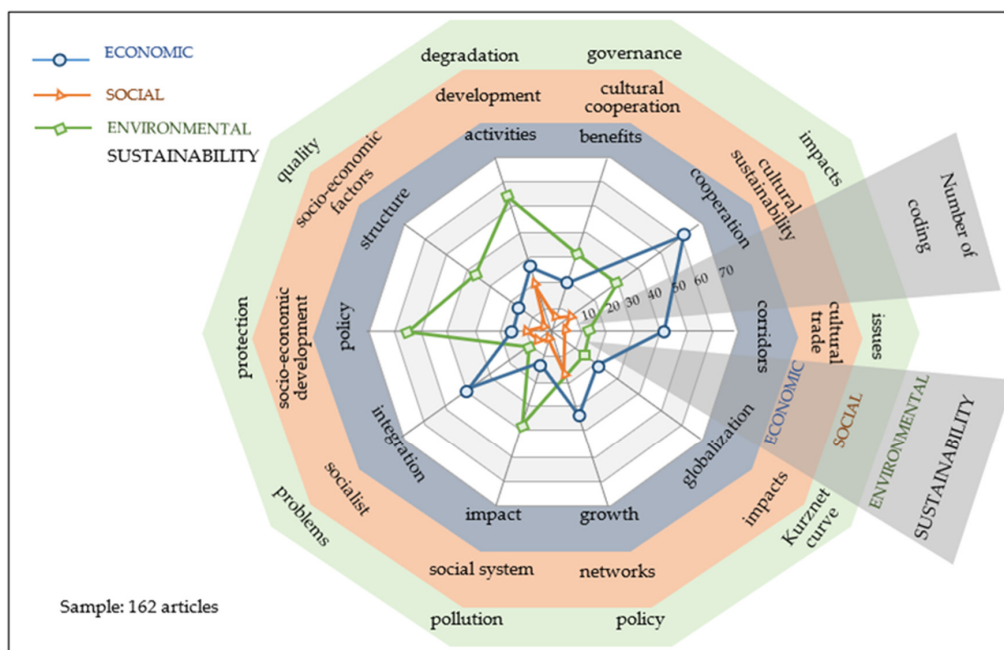
Figure 5. Clustering of articles and issues. Source: Own elaboration, articles = 162.

Tian et al. [114] and Wang et al. [115] discuss the effects of infrastructure investments in close relation to economic growth or development. A significant number of studies estimate the trade effects of the NSR, often in a quantitative manner, such as those by Chen et al. [116] or Baniya et al. [117]. Though it is frequently criticized as not being environmentally friendly, research on the NSR shows several approaches to environmental sustainability. Worth mentioning is the relation of *investments and environment*, calls to analyze the carbon footprint, and the effects of financial instruments following the central question: “Does finance affect environmental degradation?” [118]. In addition to this question, researchers are strongly focusing on the cluster *energy*, which handles fundamental questions of energy



supply in rural areas, but also the implementation of green energy projects [119]. Besides discussions on the *environmental impact*, including monitoring or climate change, several authors have addressed the *SDG* at the interface of the three sustainability dimensions [120–122]. Still, sustainability challenges the *assessment of development* in general, but also at the local scale. Reflecting the macro-literature set, the spatial concept “local” is seldom applied [123–126]. Another literature gap exists in the exploration of socio-cultural and even socio-economic effects. Issues of health [127] and education [128] are discussed, but a comprehensive understanding of residents and their socio-economic surroundings is largely missing. From a more strategic and political perspective, the cluster on *global strategy* indicates several pain points of the NSR around geopolitical relations. In this vain, cooperation was analyzed between China and regions along the corridors [10,129,130], as well as the approach of global leadership.

A further indication is provided by analyzing the three sustainability dimensions. Figure 6 presents the number of coding references according to the most frequently used keywords in the macro-set that directly include the terms: economic, social (and cultural), and environment. Deriving from the concept of strong sustainability, the economy is at the center, followed by society and the environment. In addition to the cluster analysis, this net graph reveals a research focus on *economic cooperation* and the *development of corridors*, as well as *environmental degradation, quality and pollution*. The social dimension remains under-researched.



**Figure 6.** Net graph on sustainability dimensions. Source: Own elaboration, articles = 162.

In sum, the macro-level—comprising a specialized set of sustainability concerns along the NSR—indicates that issues of economic development are quite well researched. As a core of sustainable development, research so far has not sufficiently discussed the effects of the NSR on a local scale, including the residents as a local stakeholder group.

#### 4.3. Meso-Level: How Is Local Sustainability Researched?

The analysis of the meso-level gives insights into the research characteristic of sustainability along the NSR. Therefore, a new set of articles evolves through the selection of relevant clusters; namely those that address the problem statement of local sustainability arising from the NSR impact. Those clusters are: *infrastructure*, *SDG*, *local development*, *assessing development*, and *economic development*. In general, keywords such as *development*, *countries*, *economics*, *region*, *infrastructure*, *policy* or *effects* underline the

thematic focus of this meso-level. This selection is completed by a content alignment, which finalizes 58 articles of the meso-set. To characterize the research, this section presents a more qualitative analysis on scales, concepts and theories, as well as applied methods.

#### 4.3.1. Scales: On Which Spatial Scales Does Research Discuss Sustainability?

The majority of the selected articles discuss the NSR in a cross-country analysis, involving sampling of up to 141 countries (Table 5). These analyses mostly have a quantitative and comparative character. However, there is also more specific sampling available, such as by selecting certain corridors or supranational regions; for example, Eurasia or Central Asia. In addition, specific national case studies have been conducted across Eurasia, but also in Kenya and India. Besides analyzing NSR-countries, China itself has often been studied, both at the sub-regional and national level. Subordinated spatial scales of research are hubs [131], special economic zones and industrial parks [132,133], or certain urban networks [134].

**Table 5.** Spatial scales.

Various Countries (BR)	More Specifically Defined (O)
33–141 BandR Countries [115,132,135–151]	BRI perspective along the east-west axis [152]
<b>Supranational (SN)</b>	BRI and non-BRI countries [153]
Eurasian countries [155–157]	metropolitan economy [134]
Kazakhstan and Eurasian economic union [158]	cities and regions within countries [154]
Central Asia [159]	
Latin America and Caribbean (LAC) countries [160]	<b>Single countries (N)</b>
<b>China [165] (C)</b>	Afghanistan [161]
western provinces of China [166]	Kenya [162]
Southwest China [167]	Kazakhstan [123]
China and the countries along the BRI [168]	India [163]
China and neighboring countries (India, Vietnam and Indonesia) [122]	Algerian [120]
	Poland [131]
	Mongolia [164]
	Georgia [126]

Source: Own elaboration, articles = 58.

#### 4.3.2. Concepts: Through Which Theoretical Concepts Is Research Addressing Sustainability?

Table 6 and Figure 7 assign the found concepts to the dimensions of sustainability, including the political dimension and the respective linkages in between the dimensions. Worth mentioning is the high share of research at the linkage of economic and environmental concepts.

**Table 6.** Applied concepts in sustainability research.

Sustainability Dimensions			
Economical	Social	Environmental	Political
Economic growth [115,142,150,169]			Development Aid Model [161]
Regional Labor Markets [162,166]			International development aid and FDI [147]
Total factor productivity [136]		Vulnerable environment, and energy consumption [155]	International Capacity Cooperation [132]
Tourism development [123]	People-to-people cultural exchange, including traditional Chinese Medicine [137]	Environmental efficiency [153]	Modernization and globalization towards bilateral cooperation and strategic relationships [141]
Value chains–global [124,170]–regional [157]	Social Exchange Theory [123]	Green Development Capability [149], resource [165]–energy [152]–water [159]	State-coordinated investment partnerships [172]
Global Trade Analysis Project model [136]			Governance [124]
Indirect trade relations [160]			Fragile state theory [161]
Impact of trade facilitation [138]			Accumulation regimes, spaces of sovereign exception. elite development paradigm [172]
Debt financing [135,162]			Regionalism [158]
Microfinance Institutions [148]			Local stakeholders' views [123]
Inclusive Finance [148]			
FDI Networks [171]			



Table 6. Cont.

Interfaces between Dimensions			
Environmental-Economical	Social-Environmental	All Dimensions	Economical-Social
<ul style="list-style-type: none"> <li>Economic-environmental relationship-Kuznet [173]</li> <li>Green transition of the regional economy [145]</li> <li>Financial development, industrialization, transport and FDI on the environmental quality [140,146,173,174]</li> <li>Value added per capita, transport freight and CO2 emission [174]</li> </ul>	<ul style="list-style-type: none"> <li>Critical natural capital and the socioeconomic drivers [175]</li> </ul>	<ul style="list-style-type: none"> <li>Political-economic market [176]</li> <li>Geo-economic and geopolitical [177]</li> <li>FDI and Institutional Quality [144]</li> </ul>	<ul style="list-style-type: none"> <li>Social economy, local security and regional economic development [161]</li> <li>Socioeconomic development index [139]</li> <li>Population, urbanization and economic scenarios [178]</li> <li>Socio-Economic Impact [169]</li> </ul>

Source: Own elaboration, articles = 58.

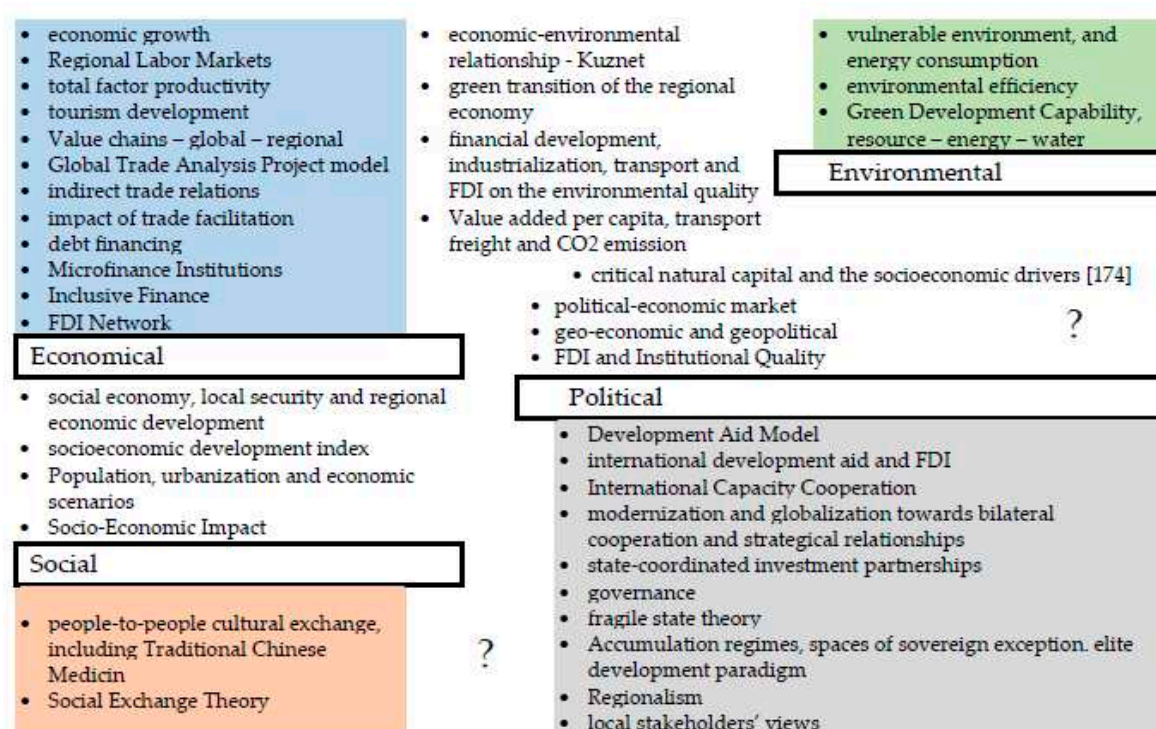


Figure 7. Linkages in sustainability research in addition to Table 6. Source: Own elaboration.

A research gap occurs in the social dimension. In general, the concepts reveal that precise theoretical approaches are missing, which makes a clear allocation towards several development streams (e.g., modernization, dependency) tricky. Partially, theoretical chapters are reduced to a minimum and represent a rather general explanation of the NSR, instead of a theoretical foundation, which leads also to an empirical analysis.

In the same way, research targets often remain broad, such as to research challenges and opportunities [162,170]. In fact, a significant share of the reviewed articles aim at understanding and measuring individual relationships, such as between growth and CO<sub>2</sub> emissions [141], trade and labor effects [166], infrastructure and (sustainable) economic development [114,115,169], or FDI and economic growth [146]. Only a few articles link the dimensions of sustainability [179].

#### 4.3.3. Methods: Which Methods Are Applied to Research Sustainability?

Research on sustainability issues along the NSR is dominated by measuring economic effects and relationships between certain variables. Such research is supported by statistical data and the

use of economic models and indicators (Table 7). Only a few articles apply spatial models or more qualitative approaches. All in all, the current research misses consequent empirical methods, as a significant share of articles remain descriptive and utilize the methods of a case study or statistical analysis as an empty framework.

**Table 7.** Applied methods.

<b>Statistical DFata (d)</b>	<b>Spatial Models [139] (s)</b>
Data from Asian Development Bank [136], United Nations [162], World Bank [142] UNCTAD [160] or China's Customs Statistical Yearbooks [165] Data on Imports and exports [132], on finance [135,148], Labor-force [166] Panel data and time-series [115,175] Analyzed e.g., by regression [165,173] or super-slack-based measure model [153], cross-correlation analysis [180]	Spatial-temporal characteristics analysis [115] Spatial Durbin Model on different cooperative patterns [149] General equilibrium model and spatial distribution of people, economic activity, and transport [154] Complex network method [171] High-Resolution Settlement Layer (HRSL) [120] Population and urbanization projection model [178]
<b>Economic models (e)</b>	<b>Various (v)</b>
Econometric models and data [138] DEMATEL analysis [124,134] Econometric test process [141] Shift-Share Analysis [166]	Monte Carlo experiment [160] Delphi Issues with international experts [181] A scenario analysis method [163] Literature review [170] Policy documents [161,167] Interviews [126,161] Remote sensing monitoring [120,182] Questionnaires [123,169,170] Case study and comparisons [126,131,133,139,158]
<b>Indicators and indexing (i)</b>	
Index system and multi-hierarchy linear summation method [145] Principal component analysis on composite indexes for Economic growth, environmental degradation, and social well-being [139,176,179] Comprehensive Evaluation Index [114] SDG indicators [122]	

Source: Own elaboration, articles = 58.

#### 4.4. Micro: How Is Sustainability Handled and Defined in the Local Context?

The micro-level is based on a manual in-depth analysis of coded statements, which occurred at the interface of spatial scales (*local, regional, national*) and the respective sustainability issues (*sustainability, development, as well as the single levels of the environment, economy and society*). As many codings mention more than one sustainability dimension, quotations from the articles are presented together with color-coding. Therefore, Table A1 (Appendix A) assists us in understanding the foundations of the research questions on local sustainability.

The analyzed quotations and articles show that the NSR has the potential to foster sustainability in general, but also in local terms [114,120,159]. Its main strength may lie in its understanding as a global initiative [121], which goes beyond traditional aid models. The quotations mention the various relationships, which are strongly connected to sustainability. Led by economic concerns, which postulate the positive relationship between infrastructure and trade, and between trade and labor markets [166] or environmental sustainability [121], the research also indicates that top economic performance does not necessarily go hand in hand with sustainability performance [183]. Unfortunately, performance measurements remain vague and difficult to compare. Only seldom has current research considered the local scale. The high share of international datasets highlights this problem. Variables are the overall development statues, which influences FDI inflow, but also environmental quality [118,140], the industry structure [183], and the different spatial scales applied. For example, urban logistics face different challenges than rural logistics. It is certain that the NSR is going to change the overall spatial patterns [126] of infrastructure, specific sectors, and trade and living environments.

Still, challenges arise at the interface of resource usage and resource protection [171]. Hu et al. [184] call for recognizing local carrying capacities, while Tian and Li [114] demand a balance between trade and environmental issues. Some case studies indicate that environmental sustainability (also referring to the concept of strong sustainability) functions as the basis for further economic and social development [159,179]. In the case of transboundary water resources in Central Asia, Howard and Howard claim that *“countries need to recognise that the economic success of the “Silk Road Economic Belt” hinges on their ability to develop programs that can ensure the region’s water resources are managed in a sound and sustainable manner.”* [159].

Selected examples from the literature that used a case study method can further represent the local sustainability discussion. In the case of Kazakhstan, Daye et al. [123] found that the tourism sector is a likely winner from the BRI through creating job opportunities and overall prosperity. The positive attitudes of local stakeholders exceed opinions on the possible negative aspects, such as financial costs and indebtedness, or loss of local autonomy. With reference to the Russian part of the Ice Silk Road, Evseev et al. provided insight into the indigenous population in the arctic zone, which represents an especially vulnerable group. For the coastal infrastructure projects, the authors call for regional ecological and social stability through buffer zones. This emphasis on regulating and provisioning ecosystems opposes the need for technological improvements on infrastructure that could assist cleaner trade and manufacturing [121,140]. In opposition, the case of Algeria [120] underlines the necessity of road access as a development driver, and part of SDG goal 9. Therefore, the researchers found that during the Belt and Road projects, the access of the rural population to expressways increased significantly. The example of Georgia in the Caucasus region [126] reveals a highly complex picture of the NSR as a playground for various international interests. The case study shows a mixed picture of perceived benefits in infrastructure, but challenges in regional authority that limits self-determination towards sustainable development. It partially shows the uncertainty of stakeholders regarding the economic benefits of the projects.

In sum, the discussion on local sustainability is strongly connected to political considerations (authority, transparency, governance). On an operational level, a linkage between environmental and economic issues is present, which also shows a gap in the research around socio-economic and socio-environmental issues. Often, the social dimension is skipped by arguing that economic development will automatically increase the welfare and the quality of life of the residents. This gap may promote future studies that will question the social benefits [126], stress civil protests [178], and local autonomy [123,158] and local participation [145]. The need to critically evaluate the NSR and to strive for a more holistic approach to sustainability opens opportunities for further research.

## 5. Discussion: Future Directions in Local Sustainability

Building upon the theoretical introduction to various determinants (Figure 2), high complexity, risk, and uncertainty accompanies the sustainable implementation of various types of infrastructure over the four sustainability dimensions. Given a holistic setting, the local sustainability of mega infrastructure has only been addressed in a fragmented way in previous research. This article contributes to outlining future directions for local sustainability within the specific setting of the NSR. Therefore, this discussion addresses three sections for the support of local sustainability.

### 5.1. Building a Joint Understanding of Sustainability

Although there exists different approaches to sustainability or sustainable development, they have in common reliance on long-term perspectives, to include different scientific disciplines and to harmonize different interests. As a bottom-up process, it should also serve to foster the quality of life of the residents (Section 2.2).

The local sustainability along the NSR is hard to assess, as motivations of international donors and domestic authorities are unclear, or transparency is lacking at various stages of planning [135]. There is no doubt that the interests on the different scales can vary or even compete [185]. The joint

implementation of mega infrastructure in a sustainable way might only be possible if consensus is created, which is based on clear positions and responsibilities. This collective understanding of sustainability needs to go hand in hand with understanding and researching the basic variables of development: What are the effects of infrastructure? How can I monitor the effects? How can a region address the full potential of external investments? What is the role of local authorities? What are the benefits for locals?

The results of this study reveal that major relationships exist between infrastructure projects and economic growth. Researchers agree that infrastructure supports the latter (Section 2.1), but the effects of mega infrastructure as a public investment on sustainable development remain poorly understood [126]. However, economic growth is often considered alongside international trade and income effects for China. Though the concept of sustainable [186] or green trade [145] are gaining momentum, the local scale is frequently excluded. The aims to increase welfare and economic development, and achieve an inclusive and sustainable economy [121], often remain un-researched at the local scale. Attempts to create indicators and monitoring systems need to be extended here, and be included effectively in policy-making [122].

Taking the framework of the SDG provides the NSR with a “*strategic policy framework for pursuing societal prosperity without undermining environmental sustainability*” [175]. Although the SDGs are appreciated and to date have been widely implemented by institutions and companies [175], the NSR still needs to prove its international openness and the local sustainability of its implemented projects in the long term. Early studies have applied these factors in the context of the NSR [120,132]. The SDGs could help to recognize sustainable development as a holistic and integrated set of economic, social and environmental actions, paired with political responsibility [146,175,179]—even if the SDGs are not free of conflicts. Likewise, a focus on the overall setting of the SDGs could also increase depth in several sub-systems on several spatial scales; for instance, the evaluation of global environmental governance [125].

Finally, a joint understanding of sustainability lies at the core of many discussions in research in general (Section 2.2), but also in implementing the NSR; this should define the responsibilities, principles, and limitations as well. Especially in vulnerable regions, sustainable development is needed that reduces trade-induced emissions and preserves natural resources, which includes local authorities in decision-making and promotes labor markets and induces local welfare [185]. Such discussions should also take into account the many factors of mega infrastructure (e.g., Section 2.2). One needs to admit that the NSR is a critical geopolitical ground, which relies on power relations in bi- and multilateral settings, including political capitalism [187] and development cooperation [188]. Combined with power issues, the risk of debt and thus financial sustainability is of major concern for several countries [115,158], and probably hinders negotiations at eye level. Therefore, the choice of an adequate development model for nations or smaller local areas is of high importance.

## 5.2. Supporting Mega Infrastructure Locally

There is a theory that mega infrastructure could be a driver for economic growth if implemented in a holistic manner, which means to include the development of infrastructure hubs, diversification and related services, to provide a local workforce, to recognize entrepreneurial opportunities, and much more (Figure 2). Implementing infrastructure thus should exceed its singularity, and opens up local and regional dimensions. Research and discussions on recent infrastructure projects worldwide assist in finding sustainable pathways.

In the discussion on stakeholders in mega infrastructure, researchers are calling to include local communities in all stages of planning and implementation, to secure the sharing of benefits or to “*enable wellbeing and sustainable livelihoods*” [181]. This is complemented by the expectation that the NSR can follow an environmentally sustainable path if a cross-stakeholders pathway is followed, and a monitoring system assists the project implementation [155]. The concept of private-public partnerships (PPP) is also relevant in this case [189]. Traditional performance measures on infrastructure are

inadequate for megaprojects of the extent of the NSR. Referring to the SDGs, mega infrastructure needs to show accountability. For example, an energy project such as a power station, wind farm, or solar array must show how it advances the goal of “*affordable and clean energy*” [53].

When external investments push infrastructure, it requires local vigilance, self-confidence, and flexibility towards the own development plans, reflecting the concept of global development. The selection of a respective development model is a strategic decision; it is about growth, dependencies, access to markets, and a lot more. The NSR can be defined as such an investment-led development model [121] to foster trade networks. Primarily, highly fragile states depend on such investments [161]. Development cooperation is a central concept of this. Alonso and Glennie [190] added the convergence of developing countries to higher levels of income and wellbeing, as well as participation in international public goods. The aims of development cooperation, or even foreign aid, certainly have changed over the decades, with a tendency to affect more areas of social life and a clear goal-orientation. Therefore, foreign aid combines the motivation of donors towards human development, democratization, sustainable resource management, and poverty reduction, but also the aims of the receiving countries [188,191]. In addition to investments and capital transfer, neo-classical approaches highlight the countries’ own policies; for instance, in adjustment programs and international development cooperation, converging in spillover theories and knowledge transfer [188]. The absence of evaluation leaves questions about the real effects of development aid on both the national and local scales [37]. In the case of Afghanistan and the NSR, researchers recommend reducing dependence on traditional development aid, and to focus more on sustainable aid models [161].

Several authors have recommended practical strategies to assist external investments, such as the creation of industrial parks along a transport corridor, linking local and international companies, involving the hinterland, and improving access to higher education and health services [88], which can be combined with tools of community involvement at a local scale [71]. This call for local adaption of the projects requires several preconditions, including financial impact assessment [135,145], international sustainability standards in domestic and international investments [177], support of inter-regional investments that promote the development of regional economies [171], and the promotion of ownership and control to the receiving countries [190]. Increasing human capital through education might be another prerequisite to participation by employing local workers. Often specific types of human resources are not available in sparsely populated areas, or the quality of the workforce in the least developed countries might not meet the requirements of mega infrastructure [71]. Further measures can be derived from the results of the SLR (Table 8).

**Table 8.** Local measures.

<b>Local Cooperation</b>	
Multiple party collaboration [192], including locals [155]	
Regional cooperation on green supply chains [145]	
Cooperation across branches [134]	
Dialogs, PPP, joint research, technology helps the environment [122]	
<b>Local Policy</b>	<b>Local Entrepreneurship</b>
Development of local and regional policy programs in accordance to NSR [118,159]	Economic zones as places of entrepreneurship, spillovers and cooperation [132]
Regional barrier-removing policies [156]	Entrepreneurial opportunities lie in the local support-linking sustainable development and local economies [184]
Determine the pace of development-moderate development might increase the quality of development, locally [193]	Promote the transition from agriculture and manufacturing to service industries [126]
New local collaborative models [194]	Planning and development of local hubs and hinterland connection [126]
Strong investment and finance framework support independence from inward FDI [115,135]	

Source: Own elaboration.

Reflecting the theoretical contributions to transport geography or local development, infrastructure projects have researched pre-requisites which should be taken into account, and which probably forces regions to diversify their economic model by moving from mere primary and secondary sectors to the operations of service transport and the planning of respective projects.

### *5.3. Introducing Governance Models and Regional Integration*

Throughout the last decades, the different global regions have seen widespread cooperation, which has culminated in regional integration—either in relatively informal or formal organizations, such as the EU or the ASEAN [195]. There is a number of reasons why states or regions cooperate in development, such as factor endowment or joint problem solutions, with the aims of promoting trade, knowledge gains, preservation of peace and security, and financial stability [196].

In the same way, the NSR changes international relations and governance modes, develops institutions, activates new regional cooperation [53], and finally promotes regional integration. Integration processes along the NSR are based on increased connectivity. In this regard, regions are bound together by a decrease in travel and transport time, or the establishment of new regional supply networks. Researchers also perceive these infrastructural connections as a prerequisite for sustainable mobility, which should be researched further [120,170,197]. Regional integration is also a matter of multi-level governance that focuses the decision-making processes and their coordination among several levels, including the local, regional, and global [198]. The popularity of multi-level governance has evolved, as it raises questions about nation-states, central governments, and also about other levels and actors, including NGOs and PPPs [199].

The governance model of the NSR is still challenged by limited transparency and power issues, which has led to calls for increased communication, dialog, joint research, and research-collaboration [122]. The main challenge of the NSR countries might be to balance different investment projects from different partners or donors. Research in this regard remains fragmented and highly context-specific, and efforts are thus underway to obtain a better overview. As the potential of international cooperation is clear [200,201], there are calls to introduce international organizations to link spatial scales [121] or Multinational Development Banks [202]. In terms of the NSR, multi-level governance can serve as a means to foster the stepwise integration of regions into global processes and networks, and to include local conditions and requirements. It lies in the center of regional integration and the overall concept of regionalism; that regional cooperation is also fostered in a national bottom-up process. This matches the findings on the need for local policies and international cooperation, and to rethink administrative decentralization in international projects. This likewise opens the discussion on supplementary or alternative development models in opposition to the Belt and Road. Fostering smaller, but independent regional cooperation networks and thus trade and infrastructure networks could also meet the recent challenges of COVID-19. Reinforced by COVID-19, the need for regional networks to be organized in a robust and resilient manner has increased. The World Economic Forum perceives regional integration as a strategy to meet the challenges of COVID-19 [187]. Regional institutions therefore could act as agents binding regions together. As a result of the shock to global supply chains, national governments were forced to provide basic necessities [203] and strengthen local supply chains instead. It is not clear yet whether regional integration was strengthened during COVID-19, as results from Africa show the opposite tendency due to breaking of regional integration protocols in favor of securing national supplies [204].

These approaches to regional integration might serve as an alternative development strategy for countries along the NSR; not to reject the Chinese BRI, but to carefully elaborate the benefits and challenges of all options, and to focus on bottom-up processes to maintain and to take responsibility for local development. This is all the more relevant as the NSR faces not only the challenges of a single national mega infrastructure project, but a complex set of intervened and transnational mega infrastructures. Nevertheless, the local scale is strongly connected to the global initiative, and vice versa. Therefore, sustainable development will require cooperation across nations and among regions

and corridors [155,166,177]. In the same way, China's economic development is closely connected to its partners and to world economies [121].

## **6. Conclusions: Proposing a Research Agenda for the NSR**

This study builds upon the emerging field of the NSR, and especially gains insight into the role of local sustainability. Therefore, this article started by claiming gaps in the local implementation of the various mega infrastructures that build the NSR. In summary, this study contributes the following: first, a comparison between the principles of local sustainability in mega infrastructure (Section 2) and the current scientific discussion on the NSR (Section 4), revealing that challenges resemble theory along the NSR—although research on the NSR has focused on bridging local interests and international politics (Section 5). Second, the SLR shows the gap in sustainability implementation in infrastructure. Third, the different scales of analysis, and especially the in-depth review on the micro-level, point to a research agenda for the NSR in line with theoretical streams based on seven dimensions:

1. International research collaboration: Especially through the global extent of the NSR and particular regional and local characteristics, cooperative research at the international level is seen as a decisive factor to take full opportunity of the NSR at a local level; for example, cooperation between international researchers and local universities of applied science.
2. Objectivity: As the NSR is strongly connected to geopolitical issues, reservations, prejudices, political intentions, and cultural barriers may impede objectivity in research. Objective research should also mean that international scholars engage in project monitoring based on transparency.
3. Scales: Current research focuses on the impacts in various countries. To derive learnings for local sustainability is difficult, which makes a case for in-depth case studies for particular regions or local areas, such as cities, hubs, and hinterlands.
4. Context: Researchers need to be aware that sustainability requires a high context- and culture-specific approach, which does not automatically meet the “first-world-view” on development or the Chinese perspective on economic growth. Even the implementation of transnational infrastructure projects requires dealing with local conditions.
5. Methods: Researchers are exploring the field through an increasing number of articles, often led by econometric models. Future research should widen the methodological perspective towards case studies and qualitative methods to gain deeper insights into local sustainability, especially in regard to impacts on residents, local governance, and policy mechanisms to identify factors for participation and regulation; examples are local case studies on specific infrastructure hubs through in-depth interviews with local authorities.
6. Theoretical concepts: Research on the NSR has been, to date, influenced by curiosity around rough insight into this complex field, often by skipping the theoretical depth. The NSR should be, in the future, recognized as a research field, offering a unique playground to develop and prove theories of sustainable development in different statues and regions. In first instance, the NSR provides theoretical proximity to concepts of economic geography—including transport and mobilities geography. In addition, non-NSR research on sustainable infrastructure requires an integrative model to provide systematization and guidance.
7. Transdisciplinary research: The complex setting of the NSR stresses the need for interdisciplinary research, or even a transdisciplinary approach, to accompany successful practical implementation. Against this background, transdisciplinary research aims to solve problems through decomposition and the synthesis of several disciplines [205]. Practically, this means bridging transport geography (e.g., connectivity, mobility, infrastructure), with economic concerns (trade, local development, local economics, employment, entrepreneurship), with natural science (environmental sustainability), but also with political science. To do so requires developing policy plans and forms of international collaboration. Finally, the research itself needs to be aware of entering a geopolitical field, which could also be assisted by cultural studies or behavioral science.

This article aimed to set up research directions for the NSR, with a special discussion of local sustainability. The NSR was analyzed through the method of SLR with a mixture of quantitative and qualitative factors. Based on these findings, this articles provide the starting point of a systematic analysis of local sustainability along the NSR, rather than providing an impact assessment. This contribution is limited by the range of an SLR, and the set criteria and focus. Thus, this article does not include further groundbreaking publications in the form of conference proceedings or edited volumes, and a detailed exploration of sustainability issues at a supranational or even global scale. The focus of this article lies in current NSR research, and evidence from former research on infrastructure assessment offers manifold theories and practical hints which need to be systematically included in future discussions. As an emerging research field, the NSR is about to enter the scientific discourse dynamically, and will probably provide further insights into local sustainability.

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## Appendix A

Table A1. Statements on sustainable development.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Ahmad, M., et al. (2020). Does financial development and foreign direct investment improve environmental quality? Evidence from belt and road countries	[140]	BR	i	<ul style="list-style-type: none"> <li>financially developed economies get more FDI inflows and boost the host country's RandD in energy innovation, which subsequently improves the environmental quality</li> </ul>
Bandiera, L., and Tsiropoulos, V. (2020). A Framework to Assess Debt Sustainability under the Belt and Road Initiative	[135]	BR	d	<ul style="list-style-type: none"> <li>In countries with weak public investment management frameworks, the availability of funds in the immediate term may also induce borrowing countries to invest in large-scale infrastructure projects based on their ability to secure financing, rather than on the priority accorded to such projects in the government's overall development strategy.</li> </ul>
Chen, Q., et al. (2019). Evolution of the Cultural Trade Network in "the Belt and Road" Region: Implication for Global Cultural Sustainability	[201]	BR	s	<ul style="list-style-type: none"> <li>While the cultural trade network has promoted the integration of cultural diversity into the global market, to achieve global cultural sustainability more active trading relations with small-sized countries should be encouraged.</li> </ul>
Chen, X., et al. (2020). Tracking national sustainability of critical natural capital and the socioeconomic drivers in the context of the Belt and Road Initiative	[175]	BR	s	<ul style="list-style-type: none"> <li>As the latest consensus-based guidelines, the Sustainable Development Goals (SDGs) including a set of measurable targets and indicators proposed by the United Nations (2015) have been playing a critical role in promoting global and regional sustainability.</li> </ul>
Chen, Y [Ya], et al. (2020). How can Belt and Road countries contribute to glocal low-carbon development?	[125]	BR	i	<ul style="list-style-type: none"> <li>The construction of green BRI can not only provide powerful supports for BRI countries to achieve the 2030 sustainable development goals, but also help BRI countries to participate in global environmental governance.</li> </ul>
Chubarov, I. (2019). Challenges and opportunities for the spatial development of Eurasia under the BRI: the case of the Eurasian Economic Union.	[156]	SN	s	<ul style="list-style-type: none"> <li>Others tend to see the BRI as not merely a regional but as a global economic initiative in support of globalization and free trade that makes it potentially compatible with regional barrier-removing policies, such as the EAEU.</li> </ul>
Coenen, J., et al. (2020). Environmental Governance of China's Belt and Road Initiative	[200]	BR	v	<ul style="list-style-type: none"> <li>In order to meet the strict environmental regulations of the EU, the Chinese consortium set up a Safety and Environmental Protection Department, introduced noise-canceling technology to protect the marine environment, and collaborates with local companies.</li> </ul>
Cui, L., and Song, M. (2019). Economic evaluation of the Belt and Road Initiative from an unimpeded trade perspective	[183]	BR	e	<ul style="list-style-type: none"> <li>From the correlation and correspondence analyses, it was concluded that the top-performing countries do not necessarily have top performance in all five sustainability dimensions, and vice versa; the bottom-performing countries do not necessarily have the lowest performance in all five dimensions.</li> </ul>
Cuiyun, C., and Chazhong, G. (2020). Green development assessment for countries along the belt and road.	[145]	BR	i	<ul style="list-style-type: none"> <li>This research has focused on the distribution characteristics and risk analyses of resources and environmental factors in countries along the route, impacts of construction projects on regional resources and the environment, and the impacts of global climate change on the BRI.</li> <li>For regional cooperation, China has actively explored green supply chains that leverage purchasers to achieve improvements in environmental performance.</li> <li>the space left for Chinese overseas investment is mostly characterized by a high difficulty of developing natural resources, fragile local ecological environments, sensitive geopolitical politics, strong religious and local forces, and relatively weak economies.</li> </ul>

Table A1. Cont.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Daye, M., et al. (2020). Exploring local stakeholders' views on the prospects of China's Belt and Road Initiative on tourism development in Kazakhstan	[123]	N	v	<ul style="list-style-type: none"> <li>The findings suggest that while there is a <b>strong support for the economic value</b> of China's BRI for the sector, there are some concerns that it may undermine local autonomy and Kazakhstan's distinctive brand as a tourist destination.</li> <li>this study will also address the gap in the literature on <b>local perceptions</b> of multi-sectoral, regional infrastructural development projects that both include and impact tourism such as the proposed BRI.</li> <li>This points to the importance of measuring the <b>attitudes of Kazakhstan tourism, civic and business stakeholders' attitudes</b> to future development plans for tourism under the BRI, to determine whether there is some perception of risk that their local autonomy and overall sovereignty may be compromised by China's control of the investment landscape.</li> </ul>
Evseev, A. V., et al. (2019). New look at territories of traditional nature use—traditional nature management lands at the coastal zone of the Ice Silk Road: a case study for the Russian Arctic	[197]	N	v	<ul style="list-style-type: none"> <li>To meet <b>ecological and social sustainable development</b> tasks in the Arctic, <b>ecological buffer territories are needed for reproduction of supporting, provisioning and regulating ecosystem services beneficial both for the ecosystem and local communities' sustainable development</b></li> </ul>
Feng, T.-t., et al. (2019). Synergies of sustainable development goals between China and countries along the Belt and Road initiative	[122]	C	i	<ul style="list-style-type: none"> <li>Several paths present themselves ahead, such as:</li> <li>to enrich and deepen creative dialogues between China and countries along 'the Belt and Road', discuss regional SDGs topics like <b>'food security, clean drinking water and sanitation facilities, clean energy, climate change, public health</b> and so on, fashion new ways to cooperate with each other, and promote public-private partnership (PPP);</li> <li>to build united labs, research and development hubs, incubators, research and science infrastructure facilities, and big data platforms, guide resources/funds</li> <li>to activate mechanism to promote tech innovation, collaborate in setting up technology transfer institutions and tech banks to accelerate the transfer, expansion and <b>promotion of environment-friendly technologies</b> [ . . . ] based on bilateral and multi-lateral partnership agreements;</li> </ul>
Galán, E. M., and Leandro, F. J. (2019). The Belt and Road Initiative: The Cornerstone of the New-Fangled Financial Institutionalism Led by China	[202]	BR	v	<ul style="list-style-type: none"> <li>regarding the new MDB proposed by China, the AIIB, its aim was two-folded: "(i) <b>promoting economic development</b> and regional integration in Asia; and (ii) showing to the world that China was capable of leading a new MDB with the highest international practices in matters of governance, safeguard policies including <b>environmental protection, resettlement, and debt sustainability</b>, among others".</li> </ul>
Gonzalez-Vicente, R. (2019). Make development great again? Accumulation regimes, spaces of sovereign exception and the elite development paradigm of China's Belt and Road Initiative.	[172]	C	t	<ul style="list-style-type: none"> <li>Project-specific issues are influenced by governmental demands and <b>civil society pressures, such as the percentage of Chinese versus local workers, environmental standards</b>, or more broadly, the adequacy of a project within a country's long-term development vision</li> </ul>
Gu, A., and Zhou, X. (2020). Emission reduction effects of the green energy investment projects of China in belt and road initiative countries	[119]	BR	d	<ul style="list-style-type: none"> <li>the opportunities for BRI countries to achieve sustainable development and <b>climate change targets at low investment costs</b> have been greatly increased.</li> </ul>
Hafeez, M., et al. (2018). Does finance affect environmental degradation: Evidence from One Belt and One Road Initiative region?	[118]	BR	e	<ul style="list-style-type: none"> <li>Due to bi-directional causality within OBOR region, <b>finance is a fruitful instrument for environmental scientists</b> and regulatory authorities to devise short-run regional policies.</li> <li>pollution-halo hypothesis: multinational organization complies with the international environmental regulations and spreads <b>green technology</b> in the neighboring countries, which implies that <b>FDI inflows mitigate the carbon emission and improves the environmental quality</b>.</li> </ul>

Table A1. Cont.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Hafeez, M., et. Al.. (2019). An empirical evaluation of financial development-carbon footprint nexus in One Belt and Road region.	[206]	BR	d, e	<ul style="list-style-type: none"> <li>financial entities must develop policies and strategies in a manner consistent with national and regional sustainability models in order to strengthen their global standards for the establishment of sustainable banks.</li> </ul>
Han, M., et al. (2020). Carbon inequality and economic development across the Belt and Road regions	[207]	BR	e	<ul style="list-style-type: none"> <li>The model integrates economic networks and ecological endowments by examining the physical balance of resource use and environmental emissions for a regional system.</li> </ul>
He, and Cao (2019). Pattern and Influencing Factors of Foreign Direct Investment Networks between Countries along the “Belt and Road” Regions	[171]	BR	s	<ul style="list-style-type: none"> <li>the practice of the Belt and Road initiative will greatly promote the economic integration process and sustainable development of these three major regions.</li> <li>According to Mundell’s research, when the volume of trade between the host country and the home country is very large, the host government will set up relevant trade barriers to the home country enterprises, so as to protect the development interests of domestic enterprises.</li> </ul>
Hou, J., et al. (2020). A global analysis of CO 2 and non-CO 2 GHG emissions embodied in trade with Belt and Road Initiative countries	[192]	BR	e	<ul style="list-style-type: none"> <li>China should lead the collaboration with multiple parties to build a green, low-emissions, and sustainable system of rules under the BRI framework in the areas of policies, projects (infrastructure), trade and trade agreements, finance, culture, and other relevant areas, in order to promote BRI countries’ green development and global climate governance.</li> </ul>
Howard, K. W. F., and Howard, K. K. (2016). The new “Silk Road Economic Belt” as a threat to the sustainable management of Central Asia’s transboundary water resources	[159]	SN	s	<ul style="list-style-type: none"> <li>Such a project would bring profound economic benefits to the entire region and create wealth and prosperity in some of the world’s most impoverished areas.</li> <li>Central Asian countries need to recognise that the economic success of the “Silk Road Economic Belt” hinges on their ability to develop programs that can ensure the region’s water resources are managed in a sound and sustainable manner.</li> </ul>
Hu, D., et al. (2017). On the Environmental Responsibility of Chinese Enterprises for Their FDI in Countries within the One Belt and One Road Initiative	[184]	C	v	<ul style="list-style-type: none"> <li>Sustainable development should take into account the carrying capacity of the local environment.</li> <li>Enterprises could achieve a steadier and more sustainable development by linking their development with that of the local community through mechanisms of information exchange, participation, and benefit sharing.</li> <li>Elastic environmental standards leave room for random explanations, causing uncertainty in the determination of responsibility, while low environmental standards may trigger protest and conflicts from local communities and opposition parties.</li> </ul>
Jia, Z., et al. (2020). Monitoring of UN sustainable development goal SDG-9.1.1: Study of Algerian “Belt and Road” expressways constructed by China	[120]	N	s	<ul style="list-style-type: none"> <li>China’s Belt and Road infrastructure interoperability major projects are fast, which has strongly promoted local socioeconomic development and population growth.</li> </ul>
Jianying, X., et al.. (2020). Partitioned responses of ecosystem services and their tradeoffs to human activities in the Belt and Road region.	[193]	BR	s, e	<ul style="list-style-type: none"> <li>our results suggested that rational utilization of water resources, maintaining a moderate population size and industrialization speed, and improving the utilization efficiency of resources, which could provide references for achieving sustainable development goals (SDGs) at a regional scale.</li> </ul>

Table A1. Cont.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Kang, L, et al. (2018). Harmony in Diversity: Can the One Belt One Road Initiative Promote China's Outward Foreign Direct Investment?	[194]	BR	e	<ul style="list-style-type: none"> <li>our main argument is that China's OBOR initiative, as a new regional cooperation model used to accelerate China's transformation from an FDI receiver to an FDI provider for the next stage of sustainable development, is an important strategy to <b>sustain its economic growth</b> by continuing its long tradition of economic, institutional, and cultural convergence with the OBOR countries.</li> </ul>
Li, P. et al. (2015). Building a new and sustainable "Silk Road economic belt	[155]	SN	v	<ul style="list-style-type: none"> <li>Any effort to build the New Silk Road in an <b>environmentally sustainable</b> will fail without the full <b>support of the local people</b>.</li> </ul>
Liu, Y. (2019). China's Implementation of Goal 9 of the 2030 Agenda for Sustainable Development:	[132]	BR	d	<ul style="list-style-type: none"> <li>Construction of <b>special economic zones and industrial parks</b> is an important method used by China in its constant exploration of deepening economic system reform and improving opening-up quality, and also a crucial platform and approach for the Chinese industry to undertake outbound industrial transfer, foster China's small and medium-sized enterprises, and further promote industrial clustering, upgrading, and regional development.</li> <li>At a local level, all provinces, cities, and autonomous regions develop their implementation and action plans to keep pace with the BRI and capacity cooperation, depending on their own development planning, location related advantages, and <b>industrial features, with a focus on enabling local enterprises</b> to be the main force of going out to participate in international capacity cooperation and explore new cooperation models</li> </ul>
Pechlaner, H., et al.. (2019). Local service industry and tourism development through the global trade and infrastructure project of the New Silk Road—the example of Georgia	[126]	N	v	<ul style="list-style-type: none"> <li>While the <b>environmental impacts remain unclear</b>, the interviewees envision many <b>social benefits</b>.</li> <li>analyzing the transition from infrastructure towards logistic services and regional services is crucial, since the <b>development of the tertiary economic sector</b> is assumed to cause regional interlinking beyond the mere transportation of goods</li> <li>This dynamics in turn affects the pattern of movement of persons and goods, as well as the <b>spatial pattern of economic activities</b> on site, resulting in a higher accessibility and an <b>increased regional productivity</b></li> <li>A further precondition to <b>allow local service development</b> is the utilization of hubs and gateways to provide supportive and logistic services in order to exceed the mere transit traffic.</li> </ul>
Pieper, M. (2020). The linchpin of Eurasia: Kazakhstan and the Eurasian economic union between Russia's defensive regionalism and China's new Silk Roads	[158]	SN	v	<ul style="list-style-type: none"> <li>both the Russian and Kazakhstani governments look at <b>China's economic power</b> with a mix of awe and alarm, as <b>do local communities</b> in Kazakhstan.</li> <li>The resulting economic and political consequences in 'BRI' partner countries debunk the persistent myth of Chinese aid as development assistance 'with no strings attached'.</li> </ul>
Qi, X., et al. (2019). Relative importance of climate change and human activities for vegetation changes on China's silk road economic belt over multiple timescales	[208]	C	e	<ul style="list-style-type: none"> <li>to ensure sustainable socioeconomic development in the Silk Road Economic Belt, and particularly in arid and semi-arid regions, <b>vegetation should be protected from human activities to prevent ecosystem loss</b>.</li> </ul>

Table A1. Cont.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Saud, S., et al. (2019). The nexus between financial development, income level, and environment in Central and Eastern European Countries: A perspective on Belt and Road Initiative	[173]	BR	d	<ul style="list-style-type: none"> <li>The Dynamic Seemingly Unrelated Regression long-run panel results reveal that (i) <b>financial development index and income negatively impact on environmental quality</b>; (ii) <b>energy consumption</b> is the key determinant of <b>CO2 emissions and reduces environmental quality</b>; (iii) <b>urbanization</b> and <b>trade</b> both <b>enhance environmental quality via reduction of carbon emissions</b>; and (iv) the <b>environmental Kuznets curve hypothesis</b> supported for the selected panel countries.</li> </ul>
Shao, Z.-Z., et al. (2018). Evaluation of large-scale transnational high-speed railway construction priority in the belt and road region	[143]	BR	v	<ul style="list-style-type: none"> <li>relying on the BandR construction, China will play a leading role in regional economic cooperation, which is not only conducive to the <b>economic development</b> of the countries along the Silk Road, but is also of great importance for the <b>promotion of the international division of labor</b>, international cooperation, and <b>integration of regional economy</b>.</li> </ul>
Sun, et al. (2019). Does the “Belt and Road Initiative” Promote the Economic Growth of Participating Countries?	[142]	BR	e	<ul style="list-style-type: none"> <li>At present, the protectionist forces of various countries are gradually rising, raising the tariff rates of imported goods to promote the <b>economic recovery</b> of their own countries, which directly <b>affects the volume of trade among countries</b>.</li> </ul>
Sun, Q., et al. (2019). Synergetic Effect and Spatial-Temporal Evolution of Railway Transportation in Sustainable Development of Trade: An Empirical Study Based on the Belt and Road	[209]	BR	d	<ul style="list-style-type: none"> <li><b>Sustainable trade</b> is a new trade model that is driven by the concept of sustainable development, which aims to <b>promote economic growth</b>, <b>enhance social capital</b> and <b>integration into environmental management</b>, and participate in regional trade development.</li> <li>take advantage of the railway transportation of the countries along BandR, realize the effective flow of goods between the countries, and form sustainable development that is based on the sharing of railway resources.</li> </ul>
Tian, G., and Li, J. (2019). How Does Infrastructure Construction Affect Economic Development along the “Belt and Road”: By Promoting Growth or Improving Distribution?	[114]	BR	d, e	<ul style="list-style-type: none"> <li>In bringing these two concepts [Maritime Silk Road and Silk Road Economic Belt] to fruition, “The Belt and Road Initiative” (OBOR) has opened a <b>new channel for production, trade, and economic cooperation</b> between China and numerous countries around the world.</li> </ul>
Tian, X., et al. (2019). Trade impacts of China’s Belt and Road Initiative: From resource and environmental perspectives	[165]	C	d,i	<ul style="list-style-type: none"> <li>The <b>unbalance between trade development</b> and <b>environmental issues</b> also imposed an “ecological imbalance” on China’s provinces, leading to regional disparity.</li> </ul>
Wang, C., et al. (2020). Railway and road infrastructure in the Belt and Road Initiative countries: Estimating the impact of transport infrastructure on economic growth.	[115]	BR	s	<ul style="list-style-type: none"> <li>From the perspective of <b>financial sustainability</b>, the large projects will <b>raise the risk of debt distress</b> and may expand debt to unsustainable levels in several BRI borrower countries.</li> </ul>
Yang, Y., and Fan, M. (2019). Analysis of the spatial-temporal differences and fairness of the regional energy ecological footprint of the Silk Road Economic Belt (China Section)	[210]	C	e	<ul style="list-style-type: none"> <li>Maintaining the spatial equilibrium between the <b>ecological environment</b> and <b>economic growth</b> is the basis for the sustainable development of a region.</li> </ul>

Table A1. Cont.

Article	Citation	Scale	Method	Statements on Sustainable Development Color Coding: Blue—Economic, Green—Environmental, Orange—Social, Grey—Political Issues
Yang, Z., and Zeng, X. (2019). Envisioning the Impact of the Belt and Road Initiative on Regional Labor Markets	[166]	C	d	<ul style="list-style-type: none"> <li>As a major commitment of the initiative, <b>investment and trade</b> are predicted to attract ample attention, which may create the potential for regional cooperation and development, especially in parts that were relatively forgotten in the previous round of <b>economic globalization</b>, such as central Asia.</li> <li>the BRI is a <b>way for China to sustain its economic growth</b>, by exploring new forms of international economic cooperation with new partners, bringing with it new opportunities for relatively less developed regions; for instance, western China.</li> <li>when the western regions <b>change the industrial structure through import and export trade</b> and introduce more <b>labor into the local market</b>, the <b>local labor structure changes</b>, and thus generates a force for regional development.</li> </ul>
Yin, W. (2019). Integrating Sustainable Development Goals into the Belt and Road Initiative: Would It Be a New Model for Green and Sustainable Investment?	[121]	BR	t	<ul style="list-style-type: none"> <li>International organisations and regional inter-government cooperative associations play a critical role in China's external effort to integrate SDGs into the BRI and <b>promote green and sustainable investment</b> along the BRI.</li> <li><b>Climate change is already having a significant impact</b>, especially on vulnerable countries and populations.</li> <li>the <b>national environmental protection consciousness of many countries is very strong</b>, which results from promoting the notion of environmental protection by the local media, civil societies, and non-governmental organisations (NGOs).</li> <li>This initiative aims to address the 'infrastructure gap', <b>promote mobilisation and efficient allocation of economic resources and deep integration of markets</b>, and encourage the countries along the BRI to coordinate their economic policy and deepen regional cooperation for the purpose of creating an open, inclusive, and balanced <b>regional social and economic cooperation</b> framework that benefits all.</li> <li>SDGs and BRI share consensus or notions in many respects, e.g., <b>sustainable investment, infrastructure development</b>, and cooperative mechanism; they are also mutually supportive of development agendas in certain areas.</li> <li>The <b>land expropriation problems</b> involved in construction project need to be communicated adequately with the local government and <b>people</b>.</li> <li>It requires aligning SDGs and the BRI firstly at the policy level, and integrating relevant projects into the national and local government development agendas.</li> </ul>
Zhang, Y., et al. (2019). Addressing the Insufficiencies of the Traditional Development Aid Model by Utilizing the One Belt, One Road Initiative to Sustain Development in Afghanistan	[161]	N	v	<ul style="list-style-type: none"> <li>It [Information Platform] <b>assists with investments</b> in Afghanistan that support the development of Afghan <b>private enterprises, improve local employment</b>, and <b>promote economic transformation</b></li> <li>The findings provide a better understanding of the BRI in promoting the internal dynamism required to develop the regional economy, and fill a gap in the literature with regard to the applied and theoretical economic growth models for stabilizing and sustaining the development of fragile and conflict-affected states.</li> </ul>
BR—Belt and Road Countries, O—Other, N—Countries, C—China, SN—Supranational, d—Data, e—economic and environmental modelling, s—spatial models, i—indexing and indicators, v—various.				

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## Article

# Reversing Uncontrolled and Unprofitable Urban Expansion in Africa through Special Economic Zones: An Evaluation of Ethiopian and Zambian Cases

Jiabo Xu  and Xingping Wang \* 

School of Architecture, Southeast University, Nanjing 210096, China; xu\_jiabo@sina.com

\* Correspondence: wxpsx@seu.edu.cn

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**Abstract:** Despite the growing attention on uncontrolled and unprofitable urban sprawling in many African countries, few pragmatic solutions have been raised or effectively implemented. While uncontrolled and unprofitable urban expansions happened primarily due to poor land use management and dysfunctional land market, the cost of land management enforcement and reform is high. This paper suggests that the recently re-emerging special economic zones (SEZs) in Africa could be a practical way of using government intervention to reduce uncontrolled urban expansion and optimize urban land use. By evaluating the spatial impacts of two SEZs on their host cities in Ethiopia and Zambia, this paper demonstrates that SEZs could notably change urban expansion in terms of its speed, direction, and spatial structure. By using SEZs as an experimental area for land policy reform, the government can also effectively unlock a profitable urban development model with the functional primary and secondary land market. However, the diverging results in Ethiopia and Zambia also show that the optimizing effect can be significant only when the government is participatory and can fulfil its public function, including delivering proper planning in advance, launching land policy reform, and even executing compulsory land acquisition for public interests.

**Keywords:** special economic zones; urban expansion; land management; spatial appreciation; entrepreneurial government

## 1. Introduction

By the end of 2018, there were over 400 million urban residents in Sub-Saharan Africa (SSA), which have been growing fast during the last three decades (the annual growth has been over 4 per cent, Appendix A). Accompanying the rapid population growth is a sharp increase in demand for urban land and construction. However, most African cities today are still suffering from ‘uncontrolled’ urban expansion, with spreading slums that lack any necessary facilities such as water or electricity (Appendix A). Worse still, a large amount of population growth will occur in uncontrolled urban slums [1]. A report by the UN-Habitat shows that most newly expanded residential areas during 1990–2014 in less developed countries (including most African countries) are ‘unplanned and disorderly’ [2]. As a result, newly developed areas in most African cities had produced few profits because there was no well-managed land market or fully-established regulation system that can reflect and protect the added value of the land during the urbanization process. Low incomes from uncontrolled and disorderly urban expansion contribute little to public revenue. Rapidly expanding African cities, with the governments possessing insufficient funding for infrastructure and urban renewal, are stuck in unplanned and unprofitable circumstances.

Scholars have estimated that by 2020, another two-thirds of African cities should be newly built to meet the demands of the urban population, which is expected to grow six times faster than in the

past century [3]. If previous uncontrolled and unprofitable urban expansion in SSA cities has been worrisome, continuous sprawling urban slums will be disastrous for the rapidly urbanizing continent during the next few decades. Seeing population explosion and rapid urban expansion, Africa has recently been the frontier of urban studies and policy experiments. African governments have both taken advice from international institutions and consultants, and explored localized solutions to urban problems. However, neither international prescriptions nor indigenous solutions have fundamentally changed the ubiquitous unplanned and unprofitable status of SSA urban land use.

On the one hand, those comprehensive plans aiming to utterly eliminate all indecent urban compositions are often too complicated and too expensive to be implemented in SSA cities. Uncontrolled slums continued acting as the (only) affordable way of urban expansion. As Cain criticized, large-scale citywide projects in many African cities, ‘demonstrating some of the most progressive theories of the day in urban design’, often turned out to be ‘expensive mistakes’. They ‘create a debt burden and drain investment from more sustainable economic and social projects’ [4]. Most citywide master plans, though depicting a fascinating future for African cities, have provided a very long to-do list and are thus economically unrealistic. In addition, plans requiring a large amount of urban renewal and land requisition are often frustrated by traditional land ownership and illegal land occupation. African cities need to unlock a relatively low-cost and feasible development approach that can start a controlled and profitable urban expansion process.

Recently, the boom in the construction of special economic zones (SEZs) in African countries triggered by China-Africa cooperation has provided an excellent opportunity to explore a new urban development approach [5]. SEZs, according to Farole, are ‘demarcated geographic areas contained within a country’s national boundaries, where the rules of business are different from those that prevail in the national territory’ [6]. Although SEZs are usually launched to implement industrial policies [7–9] and are not primarily used as a spatial development strategy, the Chinese experience with SEZ development shows that SEZs are also crucial spatial strategies. SEZs—As new urban spaces—And their attributes as pilot areas for policy reform can help the government to optimize the urban spatial structure and to explore new land use and management approaches. In the meantime, realizing that urban expanding strategies must be optimized, but previous polished and sophisticated plans have been ‘too complicated and too costly to be deployed’ in developing countries, scholars have called for a simplified planning approach. The approach, instead of delivering everything, focuses on establishing a framework and securing public goods for undeveloped areas [10]. The kernel of the simplified approach is to apply the limited development resources available to the momentous and decisive issues that would fundamentally determine the quality of urban expansion, which is pragmatic and feasible for developing countries with minimal capacity and funds. From this perspective, SEZs, with their relatively concentrated spatial pattern and specialized functions, can be taken as a simplified planning and constructing approach.

The purpose of this study is to evaluate the extent to which SEZs as a simplified and focused planning and developing strategy can be used to avoid disorderly and unprofitable urban sprawl in African cities. The study attempts to explore the spatial policy attributes of SEZs in addition to promoting economic and industrial development. While most African countries are currently facing severe challenges in urban development, China-Africa cooperation drives the construction of SEZs. This study, based on the evaluation of the practical results of two of the earliest China-Africa cooperation SEZs built in Ethiopia and Zambia, will help governments to learn from China’s zone experience in multiple dimensions. In the meantime, by comparing the development effects of the two SEZs, the study identifies which government policies and actions can help SEZs to play an active role in optimizing the urban spatial structure and enhancing the management of land use.

## **2. Literature**

SEZs can create new jobs, attract foreign investment, facilitate industrialization, help an economy to establish the necessary connection with the world economy, and act as the pilot areas for new

policies [11–13]. The African Economic Outlook (2019) by the African Development Bank explicitly indicates that establishing SEZs can alleviate the restricts of doing business due to the lack of infrastructure and can help companies to join in and survive in the African market [14]. The success of an SEZ depends on both hardware and software, which should be provided by the government. Complete infrastructure, suitable location, competitive labor, and business-friendly policies that are particularly supportive of specific industries, are usually thought to be the essential elements for successful SEZs [15–18]. Studies on a few successful African SEZs (Appendix A) highlight the importance of a developmental state (or an active government) for the success of a SEZ [19,20]. The Chinese and Singaporean SEZ experiences have fully demonstrated the government's key role in creating an innovation- and business-friendly environment, which enhances the positive effects of SEZ development [16,17,21]. A study on Russian industrial clusters also reveals that the government is crucial in establishing 'an enabling business environment' by 'providing timely funding, building personal relationships among participants and potential investors, and providing political guarantees [22]. From the perspective of the definition of an SEZ, the concept of 'speciality' is fundamental to the very existence of an SEZ. Otherwise, an SEZ will be no different from common urban spaces. The government, which creates speciality, thus has always been key to the development and operation of a SEZ. SEZs are, therefore, typical government-led development projects. The government's decision-making and related actions directly determine the development efficiency of the SEZ and its ultimate success or failure.

In addition to the widely studied economic impact, this study focuses in particular on the impact of SEZs on urban spatial expansion. Studies on the relationship between SEZs and urban spaces, especially countless studies on China's SEZ experience, indicate that recent SEZs tend to spatially integrate with nearby cities instead of being an enclave that can be observed in most early SEZs [23–25]. Studies on recent African SEZs still concentrated primarily on their economic dimension. A few of these studies have involved spatial features, such as the internal spatial structure of SEZs [26,27] and the relationship between SEZs and regional spatial development [28]. Tang emphasizes the importance of the integration of zones and cities by presenting the development of the Egyptian Suez SEZ [29]. Pieces of evidence have shown that the government plays a crucial role in coordinating zones and cities because no other actors can have both authority and mobilization ability as the government has (albeit the government sometimes is also thought to be incapable in one way or another).

Generally, the government is indispensable in promoting the quality of urban expansion by constructing SEZs for three reasons. Firstly, urban planning and construction are public issues. The change in land use and resulting impacts on people's lives during the process are usually accompanied by significant investments, as well as various conflicts. Governments are essential in ensuring high-quality urban development, as the market is not omnipotent. There are always public purposes that need public departments to serve. Even a long time ago, the very existence of a city depended on public departments to provide public goods, such as defense, roads, and a water supply system. In order to properly serve public purposes, governments need planning. The inter-dependence of different public actions, the indivisibility of certain events and their irreversible results, and imperfect information necessitate prudent planning to secure public interests [30]. However, the significance of the government not just matters in formulating planning, but also in fulfilling public responsibilities that otherwise cannot be accomplished by other actors.

The second reason is that most SEZs—as new urban spaces—are located at the peri-urban areas where urban and rural, state-owned, and customary/private land are often mixed. The conversion of land from rural to urban use, from customary/private to national, or just from one owner to another, which usually involves complex and diverse land tenure, redefines the people-land relationship and relations of production and is thus full of uncertainty and disputes [31,32]. The government thus has the responsibility enabled by the public authority to coordinate those potential contradictions.

Additionally, the establishment of an SEZ in a suitable position gives the market a signal of an emerging area. As Lefebvre indicates, technical progress enabled people to explore almost anywhere

and therefore space scarcity only makes sense in limited places—Those constituent centers and the spaces around them [33]. The investment in infrastructure and growing economic activities create new centrality, which could contribute to the agglomeration of people and industries and further to increasing land value addition. However, the centrality needs to be shown and ensured by an authoritative spatial plan, since the uncertainty and conflicting land-use might severely devalue a piece of land in terms of both use and exchange. The government, therefore, should release an integrated spatial plan in advance, showing the designated land use and ensuring that the plan should not be changed or circumscribed without a convincing reason based on public interests.

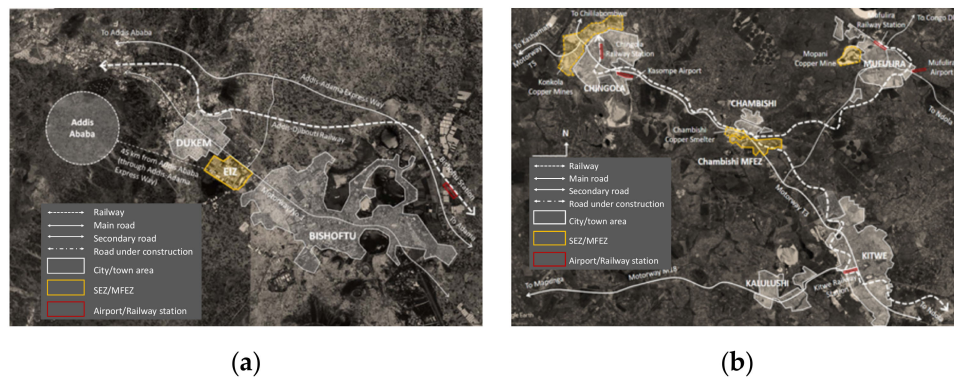
The government, in this context, can be understood as an enterprise managing space. They ‘make profits by providing public goods’ [34], namely infrastructures and policies in SEZ cases. SEZs (even the private ones as long as they enjoy government policies) are public goods provided by the government in a market economy to make profits and promote the quality of urban development. The products—SEZs—can be ‘produced and consumed’ in two ways: (1) the government directly constructs an SEZ by adding infrastructure and other facilities to a piece of land, and sells/rents the space to investors, or (2) the government sells a piece of land to a developer (usually at a low price) and urges the developer to deliver all the necessary facilities. For both options, the goal of the government is to maximize the (public) profit of SEZs. To achieve controlled and profitable urban expansion, the government thus needs a feasible ‘business model’ that enables the smooth ‘production and consumption’ of SEZs so that the land can be used in the designated way. The whole process calls for suitable and integrative spatial plans in advance and government capacity to execute relevant plans, laws and policies.

### 3. Materials and Methods

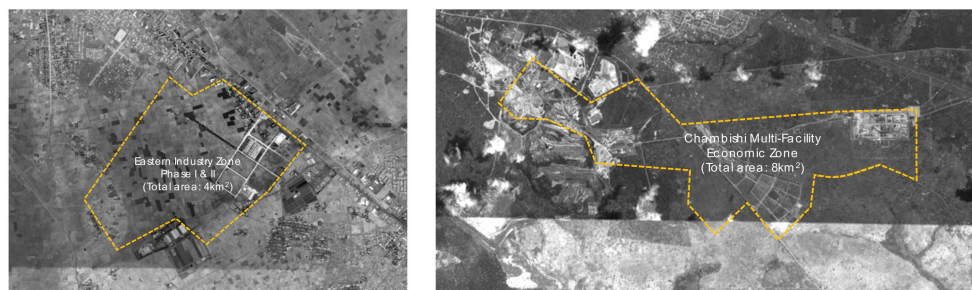
In 2006, the Chinese government announced at the 3rd Forum on China-Africa Cooperation (FOCAC) to cooperate with African countries to build 3–5 SEZs. Since then, a large number of Chinese companies have invested in Africa or have participated in the construction of SEZs in Africa. China’s support for the cooperative zones and growing investment in Africa’s manufacturing have launched a new wave of SEZ development in Africa. By 2018, at least 32 African countries have established about 237 new SEZs (most of them were established after 2015) [35]. The two cases in this study—The Eastern Industry Zone (EIZ) in Ethiopia and Chambishi Multi-Facility Economic Zone (MFEZ) in Zambia, established in late 2006, are the two earliest zones of this new wave and are more comparable among the six earliest cooperation zones established in 2006 (Appendix A). The Eastern Industry Zone is located between the small town of Dukem and the relatively big town of Bishoftu). According to the Ethiopian census, the two towns had about 100,000 residents in total in 2007. The Chambishi MFEZ is adjacent to the small mining town Chambishi, which had a population of less than 50,000 in 2010 according to the Zambian central statistics office. Around the MFEZ and Chambishi town, there are several populated towns and cities in the Copperbelt region (Figure 1a,b and Figure 2a,b).

Land use information such as appearances, night lights, and spectral features, has been widely used in previous research to reflect the characteristics of urban expansion visually [36–38]. In order to evaluate the extent to which SEZs can change the current uncontrolled and unprofitable urban expansion in the cities where they locate, this study also uses several land-use indicators to depict this impact. The evaluation has been launched based on the land use data collected through field surveys in 2016 and 2018, and the historical images from Google Earth (Appendix A) since 2000. While the construction speed of different projects using various technologies varies a lot in different countries (Appendix A), the division of monitoring period can be tricky. The period should be both short enough to present the structural change of space by stages and long enough to cover the construction period of average-sized projects. The two SEZs involved in this study were established at the end of 2006. Given the available land use information and the average construction speed in Ethiopia and Zambia,

land use in four individual years (2000, 2006, 2012, and 2018) were finally selected to monitor the spatial change.



**Figure 1.** Location of the two Special Economic Zones. (a) Eastern Industry Zone (EIZ); (b) Chambishi Multi-Facility Economic Zone (MFEZ).



**Figure 2.** Construction in the two SEZs. (a) EIZ; (b) Chambishi MFEZ.

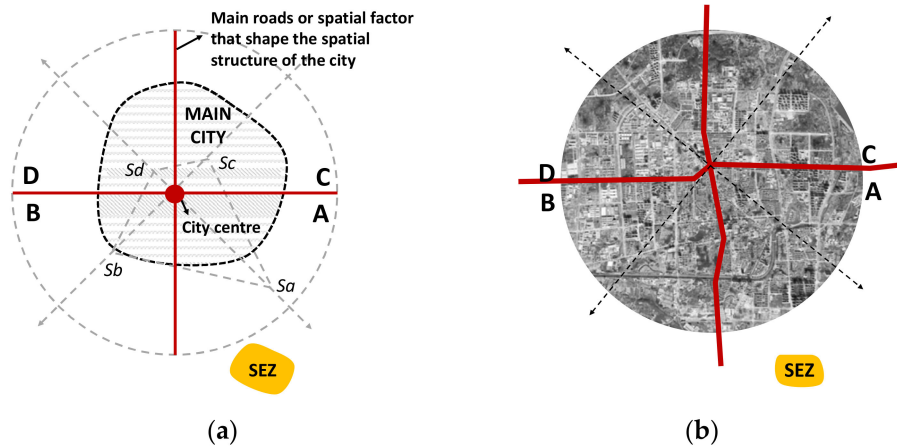
For all built-up areas within the research scope (Appendix A), this study focused on two aspects related to urban expansion and land use management. The first is its economic feature, reflecting whether urban expansion is accompanied by employment growth. All built-up areas were divided into ‘job-intensive’ (such as factories, shopping centers) and ‘non-job-intensive’ (mainly residential areas and schools, as well as a small number of blocks that cannot be identified). The second is the spatial characteristic, which reflects whether the newly expanded area is constructed following a specific spatial plan. A plot is defined as ‘planned’ if it is constructed in accordance with a specific road network (even if the road itself has not yet been built), or ‘unplanned’ if not.

Based on the classification above, the speed and spatial pattern of urban expansion before and after SEZ construction are quantitatively depicted with three indicators. The first indicator was defined as the ‘planning proportion (PP)’ of urban expansion—The ratio of the area of planned plots to the total area of newly expanded plots. It measures the changes in the control level of construction in the area before and after the implementation of SEZs, i.e., whether urban expansion happens more in ‘a planned way’. The PP value was calculated as follows:

$$PP_n = S_{Pn}/S_n \quad (1)$$

where  $S_{Pn}$  refers to the area of planned plots and  $S_n$  refers to the area of total expansion in a certain monitoring period. The second and third indicators were defined as the “concentration index (CI)” and “primacy index (PI)” of urban spatial expansion. The most prominent spatial representation of uncontrolled urban sprawl is disorderly construction in all directions. The two indicators—The concentration index and primacy index therefore together reflect the extent to which the construction of SEZs has changed the original uncontrolled expansion of the cities, i.e., whether urban expansion happens more in ‘a concentrated way’, especially more in ‘an SEZ-leading way’. Dividing built urban

spaces into concentric sectors and evaluating the spatial feature in each sector were used as an effective method to analyze the characteristics of urban expansion in different directions [39]. According to the structural characteristics of the city where the zone is located, the built-up area of the city was divided into four dimensions by main roads or other essential spatial elements (such as rivers, railways, and main roads). The four spatial dimensions were named as A–D dimensions based on their spatial distance from the SEZ (A is the nearest, D is the farthest) (Figure 3a,b).



**Figure 3.** Assessing the spatial impact of an SEZ: (a) How to divide and name the built-up area of a city; (b) An example.

The ‘concentration index’ reflects the degree of concentration of spatial expansion in a specific dimension. It is the standardized variance of the expanded area per period in each sector: the larger the CI value (variance), the more significant the difference between the expansion areas of each sector—The spatial expansion is relatively more concentrated in one (or two) sector(s). The ‘primacy index’ reflects how significant the spatial expansion is in the dimension of the SEZ compared to other dimensions. It is the ratio of the expansion rate of the zone area (dimension A) to the most considerable expansion rate of the left three. The two indicators were thus calculated as follows:

$$CI_{n+1} = \text{Sta.} \frac{\sum_{i=a}^n \left[ \left( \frac{S_{i,n+1}}{S_{i,n}} - 1 \right) - \left( \frac{S_{n+1}}{S_n} - 1 \right) \right]^2}{4} \quad (n = a, b, c, d) \quad (2)$$

$$PI_{n+1} = \left( \frac{S_{a,n+1}}{S_{a,n}} - 1 \right) \left/ \left( \frac{S_{\max(b, c, d)_{n+1}}}{S_{\max(b, c, d)_n}} - 1 \right) \right. \quad (3)$$

where  $CI_{n+1}$  is the standardized variance of the growth rate of expanded area (within a continuous built-up area) in each dimension ( $S_i$ ) in a particular base year ( $n + 1$ ), and  $S_i$  is the average of the area of spatial expansion in four dimensions.  $S_{a,n}$  is the expanded area in dimension A, and  $S_{\max(b, c, d)}$  stands for the most massive expansion in the rest three dimensions. In the meantime, it is quite common to continuously calculate the gravity center of the built-up area of a city to monitor the general change of the direction of urban expansion [40]. Here two similar spatial analysis tools (which can be automatically executed by ArcGIS) were additionally used to shape the overall spatial impact of SEZs on maps. The first one is the standard deviational ellipse reflecting the directional distribution of newly constructed blocks (the shorter the two axes, the more concentrated the spatial expansion is). The second one is the mean center of these new blocks, which can be recognized as the spatial center of urban expansion (the closer the center is to the SEZ, the stronger the zone’s impact on urban expansion is) (Appendix A).

In order to understand the reason why SEZs projects have produced corresponding spatial impacts on nearby cities, this study analyzed the spatially related policies, laws, and plans of the two

countries and the specific regions (cities) collected through field research and online retrieval. Also, this study, as a part of a broader research project, involved interviews with participants related to SEZ and urban development in Ethiopia and Zambia (including policy-makers/directors of urban planning/construction department, land management department and other land-/SEZ-related public departments, SEZ developers/developing companies, and SEZ investors/tenants). The interviews were conducted through two field surveys in 2016 and 2018, respectively, and lasted about 50 days in total (some supplementary interviews were conducted online in 2018 and 2019). More than 80 interviewees from 42 institutions participated in the semi-structured interviews (Table 1). The interviews mainly focused on the logic in the decision-making process of site selection and investment, the relationship between different participants, and the corresponding impact on the construction of SEZs and urban expansion. We analyzed the dominant factors considered by different participants when making decisions related to spatial construction. Notably, we assessed the role of the government in this process and the influence of their actions on other participants' decisions.

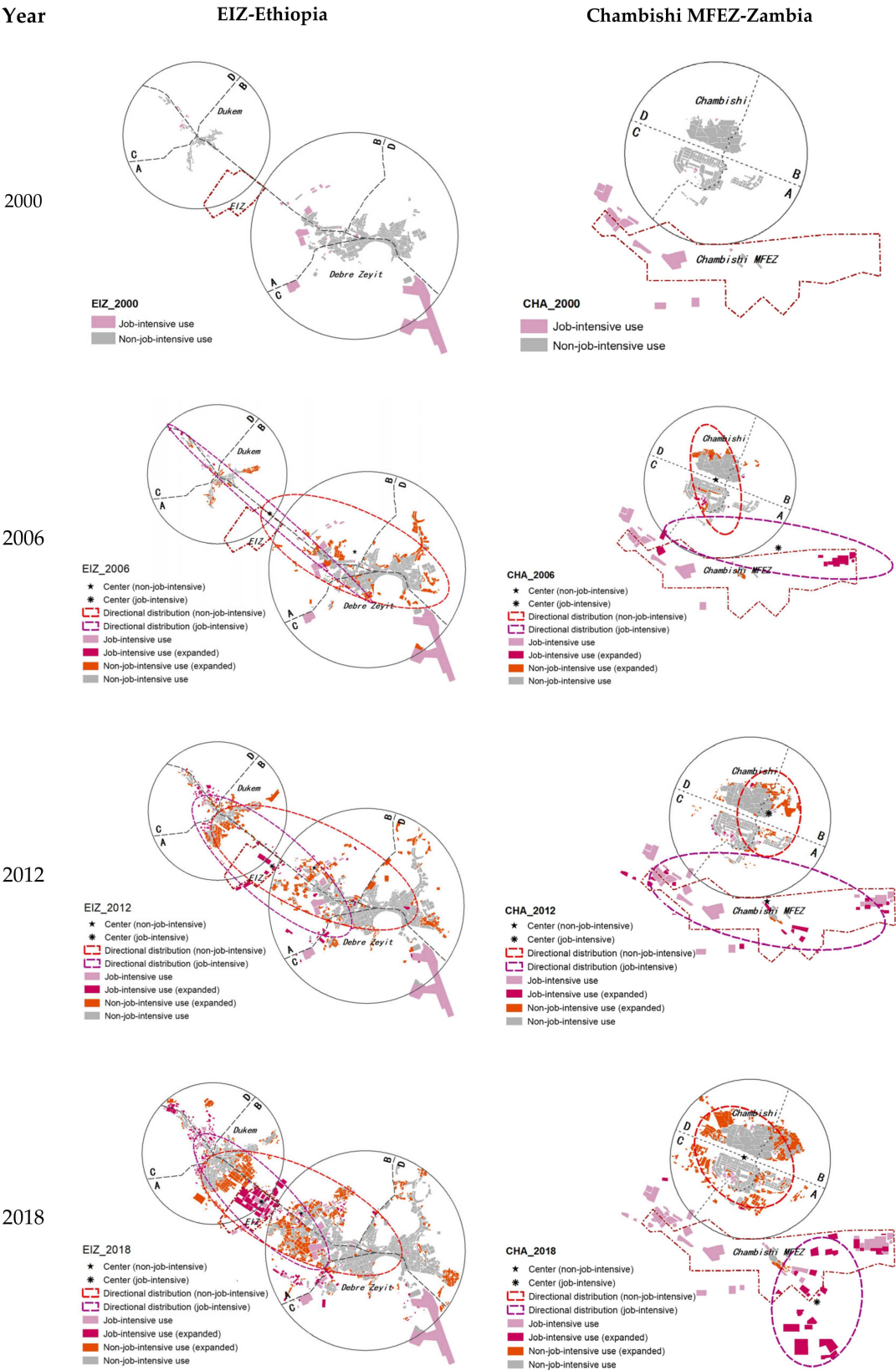
**Table 1.** Institutions and interviewees involved in the study.

Country	Institutions	Interviewees	Time
Ethiopia	28	56	2016/2018/2019
Zambia	14	25	2018/2019

#### 4. Results

Generally, all indicators reflected the fact that EIZ and the Chambishi MFEZ have both remarkably changed the original spatial expansion of the cities where the zones are located, in terms of speed, direction, function, structure, and concentration (Figure 4). However, the two zones have 'improved' the quality of spatial expansion to different extents, and the impact on local spatial appreciation has also been very different. As far as the indicators used in this study have shown, the 'positive' effects of EIZ are more significant than those of the Chambishi MFEZ.





**Figure 4.** Urban expansion before and after the SEZs were established.



#### 4.1. Spatial Expansion before and after SEZ Projects

In the Ethiopian EIZ case, especially after the zone's operation in 2009, the zone has significantly changed the spatial expansion of the two cities—Dukem and Bishoftu. The spatial expansion rate shows that both cities have expanded more rapidly after the EIZ developer started the zone construction. Between 2000 and 2006, the two cities have expanded by a third. During the latter two periods, the two cities expanded more than a half in each period. In 2018, the built area (excluding EIZ) of Dukem and Bishoftu has more than doubled compared to that in 2006 (Table 2).

**Table 2.** Expanding rate of the built-up area in the EIZ case.

Items	Period A: 2000–2006	Period B: 2007–2012	Period C: 2013–2018
Total expansion rate (%)	34.4	46.5	52.0
Zone (expansion rate %)	-	-	524.2
Cities (expansion rate %)	34.4	44.6	46.1
Job-intensive use (expansion rate %)	2.8	30.8	58.5
Non-job-intensive use (expansion rate %)	55.8	53.5	49.5
Job-intensive use (of total expansion)	3.3	20.4	30.9
<i>The percentage of the zone's contribution to newly expanded job-intensive use</i>	0	20.0	40.0 <sup>1</sup>

<sup>1</sup> Phase I of the EIZ was fully occupied by 2018. The proportion of EIZ-produced job-intensive use of the land during period C perhaps would be higher if there were extra land in the EIZ.

Moreover, the EIZ has profoundly changed the composition of expanded urban land use. Before the zone was established, there was little increase in local employment: job-intensive land use in the two cities increased by merely 2.8 per cent from 2000 to 2006, and only 3.3 per cent of the newly expanded urban area actively produced jobs. After 2007, as the EIZ was attracting industrial activities to the area, job-intensive use of land started expanding at a faster pace, with 30.8 and 58.5 per cent growth rates during period B and period C, respectively. The percentage of job-intensive areas has remarkably increased (from 20.4 to 30.9 per cent). In the meantime, the significance of the EIZ in providing industrial spaces has been rising. The zone contributed 40.0 per cent of job-intensive land use between 2013 and 2018, compared to only 20.0 per cent in the previous period, which shows the increasing attractiveness of EIZ for industrial activities.

In Chambishi, the town has expanded at a similar pace with the MFEZ. After the MFEZ was established in 2006, the spatial expansion of Chambishi town significantly accelerated. As the number of companies in the zone was increasing, more residents have been attracted to the area. From 2012 to 2018, the built area of Chambishi town saw a 76.8 per cent expansion (Table 3). Due to poor economic diversification, Chambishi town has seen little industrial development during a time when the copper industry weakened. Since the CCS started operation in 1998, the company has been the sole job provider in the region. From 2000 to 2006, the increase in job-intensive use of Chambishi town was negligible (merely 2.1 per cent, excluding the usage provided by a subsidiary of the MFEZ developer).

While the zone was growing, it remained the primary area for industrial agglomeration. However, its dominance as the only industrial area kept decreasing (although the MFEZ is far from being fully occupied). During period B and C, total job-intensive land use in the region expanded by 31.5 and 71.0 per cent. However, the MFEZ contribution decreased to 38.8 per cent in the latter period from 65.4 per cent in the former. The declining dominance of the Chambishi MFEZ as the primary industrial area, on the one hand, shows that the zone has stimulated broader industrial development in the region. On the other hand, it also shows that the MFEZ has no absolute advantage in attracting businesses compared to the region outside. The dilemma reflects a lack of 'speciality' of the MFEZ in attracting business, which can be clearly observed in the EIZ case.

**Table 3.** Expanding rate of the built-up area in the Chambishi MFEZ case.

Items	Period A: 2000–2006 <sup>1</sup>	Period B: 2007–2012	Period C: 2013–2018
Total	26.1	27.3	69.8
Zone (expansion rate %)	80.5	36.6	47.1
Cities (expansion rate %)	15.2	24.5	76.8
Job-intensive use (expansion rate %)	48.4	31.5	71.0
Non-job-intensive use (expansion rate %)	15.2	24.6	69.0
Job-intensive use (of total expansion)	60.9	44.6	40.6
The percentage of the zone's contribution to newly expanded job-intensive use	77.0	65.4	38.8

<sup>1</sup> A subsidiary of the zone developer—A refining company—was set up in the zone area during this period.

#### 4.2. Planning Proportion of Expanded Area before and after SEZ Projects

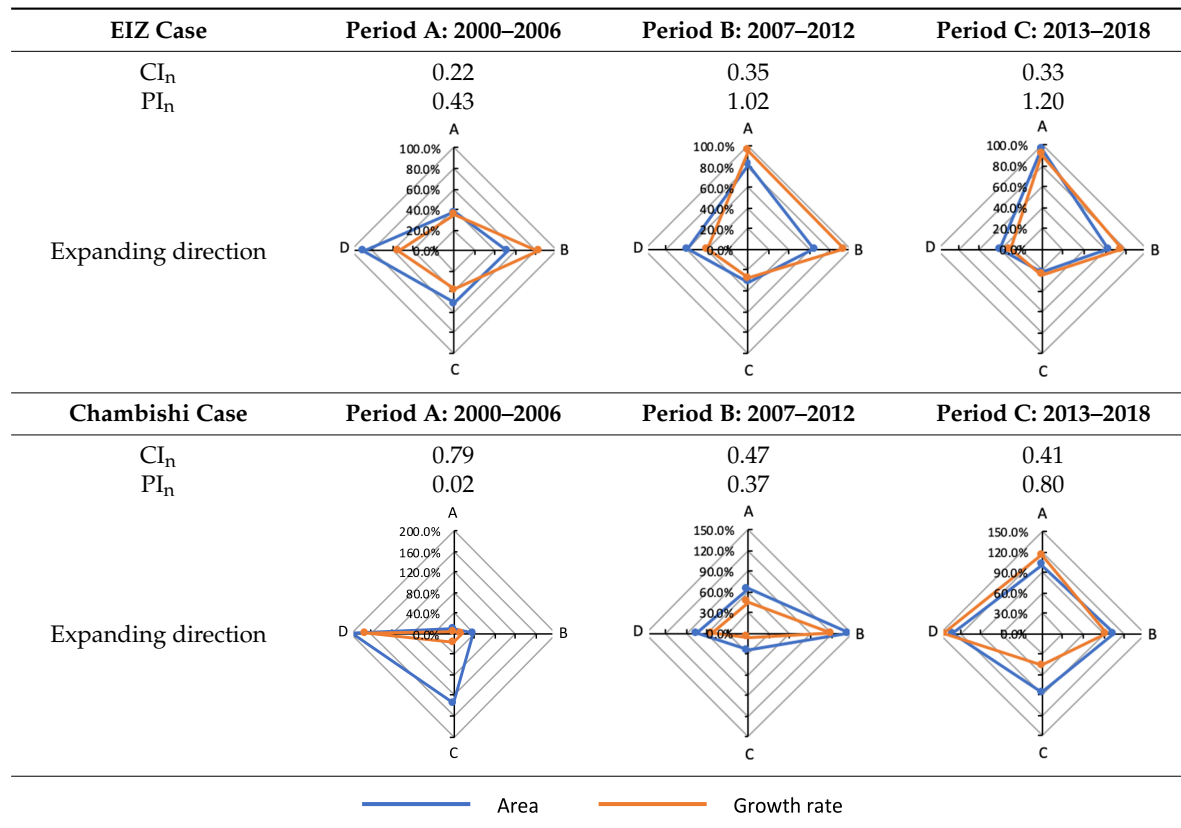
Since the construction of the SEZs has significantly changed the overall construction activity of the region and has had a particular impact on planning and land use management, the planning proportion underwent significant changes before and after the construction of the two zones. In the EIZ case, the overall planning proportion index of the newly expanded area increased from 0.28 in the first period to 0.52 in the third, with a large part of newly expanded areas following a specific layout of the road network (though in many areas the roads have not been constructed yet). In the Chambishi case, however, the overall planning proportion of urban expansion kept decreasing. In period A, the index was as high as 0.70, since a new refining company CCS was the main project of the region, and few construction activities had been carried out outside the zone. While the growth of the MFEZ attracted more residents and investors, the government was not able to enforce land management in time. As a result, the overall planning proportion of urban expansion dropped to 0.45 in period C, although the planning proportion outside the zone slightly increased to 0.28 (rapidly increasing numbers of squatters within the zone have significantly reduced the PP index) (Table 4). The effects above, however, cannot be isolated as zone effects without more ‘zone-related’ indices.

**Table 4.** Planning Proportion of newly expanded areas in the two cases.

SEZs	Items	Period A: 2000–2006	Period B: 2007–2012	Period C: 2013–2018
EIZ	PP <sub>n</sub> —Overall	0.28	0.38	0.52
	PP <sub>n</sub> —Outside the zone	0.28	0.35	0.45
Chambishi MFEZ	PP <sub>n</sub> —Overall	0.70	0.54	0.45
	PP <sub>n</sub> —Outside the zone	0.16	0.24	0.28

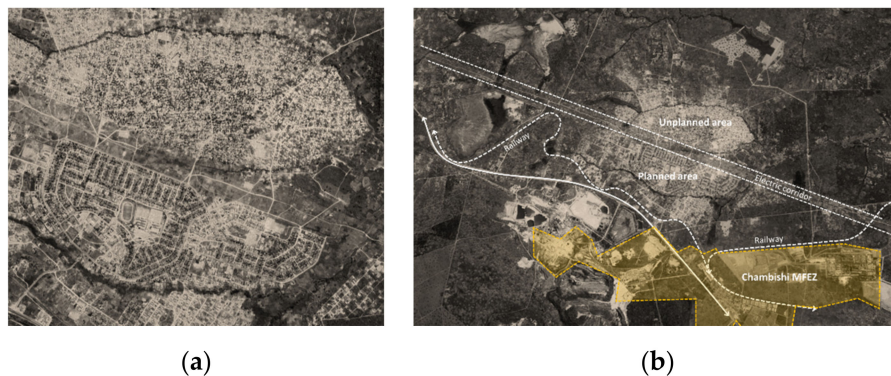
#### 4.3. Specific Spatial Impact of SEZs

Before the EIZ was created, new construction projects in Dukem and Bishoftu were mainly local farmers’ self-built houses to meet their family use. At this stage, construction activities, as the standard deviational ellipses show (especially the industrial ellipse which is dramatically shrinking towards the EIZ) (Figure 4), were somewhat scattered. No external incentives or intentions were shaping urban expansion. As EIZ was growing, spatial expansion was reshaped. The concentration index of newly expanded areas increased from 0.22 to 0.33, showing a generally more concentrated urban expansion. As the primacy index has shown, the zone area (dimension A) immediately became the main expanding direction, with the index rising from 0.43 to 1.20 during the monitoring periods (Table 5). Urban expansion to the three no-zone directions has significantly degraded compared to that in the zone-dominated direction. The mean centers of both job-intensive and non-job-intensive new areas kept approaching the EIZ, showing a more zone-directed expansion of cities.

**Table 5.** Concentration status of urban expansion in Dukem and Bishoftu.

Compared to urban expansion between 2000 and 2006 when self-built houses dominated construction activities, more industrial constructions sprung up in the region after EIZ was set up. Factories agglomerated in and around EIZ to benefit from the comparatively more complete public facilities, especially the power provision. In the meantime, housing construction has increased too. As agglomerating investors have provided thousands of jobs, labor influx from the remote rural area has fueled a massive demand for housing. Original residents in both Dukem and Bishoftu have taken a keen grasp of this opportunity and built a large number of houses for rent. Vigorously construction activities for the last decade converged the two initially separated cities together with the EIZ, creating a combined urban area—A new industrial city.

The Chambishi MFEZ, in contrast, has produced fewer directive spatial impacts than the EIZ. Enclosed by the electrical corridor in the north and railways in the south, the southern part of the Chambishi town has minimal space for future expansion (Figure 5a,b). As a result, the northern part of the town, without a spatial planning and proper infrastructure provision, has recently seen the most construction activities. Specifically, the concentration index has declined to 0.41 in period C, compared to 0.79 in period A, showing a more scattered and directionless urban expanding trend. In the meantime, the primacy index shows that the zone dimension has not been the main direction of urban expansion (partly because of the limited spaces in this dimension). Nevertheless, the index (increased dramatically from 0.02 to 0.80) shows that the zone has indeed attracted more people and industries to agglomerate. Unlike in Ethiopia, where the two separated cities have shown a clear trend to expand towards EIZ, the Chambishi case sees no such integration.



**Figure 5.** Spatial conditions of Chambishi: (a) Built-up area of the town; (b) Spatial limitations.

#### 4.4. Spatial Appreciation Stimulated by SEZs

In addition to the difference in direct spatial impacts, the two SEZs have also produced different effects on the local spatial appreciation. In 2007, the EIZ developer got the land use rights (for phase I) from the local government (the Oromia state government) at a price of only ETB 1 per square meter (USD 0.03/m<sup>2</sup>) as compensation with an extra ETB 1 per square meter each subsequent year as rent. After more than 10 years of development, Dukem and Bishoftu have significantly expanded, and their land prices have kept increasing. In 2018, when the EIZ developer decided to purchase the other piece of land reserved for phase II, the local government asked for a much higher price than that for the first phase. The developer finally got the land use rights for ETB 68 per square meter (USD 2.4/m<sup>2</sup>) as compensation and ETB 18 per square meter (USD 0.6/m<sup>2</sup>) as rent for each following year. This was a compromise for both sides after several rounds of negotiation but marked a major increase compared to the initial land price, which is beneficial for local governments. Urban expansion led by SEZ construction is becoming a profitable process.

In contrast, little spatial appreciation was observed in Chambishi after the MFEZ was set up. From 2007 to 2018, the land price in Chambishi barely increased. Even in Kitwe, the land price merely increased by ZMW 0.1 per square meter (USD 0.01/m<sup>2</sup>), which is negligible considering the magnitude of depreciation of the Zambian Kwacha. The massive investment in infrastructure in and outside the Chambishi MFEZ has produced little spatial value addition. The MFEZ developer has seen no increase in the rent, which is their primary income currently. The biggest beneficiary of spatial appreciation perhaps is the local farmers who have illegally occupied the undeveloped land of the SEZ by building houses and planting crops and asking for compensation from the zone developer. Due to the inadequate supervision of land use by the local government and the lack of enforcement for illegal land occupations, neither the government nor the zone developer have obtained spatial appreciation. Urban spatial expansion continued to be an uncontrolled and unprofitable process.

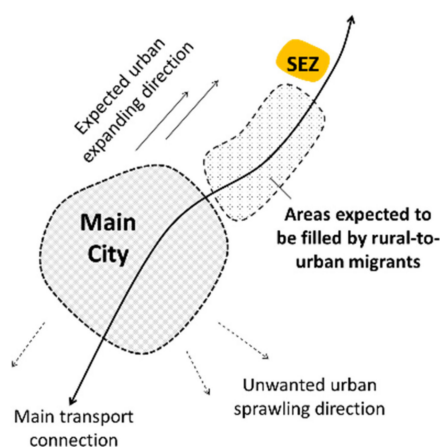
## 5. Discussion

The two SEZs, both learning from the Chinese SEZ experience, have produced diverging impacts on local spatial expansion and appreciation. The results are closely related to the local government's action and decision-making over planning and land use management when launching the SEZ projects. SEZs are typical government-led development projects. Therefore, in Ethiopia, where the government has more actively participated in zone development, the EIZ has had a more significant positive effect on urban spatial expansion and land use optimization and has generated more spatial appreciation than the Chambishi MFEZ. The development of the SEZ and the accumulation of urban capital, as well as the enhancement of local government's development capabilities, have formed a mutually reinforcing relationship in Ethiopia. In contrast, in Zambia, due to the lack of government participation, the SEZ development and urban spatial expansion were not strategically integrated. Correspondingly, spatial optimization or appreciation were not as remarkable as was observed in Ethiopia.

### 5.1. Intended Spatial Plan and Enforced Land Management in Ethiopian SEZs

The positive spatial effects of the EIZ first attributes to its advance spatial planning and suitable location. To maximize the positive spatial effect of SEZs to drive urban spatial expansion and population agglomeration, the Ethiopian government has drawn on China's SEZ planning experience and formulated a construction model of "SEZ + city + reserved development hinterland" (Figure 6). The primary goal of this construction model is to drive the orderly expansion of those secondary cities. Therefore, the SEZ sites are mostly located in the suburbs of the target secondary cities and have convenient transportation links with the cities. As the deputy CEO of Ethiopia's Industrial Park Development Corporation (IPDC) passionately explained with a sketch:

*When you build an industrial park here along the main road at a distance from the city, not too far, the industrial park will provide many jobs. People from a rural area will come and settle down here (drawing blocks in the middle area between the city and the park) ... Ten years, fifteen years later, you will get a big city. (Interview with the deputy CEO of the IPDC)*



**Figure 6.** How SEZs can promote secondary cities (IPDC).

Such a separated but not too remote position of the SEZ leaves a hinterland available for future rural-to-urban migrants between the zone and the city. In the meantime, future expanding spaces for both the zone and the city are available, so that the SEZ will not be at the center of the future 'big city', which is essential especially when the current city is comparatively small but has significant potential for future expansion. Securing future benefits from the hinterland, and avoiding adverse effects due to the irreversibility of massive spatial construction (such as possible spatial contradictions caused by excessive expansion of SEZs or cities), as previous research has demonstrated [30], is precisely the reason why the government needs to conduct planning. Also, by privileging the reserved hinterland through public service provisions, such as infrastructure, education and health facilities, and the like, unwanted and uncontrolled urban sprawl in other directions is supposed to be reduced. The EIZ has specifically played such a role by pre-considering the spatial relationship with surrounding cities and locating at a suitable site. As the manager of the zone stated:

*We locate the zone here because it is not far from the capital city (Addis Ababa) ... the site is relatively flat, which can reduce the cost of infrastructure ... it locates between Dukem and Bishoftu which means recruitment would not be a problem ... the newly built expressway from Addis Ababa to Adama (another important big city of Ethiopia) and the Addis-Djibouti railway pass by our zone (Interview with the manager of the EIZ)*

With such an elaborately selected location, the EIZ, during the urban expansion process, has acted as a spatial incentive—or put it in Lefebvre's words, has created 'centrality' [33]. EIZ attracted residents

and companies to settle around in the designated area and thus reduced uncontrolled and random urban expansion into other directions. Another study analyzing the spatial expansion of six towns in Ethiopian Oromia State also confirmed this phenomenon: all towns have expanded surrounding Addis Ababa except for Dukem [41] which, as displayed in the previous section, has expanded towards the EIZ.

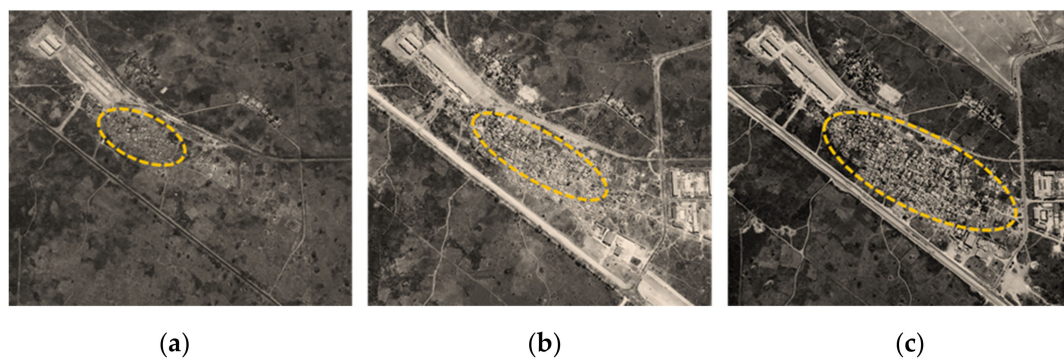
Like in many other African countries, illegal squatters prevail in Ethiopian cities. Compared to land acquisition, solving the problems of unplanned and illegal occupation of land is more challenging and controversial. Researchers indicate that ‘except in urban centers with master plans and zoning in effect, people in Ethiopia have been using the land, for far too long, in unplanned and uncontrolled fashion’ [42]. It is recorded that the land acquisition process usually lasts for several years in Ethiopia due to various disputes caused by unclear detailed land management policies [43]. In order to enforce land management and improve the efficiency of land use during the construction of SEZs, the Ethiopian government has played an active “executing and coordinating” role. When the EIZ was about to be launched in 2006, the federal government authorized the Oromia state government to complete the land acquisition process. This action has remarkably improved the efficiency of land acquisition (the EIZ developer obtained the full land-use right within a few months instead of several years) and reduced conflicts over the transaction of land ownership. Recently, to further improve the efficiency of SEZ development across the country, the Ethiopian government authorized IPDC in 2015 to exercise land acquisition rights and act as a land reserve institution with the cooperation of the eleven state/city governments.

More importantly, by executing land expropriation in advance and establishing a land reserve agency, the government has further capitalized the land and facilitated a more complete and formal land market. The IPDC—as the agent of the federal government that operates SEZs—is also able to optimize its business model by actively participating in land management. Both local governments (the Oromia state government and Dukem city government) and the zone developer can benefit from land appreciation in this model. Their redevelopment capacity has thus been enhanced, which enables them to further invest in infrastructure to improve investment conditions. In the meantime, growing rent stimulates the need for a secondary land market so that zone tenants can obtain the long-term land-use right to reduce rental costs and to enable the land to act as a considerable fixed asset for financing. In 2015, the Ethiopian federal government issued the first secondary land certificate in the EIZ, making the zone a pilot area for the secondary land market. The monopolization of the primary land market and the establishment of the secondary land market create a formalized and win-win land management system based on public-private cooperation. The virtuous circle of development and capital accumulation through SEZs thus starts.

## 5.2. *Copromised Land Management and Privately Captured Spatial Appreciation in Zambian SEZs*

While the significant positive spatial effect of the Ethiopian SEZs was attributed to an active government, the incapability of the Zambian government in land management has produced opposite effects. According to the Zambian Land Act (1995), the piece of planned and leased land within the Chambishi MFEZ is supposed to be protected against invasion. However, in practice, the expected protection from the government is often not in presence. Before the Chambishi MFEZ was established, a few houses stood around the old railway station at the central area of the planned MFEZ. The zone developer left those houses untouched, since they are not in the start-up area of the zone. However, when the zone was growing, local farmers moved into the zone and illegally built houses adjacent to the existing residential area. By 2018, the area has significantly expanded several times compared to the size in 2016 (Figure 7a–c). Some farmers even grew maize in the northern part of the zone where the land was still empty.





**Figure 7.** Increasing presence of ‘squatters’ within the Chambishi MFEZ: (a) 2006 (No Chambishi MFEZ); (b) 2012; (c) 2018.

As the construction of the second phase became imminent, the zone developer tried to persuade local farmers to move away from the land that they illegally occupied. The negotiation, however, failed and squatters claimed ten years’ compensation for ‘their’ maize and ‘their’ land. Since the zone developer has no administrative rights and does not want to have any confrontation with local people, it cannot and does not want to evict the squatters forcibly. The developer has instead turned to the local government for coordination. However, the ‘coordination’ did not work because the zone developer expected conformity with any existing law to occur (which requires compulsory acquisition, eviction, or demolition in illegal occupation areas). A local legislative committee asserted that the developer should compensate all the farmers in the zone, including those illegal squatters. This irrational coordination made the situation deadlocked until mid-2018 when a new policy required the developer to clear the land within two years or the current houses built by squatters will be recognized as legal property. Annoyed by this ‘absurd’ requirement, the developer complained to the Kalulushi government again. The intervention of the mayor of Kalulushi municipal finally ‘solved’ the problem at the price of the developer: the zone developing company needs to pay the ‘compensation’ (though slightly lower than what the legislative committee asked before) required by invaded farmers. Due to the lack of enforced land management, legally possessing the land use rights does not mean effectively avoiding the contradiction of land use, especially when a foreign company is involved. As the manager of the Chambishi MFEZ said:

*We know they are squatters. But what can we do? We don’t want tension with local people. We have more concerns (as a Chinese state-owned company). Every step and every decision must take into account the impact on the local community. We should always take care of whether a thing we did might hurt our national image. Without firm support from local government, it’s tough. (Interview with the manager of the Chambishi MFEZ)*

Illegal land occupation, as can be observed in other Zambian SEZs (as well as other developing projects), has become a significant obstacle for urban development because it has significantly reduced the efficiency and increased the cost. Not only did the government fail to protect the public interest in the process of urban construction as scholars pointed out [30], it also increased the uncertainty in the development process due to incapability. Aiming to ‘eliminate the growth of unplanned areas through the timely provision of shelter or serviced building plots’, Zambia’s new national land policy, however, offers no solution to existing invasions. The measures in the policy, such as ‘urging local authorities to raise funds for planning and surveying’, or ‘enabling systems for timely planning, surveying and servicing land for development in the urban fringe’ [44], are all soft measures to encourage planned land use rather than to forbid and eliminate unplanned land use. As a result, the hot potato issue of squatter eviction is left in the hands of investors—In the Chambishi MFEZ case, this was the zone developing company. With no legal right to evict any person or demolish any building, the zone developer has no choice but to count on the (incapable) government to ‘protect’ them from invasion.

Under such compromised forms of land use management, “usufruct” has gradually evolved into a land-use tradition which is “occupation equals to (makes) legal possession”. With this occupation-made possession, illegal land occupation is becoming more and more popular. The boundary between (actual) occupation and (legal) land possession is completely blurred, making illegal occupation normalized or even legalized, which further impedes land acquisition and reduces the efficiency of development and construction projects, including SEZs. Neither the local government nor the zone developer has obtained economic benefits from the significant investment of the SEZ. On the contrary, squatters have enjoyed extra profits by claiming ‘illegal’ compensation. Conflicts caused by land transactions, as has been observed by previous research [31,32], extended chaotic urban expansion and compromised public interests (SEZ development and orderly urban expansion in this case) in a lack of enforced land management system.

### *5.3. The Role of Government in Controlled and Profitable Urban Expansion within an SEZ Framework*

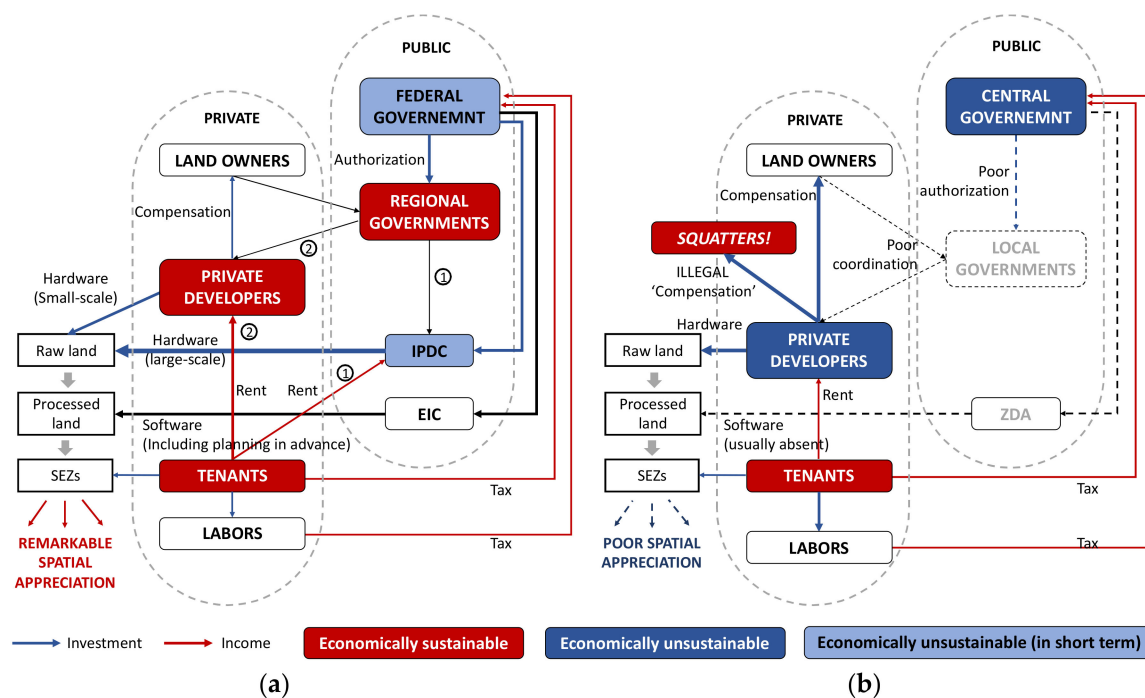
Uncontrolled and scattered spatial expansion are representations of absence or failure of the implementation of planning intentions. It shows a social form where government authority is weak in urbanization field. Put it in Schafran’s theory, a ‘control sector’ is underdeveloped, and the economies of urbanization are disconnected to social reproduction [45]. This disconnection leads to weaker government control in urban development as the revenue from the betterment of public service cannot be channeled without a properly designed system. This series of negative features means that the government, as ‘an enterprise managing space’ [34], has failed its business.

The creation of SEZs in this sense can create spatial incentives and enforce control first in a specific area—Creating centrality and corresponding spatial scarcity [33]. For African governments (as well as governments in other developing countries), using SEZs as a way of government intervention and a simplified planning approach [10] to optimize urban land use is practical. However, to reverse uncontrolled and unprofitable urban expansion through SEZs depends on whether the government can fulfil its function during the zone development process.

By delivering a suitable spatial plan and providing hardware and software through two public agents—IPDC and EIC (in charge of the hardware and software for SEZs respectively), Ethiopian federal and regional governments actively participated in SEZ development. The government, instead of the zone developer, deals with disputes and contradictions over land use, while SEZs are fully integrated with public urban development plans. SEZs proliferate with firm support from the government and in turn have produced significant economic profits in terms of rent, tax, and spatial appreciation, which return to the developer and the government (Figure 8a). The development ability of the government and its designator (though economically unsustainable for the short term) can be continuously enhanced during the process. It is possible to say that by actively producing public goods—SEZs—the Ethiopian government is making itself a successful entrepreneurial government. Although this enterprise, as Zhao indicates [34], cannot be assessed only by its claimed goals and principals but by its efficiency of input and output, the Ethiopian government’s products—SEZs are indeed reversing urban expansion in a more controlled and profitable way.

The Zambian government (especially the local government), however, has been absent from the zone development process. Even the designator of the central government—The Zambian Development Agency, which is supposed to be the leading supporter of SEZ development, is powerless. Due to the lack of necessary support from the government, zone developers are struggled to make profits, and SEZ development has been sluggish. SEZs and cities are separated, and spatial appreciation is negligible. The economic output of the SEZ is thus limited to the single aspect of taxation (Figure 8b). While the zone developer is economically unsustainable, the government remains incapable of delivering public goods and promoting the quality of urban expansion. The Zambian government (both central and local) is an absent administrator/coordinator rather than a participator/manager in its SEZs ‘business’. It is not surprising that the whole business model of Zambian SEZs is unsustainable and expected beneficiary participators have struggled to survive.





**Figure 8.** SEZ 'business models': (a) Ethiopia; (b) Zambia. (Source: Compiled and depicted by the authors according to the interviews with relevant participants).

## 6. Conclusions

Uncontrolled and scattered urban expansion has imposed significant pressure on many African governments seeking to meet the demand for public service and infrastructure. The resulted stagnated cities have severely weakened the economies of urbanization. This study has shown that by developing SEZs, the government can experiment with a new land management approach and create spatial incentives to optimize urban land use. The extent, to which SEZs can produce such positive effects, however, depends highly on whether the government can deliver an advance spatial plan and effectively enforce land management.

With an advance spatial planning, the authority over land management and the commitment to ensuring the priority of land provision to public projects (such as SEZs), the government can produce spatial incentives—The centrality of a specific space. With such spatial incentives, the government can stimulate urban expansion in specific directions, and in turn, benefit from orderly urban expansion and significant land value addition. For many African countries where uncontrolled and unprofitable urban spatial expansion prevails, the budget for urban development is also limited. While dual land tenure system or even informal and illegal land tenure has been a big challenge for orderly and profitable urban expansion, SEZs, as this paper has shown, provide a chance to reverse this gradually. By creating SEZs within specific boundaries, the government can unlock broader promotion and formalization of urban expansion and bring urban land use on a more productive and profitable way.

There are some limitations to this study. First, there are some unavoidable deviations in the assessment of spatial expansion because the land use might be misidentified and the accurate blueprints of the relevant cities were usually unavailable (some planning were still under preparation at the time of the field survey). Secondly, due to time and material constraints, and the relatively short period of SEZs being implemented in the two countries, the sample size of interviews is slightly insufficient, which affects the comparability of the relevant factors between the two countries. With further development of SEZs in the two countries and the adjustment of related departments, future research can follow up on this. In the meantime, the impacts of different types of SEZs (such as public/private, domestic-/foreign-leading) under different policy environments can be further distinguished in future research.

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## Appendix A

1. The World Bank data (<https://data.worldbank.org/>) shows that from 1989 to 2018, the average annual growth rate of world urban population has been around 2 per cent—Half of that in the SSA.
2. According to the World Bank data (<https://data.worldbank.org/>), from 1990 to 2014, the proportion of people live in slums in Africa has decreased from 67 to 55 per cent (the world proportion decreased from 47 to 33 per cent). Infrastructure is severely insufficient on the continent. Access to electricity in Africa, for example, has been significantly improved from 1990 (16 per cent) to 2016 (43 per cent), which is still much lower than the world average (which was 87 per cent in 2016). Sanitation is much worse. Only 28 per cent of African population use ‘at least basic sanitation’ (which means improved sanitation facilities without sharing with other households compared to) while the world level is 68 per cent.
3. Most African SEZs unfortunately have ‘failed’ in terms of facilitating industrialization, especially when compared to their Asian counterparts: a World Bank report shows that in 2007, 114 African SEZs have created 1 million jobs (0.2% of the total) and 8.6 billion exports (48.7% of the total), while 991 Asian SEZs have created 61 million jobs (2.3% of the total) and 851 billion exports (41% of the total).
4. Among the five countries (including Egypt, Ethiopia, Mauritius, Nigeria and Zambia) participating in the earliest China-Africa cooperation zones (six zones in total), only Ethiopia and Zambia have no experience in SEZ development. Mauritius was one of the first countries in Africa to set up SEZs as early as the 1970s. Egypt and Nigeria also established their first SEZs in the 1990s. The history of the China-Egypt Suez Economic and Trade Cooperation Zone can be traced back to 1994 (the TEDA Group was selected to operate an industrial park in cooperation with Egypt). Besides, EIZ and Chambishi MFEZ are more similar in function compared with other cooperation SEZs: the Mauritius Jinfei Economic and Trade Cooperation Zone is more like a resort; the Lekki Free Trade Zone in Nigeria is planned to be a satellite city of Lagos; the Suez Economic and Trade Cooperation Zone is planned to be a new industrial city with multiple functions such as residence, tourism and manufacturing. EIZ and the Chambishi MFEZ are generally focused on manufacturing.
5. Maps have been reproduced by the author in ArcMap. In order to minimise the misleading results caused by deviation (such as inaccuracy in visual interpretation or neglects of small-scale construction projects on the satellite maps in 2.5 metres per pixel), the comparison will always use relative (instead of absolute) value.
6. For example, the construction period of a regular real estate project usually takes 2~3 years. However, there is two-month built skyscraper using pre-manufacturing and assembling technology, as well as unfinished small housing projects after several years’ construction (which is quite common in Africa).

7. The “research scope” is defined as the continuous built-up area of the SEZs and the city where it is located (including continuous built-up areas beyond the urban administrative divisions), while excluding green space and sporadic land. The “built-up area” refers to the blocks with more than 80% buildings completed in a certain base year compared to 2018.
8. It should be noted that the methodology used here perhaps would only be revealing and convincing for small-sized cities or towns like the cases in this thesis. Big cities with more complex spatial structures and more complicated spatial dynamics need extra analysis.

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## Article

# How the Belt and Road Initiative Informs Language Planning Policies in China and among the Countries along the Road

Yang Gao 

English Department, School of Foreign Languages, Dalian Maritime University, Dalian 116026, China;  
gaoyang666@dlmu.edu.cn

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**Abstract:** Given that the Belt and Road Initiative (BRI) has penetrated most, if not all, fields in China and the countries along the road, this paper attempts to join the existing literature by providing a unique perspective (language planning) to understand the BRI and its impacts. The article presents the way in which the BRI has informed language planning policies among China and approximately 65 countries along the road. From an ecological standpoint, it proposes how BRI language planning aims at promoting and constructing a language-and-discourse ecosystem. Taking an interpretive policy analysis method, it analyzes policy documents and the existing literature by elaborating upon the planners, purposes and principles involved in designing the language planning initiative. Specifically, different ministries, departments and committees have worked together to propose a systemic, sustainable language plan for BRI; BRI language planning then serves communication, discourse power, global governance and socioeconomics purposes. Under the overarching ecosystem planning, specific planning principles, including Chinese language status planning, foreign language planning, language structure planning, language-in-education planning and language service planning, co-evolve to sustain the system. Instead of simply depicting the language-and-discourse ecosystem, this article also discusses challenges that BRI language planning initiative might meet along the way of its implementation, including the avoidance of making language unity the same as language imperialism, and continued efforts to balance language internationalization and language localization.

**Keywords:** The Belt and Road Initiative; language planning policies; ecological stance; interpretive policy analysis method; challenges

## 1. Introduction

On 7 September 2013, President Xi Jinping spoke at Nazarbayev University in the Republic of Kazakhstan and proposed the concept of One Belt One Road (OBOR) for the first time. Ever since then, OBOR was used for approximately three years, until 28 March 2015, when the official outline for the Belt and Road Initiative (BRI) was issued by the National Development and Reform Commission (NDRC), the Ministry of Foreign Affairs (MOFA) and the Ministry of Commerce (MOFCOM) of the People's Republic of China (PRC), with authorization of the State Council. BRI thus replaced OBOR, and was defined as a transcontinental long-term policy and investment program aiming at infrastructure development and the acceleration of the economic integration of countries along the route of the historic Silk Road (the Road). Originally proposed to include 65 countries in Eurasia at the beginning, over recent years the BRI has far exceeded this range. It has thus become an initiative not only for China but also the whole world.

With considerable positive responses over the last few years, BRI brought about benefits and achievements to different fields in countries along the Road. For example, statistics from the MOFCOM indicate that nearly 4000 companies from all over the world have stationed from 2014 to 2019, creating 244,000 local jobs for the countries along the Road. In 2017 alone, China established 19 new overseas economic and trade cooperation parks in Thailand, Cambodia, Malaysia, Zambia, Kazakhstan, Laos, Russia and other countries along the Road, with the number of new enterprises being doubled to 2330, compared to the number from 2016. By the end of 2017, 1522 enterprises from 20 overseas economic and trade cooperation zones recognized by MOFCOM had a total output value of \$70.28 billion, a total investment of \$24.19 billion and a total tax \$2.67 billion to the host countries. These revenues have played a positive role in promoting the industrialization of the host countries and bilateral economic and trade relations between China and the countries.

However, there remains a dearth of literature revealing how BRI works and informs different aspects of people's lives and different fields in the world. Therefore, it requires great efforts from scholars to explore hidden themes behind the initiative. In this paper, I take a language planning perspective and present why and how BRI informs language planning and policies in China and also countries along the Road. The concept of language planning emerged at the end of the 1960s, and sharply developed during the 1970s, with Haugen [1] featuring the classic work studying the normative and standardizing activities of languages in a heterogeneous language community. Over the decades, it has been extended to activities that take steps and processes to solve language problems or bring about changes in language structures and/or functions at the community and inter/national levels [2]. Language planning may help inform sociocultural or even political decisions. BRI, as one giant initiative across 65 or even more countries, relates closely to language planning in the way that communications among the countries require great and meaningful language planning. Therefore, studying how BRI informs language planning among China and the countries along the Road is of great significance. By reviewing the different sources of the documents, I thus aim to present answers to the following questions:

- (1) Who are the BRI language planners, including national ministries and policy initiators?
- (2) What are the purposes of the BRI language planning initiatives?
- (3) What are their general and specific principles in guiding BRI language planning initiatives?

With all these answers, I propose that a language-and-discourse ecosystem may emerge from these planning initiatives. I also discuss some challenges along the way to implement these planning initiatives.

## **2. Literature Review**

Traditional and classic language planning focuses on the changes brought about from a linguistic, particularly sociolinguistic perspective [3], as sociolinguists are keen on exploring new terms, non-standard grammatical forms, the nomination of a certain variety of language and how these linguistic units have been changed or added to in the official language. Kaplan and Baldauf asserted that "language planning is a body of ideas, laws, and regulations (language policy), change rules, beliefs, and practices intended to achieve a planned change (or to stop change from happening) in the language use in one or more communities" [4] (p. 3).

### *2.1. Typology of Language Planning*

With the emergence and development of language planning, scholars at the beginning of the century studied the typology of the field [4–10], among which Kaplan and Baldauf [4] is a widely used version with four major types of language planning, including status, corpus, language-in-education (or acquisition), and prestige language planning.

Status Planning: status planning, as the name indicates, defines the particular status a language or languages hold in a society or specific context [4]. The planning is more often applied to defining the status of the second language instead of the first language. For example, van Els [11]

summarized four primary statuses of second languages which work together to serve certain purposes, including communication, language instruction, immigrant or ethnic minority languages and linguistic or language rights. However, on top of these purposes sits community needs, which dominate status planning decisions. Baldauf and Kaplan [8] explained the nature of the community needs and presented how these needs can be identified and planned for status purposes.

**Corpus Planning:** corpus planning is concerned with the internal structure of a language and the standardization of that language. It may create new words and expressions, or replace old ones with new meanings. It thus involves making changes to linguistic codes and/or grammars and dictionaries for the selected language. The typical activities of corpus planning include devising a writing system for a spoken language, initiating spelling reforms, coining new terms, publishing grammar books or dictionaries, or creating corpora. Often informed by status planning decisions, corpus planning also relates to language teaching and research, which paves the way for language-in-education planning [8,9]; it may be a result of status planning and policies with political and societal ideologies, which lead to the building of certain corpora. Corpora are then used as a language resource for language education.

**Language-in-Education Planning:** Baldauf and Kaplan [8] also termed language-in-education policy and planning as acquisition policy and planning, which constitutes the sole language planning activity in many countries. However, such a language planning is often restricted to academic contexts, and schools in particular; it may thus affect minority languages outside the school context [12]. Taking three different contexts, including Japan, Sweden and North Korea, Baldauf and Kaplan [8] also examined seven key language-in-education policies (i.e., access policy, personnel policy, curriculum policy, methodology and materials policy, resourcing policy, community policy, and evaluation policy) and four key language-in-education planning goals (i.e., language maintenance, language reacquisition, foreign/second language learning, language shift).

**Prestige Planning:** compared with the other three language planning categories, prestige or image planning has been far less developed. Ager [13] examined the planning category in Wales, Malaysia and Québec, and then suggested three separate activities that might underlie the prestige of such a planning category. Specifically, prestige in Québec seemed to be related to ethnic or civic identity and language promotion; prestige in Wales worked as a way to guide language policy design, implementation and evaluation; in both Malaysia and Québec, prestige connected language planners and communities through planners' motivations and planned activities.

A synopsis of the typology of language planning may direct us to notice the similarities, overlaps and limitations of the typology. For example, language planning may occur at the macro-level (the state) or the micro-level (the community), which renders a more general type of classifications. Besides this, hardly any coherent theoretical orientations can be found through the types of language planning, as they may diverge in their theoretical orientations and foci of attention. Specifically, status planning focuses on the society, corpus planning on the language, acquisition or language-in-education on learning and teaching, and prestige planning on the image. Van Els [11] argued that this might result in planners who might be politicians and laymen outside a certain field being unable to offer sufficient and effective planning strategies for the target field. Therefore, it is vital to map out the theoretical orientations in language planning to help language planners, linguists and other stakeholders in the language planning process.

## 2.2. Theoretical Considerations in BRI Language Planning

The scientific evolution from positivism to post-positivism leads us to believe that no single orientation could account for a complex phenomenon. This is especially true for language planning, as it involves different dynamics, constructs and stakeholders in the process. However, it is still necessary to exemplify a few theoretical orientations that have been developed for years and contribute to the field. In the following excerpts, I present three primary theoretical orientations in guiding the

development of the language planning field; however, these theoretical orientations may overlap in certain tenets.

### 2.2.1. Language Planning in a Sociolinguistic Stance

It is generally believed that the study of modern language policy and planning began in the field of sociolinguistics in the 1960s, and developed in the 1970s, when classic language planning emerged as a prototype of the field. The first theoretical orientation is rooted in sociolinguistics. Neustupný [14] attempted to describe the history of language planning as a social practice determined by a number of sociocultural phenomena, including but not limited to the means of production, social equality, ideologies and beliefs about language variation. In chronological order, he even summarized language planning in a four-stage classification: Premodern, Early Modern, Modern, and Postmodern.

Under the overarching theoretical orientation stand different specific approaches. For example, Spolsky [15] developed the language management approach by incorporating sociocultural and sociolinguistic tenets into the field. Nekvapi [16] explained language management as dealing with the management of utterances in specific conversations among individuals and/or in institutions. While highly situation-oriented, language management theory yields insights for studies in various language situations [14,17–21].

Another approach in this theoretical stance is the domain approach stemming from Fishman [22]. This approach has been implicitly and explicitly developed by scholars, including Spolsky [12,23] and Shohamy [24]. Under the domain approach lies its key components, including but not limited to family [20], religion [25], the workplace [26], public space [27] and other settings.

### 2.2.2. Language Planning in a Critical Approach

Baldauf [28] stated that critical theory has informed language planning studies and discussed key concepts including power, struggle, colonization, hegemony, ideology and resistance. Tollefson [29] argued that language planning in a critical approach serves as a reaction to language imperialism and classical language planning in a hegemonic approach. It also serves as a way to promote social change and reduce inequalities. Some African countries, for example, made efforts to fight against colonial languages with indigenous languages as a way to show their attempts to advocate for social justice and protect their heritage culture [30,31]. Under the critical theoretical orientation, two primary critical approaches have been used, including the historical structural approach [32] and governmentality [29,33].

In addition, as a hybrid between critical literacy and sociolinguistics, critical discourse analysis (CDA) also yields insights in guiding language planning to develop. Fairclough, as a classic CDA work, highlighted the importance of language and power, and argued that “language connects with the social through being the primary domain of ideology, and through being both a site of, and a stake in, struggles for power” [34] (p. 15). With such a premise, Lo Bianco [35] explored aspects of the relationship between critical discourse analysis and language planning, and explained that critical textual analysis could play a vital role in democratically oriented projects of language policy. Likewise, Li [36] used critical discourse analysis to examine the shaping of socialist ideology through language policy for primary schools in China, and Skeritt [37] examined the language planning situation in Estonia in the same approach.

### 2.2.3. Language Planning in an Ecological Approach

As the world becomes increasingly complex and dynamical, the recently-emerged language ecology paradigm extends the literature of language planning. A typical language ecology theoretical orientation presents the following core tenets: the recognition of human rights, equality in communication by means of different national and ethnic languages, multilingualism, the sustainability and diversity of languages, national language status sovereignty, and advocating effective and cooperative language instruction. For example, Mühlhäusler stated that:



“In an ecological approach, language planning is seen as a process which is a part and closely interrelated with a large range of natural and cultural ecological factors. It is focused on the question of maintaining maximum diversity of languages by seeking to identify those ecological factors that sustain linguistic diversity. Linguistic diversity in turn is seen as a precondition of maintaining cultural and biological diversity. The ultimate aim of ecological language planning differs from most conventional approaches to language planning both in its aims (diversity rather than standardisation) and the aims required (community involvement rather than specialist management)” [38] (p. 306).

Puppel [39] explained the ecological perspective of language planning by arguing that linguistic diversity enriches the human ecosystem, embodies diversified ethnic identities and presents a holistic inventory of human knowledge. The ecological theoretical orientation paves the way for language standardization and language diversity to co-exist and co-evolve; it also helps protect and restore language resources by mapping out languages with different statuses and functions in a system. This theoretical orientation has thus been widely used and developed over recent years.

The synthesis and analysis of the theoretical frameworks in language planning provide a conceptual and theoretical framework for this current study. I argue that no single theoretical framework is strictly applicable to the BRI language planning in China; tenets from different theoretical frameworks work together to contribute to the underpinning of the BRI language planning theoretical stance. However, an ecological approach may work better as the theoretical framework for analyzing BRI language planning and policies. Specifically, BRI language planning does include prestige and national identity as constructs when it promotes the standardization of Chinese mandarin along the Road; it also encourages the development of linguistic diversity to provide a culturally and ecologically diversified environment along the Road.

### **3. Research Methodology**

The research foci and contents of the study decided the research methodology. As I attempted to explore what the specific language planning policies are under the overarching BRI, and how the BRI informs the language planning and policies among China and the countries along the Road, I thus chose policy analysis as a fitting methodology for the study. Generally, policy analysis provides a way of understanding how and why governments enact certain policies and achieve certain effects. With that general purpose, policy analysis has been broadly classified in three orientations, including traditional, mainstream and interpretive orientations [40–42]. The three different orientations differ in their ontological and epistemological underpinnings, and yield different approaches. One of the key distinctions among the three orientations, according to Bacchi [40], is that the first two orientations focus on problem identification and improvement, whereas the last—the interpretive orientation—focuses on problem representation. Given the theoretical framework and the nature of the study, I chose an interpretive policy analysis approach, the rationale for which is provided in the following section.

#### *3.1. Interpretive Policy Analysis*

Interpretive policy analysis derives from the interpretive turn during the late 19th century and the early part of the 20th century, and paves the way for specific methodologies and paradigms including phenomenology, hermeneutics, (some) critical theory from Europe, and symbolic interactionism, pragmatism and ethnomethodology from the United States. Interpretive policy analysis complements positivist approaches, including cost-benefit and analyses, decision trees, and attitudinal and other survey research, and the like [42]. It focuses not only on meanings but also on how analysts and researchers access, generate and explain these meanings [43].

As meanings are situation-specific, a meaning-focused policy analysis is thus contextualized. With that premise, interpretive policy analysis aims at informing rather than generalizing any findings. Yanow [43] thus argued that interpretive policy analysis challenges the very foundations of

traditional public management, which are scientific or evidence-based. With the specific ontological and epistemological foundation, interpretive policy analysis is central to two typical methodological orientations: phenomenology and hermeneutics. Phenomenology has been a major force for shifting attention across the social sciences from generalizable laws of human behavior to situation-specific interpretations of the meaning(s) of human acts. Another typical orientation is hermeneutics, which is also the one I chose for the current study.

Hermeneutics was originally developed as an analytical method to deal with reading texts, particularly the Bible. It was extended over the decades to include other texts, including news, novels, poetry, picture books, and even artifacts, including paintings and films. In policy analysis, a hermeneutic approach leads to a focus on policy-relevant texts [43]. Therefore, in the current study, I chose this hermeneutic, interpretive policy analysis method to map out how different language planning policy documents, reports and news had been issued and delivered to inform the BRI language planning policies. However, taking a critical lens, I argue that not a single methodology or approach fits the current study, and my argument resonates with the belief that meanings are situation-specific and contextualized [44]. While I chose the interpretive policy analysis method, some analyses fall into traditional policy analysis methods. This may partially result from the nature of the theoretical framework and the specific feature of the context. I provide my reasoning on aligning the ecological theoretical orientation with the interpretive policy analysis method in the next section.

### 3.2. Theoretical and Methodological Underpinnings

The focus of BRI is moving from merely infrastructure and technological development to other social, political, cultural and economic developments among China and the countries along the Road. In other words, it aims at developing a multifaceted, diverse system that embraces most, if not all, industries among these countries. BRI language planning also falls into a systemic and ecological stance. As mentioned earlier in the paper, BRI language planning aims at encouraging the development of linguistic diversity, in order to provide a culturally and ecologically diversified environment along the Road. With that premise, an appropriate, fitting methodology is required for the study.

The interpretive paradigm is a way to gain insights by discovering meanings, and it explores the richness, depth and complexity of phenomena. It aims to produce an understanding of the social context of the phenomenon and the process in a hermeneutic approach [45]. As mentioned in the previous section, official documents, news, and reports are the policy texts that I have used to present and interpret the meaning of the BRI language planning in the study, in terms of its purposes and functions. It fits a hermeneutic, interpretive policy analysis approach. Therefore, the theoretical framework and the methodological approach were aligned with each other to inform the development of the study.

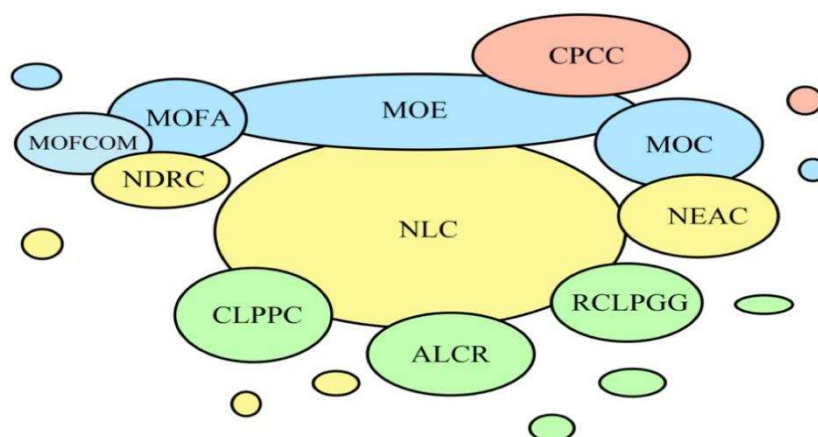
## 4. Findings

In China, language planning has been a research topic in applied linguistics and sociolinguistics for years, while there is a trend in recent years for studies in culture and foreign affairs to join the language planning literature in order to broaden its scope. Zhou [46] collected and edited some major national language planning and policy works in the Foreign Language Policy and Planning Process. Other language planning and policy planners, either as scholars or institutes, work in their way to broaden the literature in the field [47–55]. All these sample works play a very important role in aligning national language planning and policies with BRI. On 2 June 2020, MOE, together with National Language Committee (NLC), reported 2019 Chinese Language Situations through a press conference. So far, language planning and policies in China have been developed in full wings. In this section, I aim to present why and how BRI language planning works in an ecological way. Specifically, I elaborate on three major constructs, including *planners*, *purposes*, and *principles* in BRI language planning.

#### 4.1. BRI Language Planning: Planners

The understanding of the primary purposes and functions of BRI language planning helps us further explore who might be the planners or administrations in the initiative, and what its overall and specific planning principles are, which will be underpinned in this section. As language planning is more a dynamic, context-specific process than a static and solo work, the role and motivations of planners and the administration involved in the process serve as an important part of language planning [8,56].

BRI language planning has gone through different state ministries and committees which cooperate and collaborate with each other to draft and issue policies and documents. Some of the committees or ministries have taken a leading role, and others are supportive. Specifically, the NLC took a leading role in this initiative. However, two divisions of NLC are affiliated to the Ministry of Education (MOE), which provides firm support to NLC for its language planning decisions. Similarly to the MOE, other ministry-level support comes from the Ministry of Culture (MOC) and the Ministry of Foreign Affairs (MOFA), etc. Under the Communist Party of China Committee (CPCC), the United Front Work Department and Publicity Department also support the NLC in language planning decisions. Furthermore, there are several key academic institutes and language research centers working to support BRI language planning, including but not limited to the Beijing Advanced Innovation Center of Language Resources (ALCR), the Research Center for Language Planning and Global Governance (RCLPGG), and the Chinese Language Policies and Planning Committee (CLPPC). The following figure provides a general picture of what administrative and planning ministries, departments and committees might be involved in the BRI language planning process. However, it should be noted that not all the parties, rather only the primary parties involved in the process, are listed (see Figure 1).



**Figure 1.** Planners & Supporters in BRI Language Planning.

It should be noted that the circle size in the figure does not indicate the efforts the party has made in the language planning process. Efforts made from all the parties cannot be measured or weighed in a numerical account. However, it does present which committee or planner has taken the lead or made more contributions to the process. For example, the NLC, as the leading committee, together with the MOE, has planned and issued language policies and decisions. As some of the policies and decisions are involved with other policies or decisions, including the ethnic affairs or foreign affairs domestically in China or among the countries along the Road, the National Ethnic Affairs Commission (NEAC) and MOFA thus provided their support and guidance in the language policies and decisions in BRI. With all the guidance from different ministries, departments and committees, the NLC and MOE have developed a systemic, sustainable language plan for the BRI. In the following part, I elaborate on the BRI language planning from both macro and micro perspectives.

#### 4.2. BRI Language Planning: Purposes

A review of the existing literature and documents helps map out five major purposes that BRI language planning aims to achieve. These five purposes work together to serve certain functions, either ideologically or socioeconomically.

##### 4.2.1. Language Planning Serves a Communicative Purpose

The official document of BRI lists five cooperation priorities, also termed as five connectivities or *Wu Tong*. These priorities include *policy coordination, infrastructure connectivity, unimpeded trade, financial integration, and closer people-to-people ties*. Achieving these priorities requires languages, which play a very decisive role in being a communicative medium, leveling off the barriers of different cultural societies in the world and bringing people from different cultures together. Li [48] argued that language, in its communicative purpose, works in two ways to bind people or things. The first type of connection is ‘thing-to-thing’, and the second is ‘people-to-people’. Global governance requires both ‘thing-to-thing’ and ‘people-to-people’ communication. English may connect things to things, but may not connect people to people, as Chinese culture cannot be fully expressed and conveyed in that language. As the primary investor and initiative planner, China plans to develop Chinese as the communitive language or another lingua franca, or at least the one connected to other languages along the Road.

##### 4.2.2. Language Planning Entails Discourse Power

Li [48] argued that discourse power is not only expressed in the bilateral relations between countries, but also in the multilateral relations represented by international organizations; not only in foreign exchanges between governments but also in the operation of international non-governmental organizations, and in countries around the world in which people’s various outlooks exchange. The acquisition of international discourse power takes time; it thus requires detailed, feasible language planning. BRI language planning thus works as a gradual process to support the international discourse system. BRI language planning aims at fostering a positive discourse attitude. Whenever there is a need to speak, whoever has something to say among the countries, BRI aims to provide the countries with opportunities to speak.

##### 4.2.3. Language Planning Matters in Global Governance

Language planning is also one of the basic components of global governance. At present, the main problems in global language planning include language conflicts, endangered languages, English imperialism, information marginalization, language intelligence and language resource construction, etc. For example, as a lingua franca, English provides great convenience for human communication and undoubtedly has positive significance for global governance. However, its drawbacks are also obvious: it hardly leaves any room for other languages, having maintained its language status for decades or centuries. This language imperialism or over-standardization impedes cultural diversity. Language is a worldview, a tool of thinking and a carrier of different ideological achievements. It thus requires different languages to voice and convey ideas. BRI language planning may take the chance to solve these problems, or at least make changes in current situations.

##### 4.2.4. Language Planning Promotes Socioeconomic Growth

From the perspective of language economics, Dalmazzone [57] advocated that language serves a network effect, or the externality of the network, which presents three key types of rewards: first, the rewards that individuals receive from joining a language community develop certain potential communicative abilities; second, all members of the community may be rewarded with more communication opportunities due to the effect; the third kind of reward is the innovation or innovative ideas brought about by the expansion of communication and knowledge sharing, typically in economic

and social activities. BRI language planning, from this stance, provides China and the countries along the Road with more opportunities to boost their socioeconomic development.

### 4.3. BRI Language Planning: Principles

#### 4.3.1. Overall Planning and Policy: Promoting a Language and Discourse Ecosystem

In July 2016, the MOE in China issued its Education Action Plan for the Belt and Road Initiative, aiming to develop a cooperative educational system and promote the common prosperity of education in the countries along the Road. Under the overarching educational principles, a specific principle pertinent to language planning was issued, the core of which aims to break language barriers between the Belt and Road countries. To achieve that goal, the MOE set specific objectives, including:

- “to explore how to build coordination mechanisms for breaking language barriers to jointly develop open language courses, and gradually incorporate courses on our different languages into the curricula of each Belt and Road country.
- to expand inter-governmental language exchange programs and work together to cultivate, and help each other to cultivate, high-level language experts.
- to give full play to the strengths of universities focusing on foreign studies and foreign languages in training strong linguists and promote the development of multilingual teaching staff for elementary and secondary education as well as foreign language education.
- to expand the number of students sent overseas with government scholarships for language training and encourage institutions from the Belt and Road countries to work in partnership with Chinese institutions to establish programs that teach their own languages in China.
- to support the engagement of more social actors in establishing Confucius Institutes and Confucius Classrooms, and scale up efforts to train both full-time Mandarin teachers and volunteer Mandarin teachers to meet the demand from the Belt and Road countries for Mandarin language training” (Education Action Plan for the Belt and Road Initiative [58]).

A close look at these specific principles directs us to some thoughts; the former two objectives cater to the communication and the cultivation planning which has been underpinned by status planning [9,10]; the other three objectives echo to the language-in-education or acquisition planning type, which makes sense as they were launched and administered by the MOE. Behind these specific communication, cultivation, and acquisition planning types stand status and prestige planning types, which aim at promoting China’s image, national identity and relationships with the countries along the Road. I argue that the overall planning and policies depict a general picture of a language and discourse ecosystem, which is intended to be sustainable, systemic and dynamical (see Figure 2).

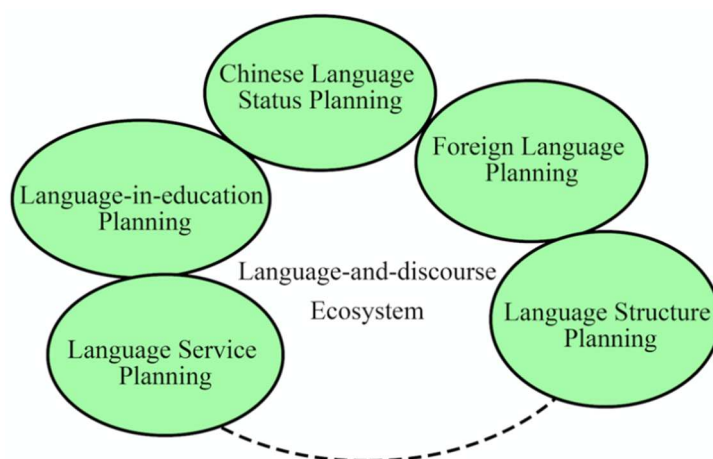


Figure 2. A language-and-discourse Ecosystem.

BRI language planning, at its core, thus aims to improve Chinese discourse power and foster a Silk Road discourse system. It ultimately aims at balancing the political and ideological powers across the globe. The world, over the last few centuries, has increasingly featured the English language and the Western world. BRI language planning supports the promotion of people-to-people communication, and enhances the international influence of the Chinese discourse system. It thus aims at solving various discourse planning issues, including but not limited to policy discourse, academic discourse, institutional discourse and structural discourse. However, to achieve the overall goal and implement the overall language planning and policies, specific planning initiatives are required to take action, including Chinese language status planning, foreign language planning, language structure planning, language-in-education planning and language service planning. Each of the specific planning initiatives works as a unit and contributes in their own way to the planned system.

#### 4.3.2. Specific Planning & Policies: Sustaining the Language and Discourse Ecosystem

**Chinese Status Planning:** Kaplan and Baldauf [4] explained language status planning as a way to define particular status language(s) hold in a society. It may take the form of overt status planning through legislation or constitutions. Overt status planning may take the form of the officialization and nationalization of a language, and the formalization of language rights. It may also be in the form of covert status planning, which occurs implicitly within certain communities. Primary status planning jobs may include language revival, language maintenance, inter-lingual communication and language spread. Aligning the BRI language planning purposes with these specific principles, I argue Chinese status planning is one key example of language status planning in this sense.

BRI provides a platform to develop Chinese language status overtly, and makes the planning of developing Chinese as a lingua franca possible: the ‘Greater Chinese’ concept proposed in recent years is conducive to enhancing the centripetal power of Chinese and its global radiation [48,55]. Chinese is still the language of the second phalanx in the world, with its Chinese learners close to 100 million and the number of international students studying in China exceeding 400,000 a year. Within the last ten years, the number of students pursuing a master’s degree in translation and interpretation has sharply increased, and the country has equipped the language planning initiative with its seeds. From the perspective of language ecology, it is also overseas Chinese immigrants’ human linguistic right to learn their heritage language. Moreover, the inheritance of Chinese as heritage language not only maintains the Chinese language in Chinese ethnic groups from generation to generation but, more importantly, leads them to inherit the national characters and cultural identity bearing behind the language. The inheritance of Chinese could be taken as the key to helping overseas Chinese immigrants and their descendants to solve the confusion between language identity, ethnic identity and even national identity.

To attain the language status planned, China attempted to increase the international spread of Chinese as a second language, which helps spread the culture behind the language. It may take steps to increase the spread through the localization of Chinese teaching as a second language, the local cultivation of Chinese teachers, and the integration of Chinese and Chinese culture with the languages and cultures of the target country, etc. By doing so, China never aims to provoke another language imperialism, such as the existing one featuring English [59]; it instead aims to sustain the world’s linguistic ecosystem.

**Foreign Language Planning:** China has so far made remarkable achievements in language planning for the official languages of the countries along the Road [47–52]. However, with an increasing number of countries joining the initiative, attention should be given to the hidden or possible issues behind the implementation of the initiative.

One issue might be the regional lingua franca plan. BRI is not limited to government exchanges and foreign affairs, but is also connected with transnational cooperation and private trade in different local, unofficial languages. For example, languages including Hausa, Zulu, Amharic, Fulani and Mandinka are not official languages in Africa, but are widely spoken and used in parts of Africa.

Supposing conflicts or disputes, if any, occurred between China and these African countries, an official lingua franca, even in the regional sense, would offer a great solution to these conflicts or disputes. This is the rationale for advocating a regional lingua franca.

However, behind the advocate lies the great efforts that China is supposed to perform to better the understanding of the different languages. Therefore, Wang [50–52] and his team published three books in volumes on language situations among the countries along the Road. The project was sponsored and funded by the NLC, and the idea was started in 2014. Then, in 2020, the third book came out. The project helps scholars, linguists and governments better their understandings of the languages and cultures, and thus enhances the foreign language planning scheme.

Language Structure Planning: mapping out different languages and setting up different language planning policies leads us in the direction of thinking about the language structure along the Road. In the current language structure, Russian is the common regional language of Central Asia, Arabic is a cross-regional common language in the Middle East and North Africa, and French is the common language in West Africa. North Africa and other places are actually cross-regional lingua franca, and English as an international lingua franca has not only absolute influence in Southeast Asia but also a steadily increasing influence in Central Asia.

However, as the initiator and important planner of the initiative, China should make early arrangements and plans for language functions. On the one hand, we should use the construction of various common languages as a starting point, strengthen the strategic research on common regional languages in the ‘Belt and Road’, and investigate the status, distribution and vitality of various common languages in countries along the route. On the other hand, Chinese language should be identified as one of the universal languages for the construction of the ‘Belt and Road’ as soon as possible, in order to expand the leading position of Chinese language in the governments and major construction areas of the countries along the route, and to ensure that the Chinese language is in key fields, important projects and major projects. The leading position and role of the basic texts, working documents, negotiating instruments and international conferences are of strategic importance.

Language-in-Education Planning: under the umbrella of language-in-education planning, two specific planning initiatives are put on the agenda. They include Chinese international education planning and Chinese as a medium of instruction (CMI) planning [53,54]. The two specific initiatives collaborate with each other and work on extending Chinese learning in both breadth and depth.

In breath, as a major investor and exporter of BRI, China aims at sponsoring the construction of Confucius institutes and providing the countries along the Road with sufficient and effective Chinese-as-a-foreign-language curricula and language resources. It may bring about language resources, facilitate language communication, enhance language cultivation, and then create a great language environment.

In depth, BRI language-in-education planning attempts to advocate for CMI development. It has been for a long time that English as a Medium of Instruction (EMI) programs have penetrated across Europe, Southeast Asia, Africa, the Middle East and even Central Asia as one of the strategic initiatives to promote the internationalization of higher education in these regions. Likewise, the BRI language planning initiative attempts to design and promote CMI programs among the countries along the Road. The primary purposes are to support the realization of the internationalization of higher education among China and these countries, and also to replace the linguistic imperialism of English with a diversified language system in the world’s higher education.

Language Service Planning: alongside language-in-education planning comes language service planning, which, in essence, is also an extension of language-in-education planning and an embodiment of language economics planning. Specifically, language service planning involves many industries, such as language translation, language training, online language education, language technical support and language consulting. Under the language service plan, language science research can help companies go global at the basic and application levels, which will have a positive effect on linguistics research ‘going out of study’ and facing society.

Gazzola and Wickström [60] underpinned the economics of language policy and argued that issues of language diversity have economic and political implications, including transnational labor mobility, trade, the social inclusion of migrants, democracy and education in multilingual countries. Shen [53] explained that when the host country uses the language of the investment country as the language of foreign language education, the country is more attractive to the capital inflow of the investment country. Therefore, the reciprocal learning of Chinese and the languages along the Road is strongly suggested, as it will bring about economic benefits together with educational outcomes. To meet that demand, Wang [50–52] studied the language policies among the countries along the Road and attempted to offer more insights on reciprocal learning. Another example in the BRI language service planning is the ever-increasing number of graduate students pursuing a master's degree in translation and interpretation. This development equips the country with sufficient hands to smooth over issues in communication, education and trade or other fields, and to ensure sustainable communication among the countries along the Road.

## **5. Discussion**

BRI language planning, with clearly-stated purposes, cooperative planners, and overall and specific principles, aims at promoting a sustainable language and discourse system. It aims high and long, and prepares resources and funds for the planning initiative. In this section, I discuss how the BRI language planning initiatives are un/fit for the ecological, theoretical framework in depth. Taking the interpretive policy analysis approach, I also elaborate on challenges along the way to fully implement the BRI and these specific language planning initiatives.

Mühlhäusler stated that “the ultimate aim of ecological language planning differs from most conventional approaches to language planning both in its aims (diversity rather than standardisation) and the aims required (community involvement rather than specialist management)” [38] (p. 306). With that explanation, BRI language planning attempts to embrace language diversity among the countries along the Road. For example, Wang [50–52] published three volumes of works studying language situations among these countries. However, these works so far have only explored language situations among these countries, instead of giving specific explanations on how the exploration of these language situations may help China better align their language planning policies with those in countries along the Road. Therefore, sustaining the BRI language ecosystem requires tons of work in the future.

Wiertlewska [61] argued that one major purpose of ecological language planning is to protect natural languages and avoid any language loss. This belief resonates with the proposed language-and-discourse ecosystem, which attempts to embrace linguistic diversity and protect languages in countries along the Road. While it does highlight the importance of Chinese as a possible lingua franca, it does not deprive other languages of their national status. However, as BRI language planning is still running in its emerging stage, it might not be safe to say how it will go with a balanced status between Chinese and other languages. This should be something we keep our eyes on in the coming years or even decades.

Taking a critical, interpretive perspective, I argue that evaluating and assessing BRI language planning initiatives is a long journey with possible challenges. The first challenge that requires attention is the differentiation between language imperialism and language unity; in other words, the avoidance of making language unity the same way as language imperialism. BRI language planning aims at promoting the status of the Chinese language, and helps to facilitate communication between China and other countries along the Road. However, the initiative is theoretically not a replication from the English to the Chinese, which may cause another case of language imperialism. It aims at fostering language unity, serving for simplicity and practicality [53]. Therefore, the implementation of the BRI language planning requires planners, scholars and other parties involved in the process to deviate from a possible language imperialism track.



Together with the first challenge comes the second; that is, how to avoid language utilitarianism. Language unity aims for simplicity and practicality for communication, education, trade and other purposes; however, this is definitely not the premise that BRI language planning serves simply for its utilitarianism, either for economic profits or for political benefits. It should aim at fostering and promoting cultures, education and language diversity as well, which is at the core of a language and discourse ecosystem.

In addition, another challenge of BRI language planning lies in the balance between language internationalization and language localization. In other words, language internationalization cannot be achieved at the expense of language localization, or vice versa. Specifically, China may strive for its mandarin Chinese to be an internationalized language; however, it should also plan for and contribute to its minority language development. Likewise, the countries along the Road should also balance their language planning and policies between their heritage languages and Chinese.

Last but not least, risk analysis and prevention strategies are strongly required along the way to plan and implement the BRI. Most regions along the Belt and Road are developing countries and emerging economies, with immature market economic systems and relatively backward infrastructure. Moreover, religious and refugee issues might also be prominent, causing potential risks, if any, to foreign investment, business exchanges, outbound tourism, and cultural and scientific exchanges, etc. In addition, extraordinary regime changes are rare, but carry profound implications, as regime changes among BRI countries are cyclical, recurrent, and unexpected. China, to gradually achieve a language and discourse ecosystem with shared interests, responsibilities and futures, needs to take risk analysis and prevention into consideration.

## **6. Conclusions**

While BRI has been proposed since 2013, people all across the globe, typically those from the West, still know only a little about the initiative. Originally proposed to boost major industries, including infrastructure development and technology, BRI has been extended to other fields, including education and the arts and humanities. Language planning is a vital field to smooth over intercultural communication and facilitate international transactions, and thus plays a very important role in China and countries along the Road. To provide the global reader with some knowledge on how China aims at planning the languages of her own and even the countries along the Road is the primary purpose of this paper and also something significant.

In this paper, I presented theoretical orientations in language planning and, typically, how they relate to the BRI in China. I then talked about why and how the BRI helped inform language planning and policies in China and along the Road. Specifically, in bonding different cultures, societies and countries, BRI language planning functions to promote communication, discourse power, global governance and socioeconomic growth. Specifically, under the overarching BRI language planning, specific planning strategies, including foreign languages, language communication, language function, language service and Silk Road discourse, co-evolve to consolidate the planning scheme. Using an ecological, theoretical framework, I mapped out and proposed a language-and-discourse ecosystem through all the stated language planning purposes and functions. However, taking an interpretive policy analysis approach, I did not only depict a language-and-discourse ecosystem through selected policy documents and existing literature; I also pondered the challenges that might await along the journey of implementing the BRI language planning policies.

Throughout human history, it has taken time to design, implement and evaluate any project or plan that is influential and phenomenal, including the BRI. While the BRI has been running for years, it is still in its developing stage. It requires a great deal of effort in planning, updating and monitoring the BRI language planning scheme to ensure a sustainable language-and-discourse ecosystem.

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