Environmental governance of transportation infrastructure under Belt and Road Initiative : A unified framework

Wang, Xueqin; Wong, Yiik Diew; Yuen, Kum Fai; Li, Kevin X.

2020

Wang, X., Wong, Y. D., Yuen, K. F., & Li, K. X. (2020). Environmental governance of transportation infrastructure under Belt and Road Initiative : A unified framework. *Transportation Research Part A: Policy and Practice*, 139, 189-199.
doi:10.1016/j.tra.2020.03.001

<https://hdl.handle.net/10356/146370>

<https://doi.org/10.1016/j.tra.2020.03.001>

© 2020 Elsevier Ltd. All rights reserved. This paper was published in *Transportation Research Part A: Policy and Practice* and is made available with permission of Elsevier Ltd.

Downloaded on 26 Apr 2023 18:57:55 SGT

Environmental governance of transportation infrastructure under Belt and Road Initiative: a unified framework

Abstract

China's Belt and Road Initiative (BRI) has attracted much attention in the field of transportation research. With a primary goal to improve regional and global connectivity, the initiative proposes a massive development programme of transportation infrastructure (TI) linking China with the rest of the world. While it creates a tremendous development opportunity, the unprecedented scale of TI construction also brings with various challenges. In particular, the environmental impacts of the TI projects are of critical concern. Herein, smooth implementation of the TI projects would depend on the capacity of all the concerned actors to conduct collaborative planning and integrate environmental considerations. Therefore, from a multi-actor perspective, this paper aims to provide a unified framework of the environmental governance of the TI projects under the BRI. It is achieved by a focused review of relevant research articles and technical reports published in both English and Chinese. Based on the review findings, the framework along with four propositions are proposed, focusing on the key actors (who), the environmental considerations (what), and the governance structures (how). The study concludes with theoretical and managerial implications.

Keywords: Belt and Road Initiative, Transportation Infrastructure, Environmental Governance, Literature Review, Multi-stakeholder perspective; Transport policy

1. Introduction

Ever since its inauguration in 2013, China's Belt and Road Initiative (BRI) has attracted much attention from both the mass media and the academia globally (Lee et al., 2018; Qiu et al., 2018). The Initiative encompasses the "New Silk Road Economic Belt" (the Belt) which links China with Europe through Central and Western Asia, and the "21st Century Maritime Silk Road" (the Road) which extends China's connection with countries in Southeast Asia, Africa and Europe (Pike, 2017). With a primary goal to improve regional and global connectivity and cooperation, the Initiative contains a massive development programme of transportation infrastructure (TI) including highways, railways, sea ports, airport, etc. To put it into perspective, the statistics show that the BRI covers more than 70 countries with about two-thirds of the world's population and three-quarters of the known energy reserves. Projected at a total investment of US\$8 trillion by 2049, the BRI is widely regarded as the largest development plan the world has ever witnessed (WWF, 2018).

However, the BRI is not without controversy (Han et al., 2018; Zhou et al., 2018). While it creates a tremendous development opportunity, the unprecedented scale of TI construction also brings with various challenges (Losos et al., 2019). In particular, the environmental impacts of the TI projects are of critical concern (Hoare et al., 2018; Solmecke, 2017; Wang and Dong, 2017). For example, TI projects can have profound environmental impacts including emissions of greenhouse gases and other air pollutants, soil and water pollution, habitat loss, and overexploitation of resources (Ascensão et al., 2018; Maliszewska and van der Mensbrugghe, 2019). Such impacts can be especially pertinent to countries involved in the BRI, as there is a significant overlap between the BRI corridors and areas that are deemed as environmentally vulnerable such as marine biodiversity hotspots, wilderness areas and key conservation areas (Guo and Wang, 2017; WWF, 2017; Yang and Shen, 2016). In addition to the immediate biophysical impacts, the construction of fossil-fuel-dependent TI may also lock the regions into an unsustainable development pattern for decades to come, creating long-lasting environmental consequences (Gokkon, 2018; UN environment, 2018).

On a more positive note, the environmental challenges may be turned into extraordinary opportunities for green growth in Asia and beyond (Guo and Wang, 2017; Li and Ding, 2016; Ortolani, 2018). To illustrate, large-scale TI projects are often a major source of business contracts. Dramatic improvements may be achieved across the sector by incorporating environmental considerations into the evaluation and award of contracts, and subsequently the implementation of projects (Hoare et al., 2018). As commented by Hoare et al. (2018), the "green" infrastructure may act as an agent of change within the partner countries and the BRI can play a transformative role in shaping their economies towards more sustainable development. The rationale is in line with the vision of the BRI that is to promote "low-carbon, circular and sustainable" development so as to build a green Silk Road (Ma, 2016; Middlehurst, 2018). Nonetheless, such an aspirational vision cannot be realised without a proper governance framework which provides the necessary environmental safeguards and steers the TI projects towards "greener" outcomes.

Therefore, the objective of this paper is to provide a unified governance framework that guides the selection and implementation of the TI projects by integrating various environmental considerations. This is achieved by a focused review of research articles and technical reports addressing environmental considerations of the BRI. It is also a unique attempt to synthesise the scattered sources of information as obtained from both English and Chinese platforms. To the best knowledge of the authors, this study represents the first review study in this area. As such, this study contributes with a balanced synthesis of academic insights and practical viewpoints which approach the subject matter from both the "insiders" (Chinese-based) and the "outsiders" (English-based) perspectives.

On a theoretical premise, this study adopts the concept of *environmental governance*, which has been broadly understood as the establishment of institutions in order to resolve conflicts over environmental resources (Paavola, 2007). It considers the roles played by various key actors and the associated interactions that influence the environmental actions and outcomes (Lemos and Agrawal, 2006). In this study, it is found that while the (*inter*)government agencies act as a coercive force that pushes the TI

projects towards “greener” development, the *local communities* (as well as the public media) provides a normative force, that is, a pulling factor. Furthermore, the *financing institutions* (along with the *environmental non-governmental organisations* (NGOs)), serving as the facilitators and the green capacity builders, enable the green outcomes of TI projects. The remaining discourse of this study is organised as follows. The data collection method is first elaborated in Section 2. Focusing on the three key actors identified, the review findings are presented in relation to their environmental considerations and the associated interplays. Based on the synthesised findings, four propositions are proposed which are unified into a conceptual framework that illustrates the environmental governance mechanism under the BRI. Finally, we conclude the review study with theoretical and practical implications. A list of research questions is also proposed for future research.

2. Data collection method

In this review study, we identify and evaluate relevant publications, based on which the synthesised insights are presented, and a unified framework is proposed. An iterative cycle for data extraction was conducted starting from defining search keywords, screening literature, to completing the analysis (Davarzani et al., 2016). Given the wide coverage of the review topic, we extend our review focus from academic research articles to also include technical reports published by credible institutions or agencies. In line with such considerations, Scopus of Elsevier and Google search were employed as main databases to obtain relevant research articles and technical reports, respectively. As mentioned earlier, to avoid a potentially skewed “outsiders” perspective, we also employed the China National Knowledge Infrastructure (CNKI, known as ‘Zhi Wang’ in Chinese) as an auxiliary database to search for research articles published in Chinese (see Appendix 1 for a summary).

In order to identify relevant research articles, appropriate keywords or keyword structures were identified by way of trial and error. Firstly, an initial set of keywords was defined based on the authors’ prior experience and domain knowledge. Keywords searches were then conducted. Secondly, the search results were scanned to ensure the appropriate coverage and to look for additional keywords. Thirdly, the initial set of keywords was updated and another round of keyword searches was carried out using the updated keywords. Accordingly, applying the 3-step trial and error, a keyword structure was finalised as follows: (transport* OR logistics OR infrastructure) AND (environment* OR sustaina* OR ecolog* or green*) AND (“Belt and Road” OR “One Belt One Road” OR “Economic Silk Road”). The same structure was also translated into Chinese with necessary modifications. Search requests were then run in Scopus and CNKI using the keyword structure. A total of 126 publications (74 from Scopus and 52 from CNKI) was returned which contained journal articles, journal reviews, conference papers, thesis, and book chapters. To ensure the quality and credibility of the research papers, we further restricted our selection to peer-reviewed journal articles. Indeed, these articles are used to disseminate the most up-to-date theories, and represents the most advanced and credible level of research. As such, a total of 77 journal articles was identified forming the initial review list for further analysis.

Additionally, in search for relevant technical reports, the keyword structure “technical reports on green transportation infrastructure in Belt and Road initiative” was applied in Google search engine. Herein, a less explicate keyword structure was used as Google search is relatively “smarter” compared to the two academic search databases. In view of the enormous amount of results generated by Google search, we chose to restrict to the technical reports listed on the first 25 pages of the search results. We believe this is a reasonable cut-off point beyond which the generated results become less relevant. Accordingly, a total of 38 reports were extracted from the Google search results.

Finally, combining the journal articles and technical reports, a further screening procedure was conducted. During this phase, the abstracts / executive summaries of the articles / reports were read to determine their relevancy to our review study. In case of uncertainty, introduction and conclusion sections would be read in detail. Essentially, our objective was to identify articles and reports that address the prevailing environmental considerations in the mega TI projects under the BRI. After the screening procedure, 42 were shortlisted and included for final review. In addition, we also selected 5 articles that were frequently cited and appeared in the reference section. These articles generally provide

good background knowledge of the subject matter and are thus added into our final review list. Altogether, a final list consisting of 47 articles or reports were used for our review study.

3. Review findings

Despite the many benefits from large-scale infrastructure developments, the construction or expansion of TI projects under BRI has become a controversial issue, given the many painful experiences and excesses of past infrastructure implementations by financing agencies like World Bank, International Monetary Fund, and Asia Development Bank. The negative impacts of large-scale infrastructure projects on biodiversity are well known from past national and transnational projects, including habitat loss, wildlife mortality, and foreign species invasion. According to a recent study conducted by World Wildlife Fund (WWF), the BRI economic corridors would overlap with a range of 265 threatened species, 46 biodiversity hotspots, and 1,739 important bird areas or key biodiversity areas (WWF, 2017). These overlaps indicate risk areas for potentially negative impacts of the TI projects (see Figure 1). In addition, the TI projects may lead to a dramatic influx of people and thus a substantial increase of human activities, which significantly alter the local environment (Zhang et al., 2018). Consequently, some TI projects (e.g. Bandung High Speed Railway in Indonesia and Hambantota Port in Sri Lanka) faced serious opposition from local communities, the civil society, and the local government (Brombal, 2018; Friends of the Earth, 2017; Xue, 2016). The planning and implementation of sustainable transport projects is a complex task, which requires addressing the interests and concerns of the diverse stakeholders (Wei et al., 2016a). To this end, the success of the TI projects would depend on the capacity of all the concerned actors to conduct collaborative planning and integrate environmental considerations into it (Brombal, 2018). The remainder of this section is devoted to present a synthesised framework of environmental governance of the TI projects under the BRI.

Figure 1: Environmental impact of economic corridors of BRI (source: WWF (2017))

To better synthesise the review findings, we adopt the concept of environmental governance. It refers to the set of processes, mechanisms, and organisations, through which the concerned actors influence environmental actions and outcomes (Lemos and Agrawal, 2006). In a broader sense, governance has become an important aspect in societies where a large number of concerned actors are involved in the decision-making process (Gudmundsson et al., 2016; Öberg et al., 2016; Öberg et al., 2018). In particular, the enforcement power of the government agencies and the voluntary cooperation from various non-state actors are often emphasised, reflecting the institutional diversity that is essential in an effective environmental governance framework (Driessen et al., 2012; Paavola, 2007). In this connection, local communities (e.g. general public and press media) and social groups (e.g. environmental NGOs) are often considered critical non-state actors, whose participation may nevertheless lead to more sustainable decisions (Lawer, 2019; Newig and Fritsch, 2009). In addition, while not often considered a principal player in the conventional environmental governance scheme,

the financing institutions play an unreplaceable role in promoting green development in less-developed countries. Such is the case of the BRI, where significant financial gaps exist and external financial resources are expected to fill the gaps. Therefore, in this paper, we focus on four key actors within the governance framework, that is, the government, the local communities and press media, the financing institutions, and environmental NGOs, each with different roles, responsibilities and capabilities. To a certain extent, our study reveals a polycentric multi-actor environmental governance framework of the TI projects under the BRI. Key to the governance framework are the environmental considerations by each of the concerned actors, and the structures within the framework, which are elaborated in the following sub-sections.

3.1 (Inter)-governmental agencies - Standardisation of environmental regulations

One of the key concerns of the (inter)-governmental agencies is the gaps in the national environmental standards among the BRI partnering countries (Huang et al., 2017; Shi et al., 2018; Xue, 2016). The differentiated environmental standards may result in inter-country relocation of polluting industries, turning certain countries (with relatively lower environmental standards) into “pollution havens” and propelling a regional “race to the bottom” in terms of environmental standards (Cai et al., 2018; Tracy et al., 2017).

Some studies have gone one step further to test the impacts of the BRI on the partnering countries’ environmental performance due to the differentiated environmental standards (Cai et al., 2018; Han et al., 2018; Rauf et al., 2018). However, the empirical evidence obtained seems to lead to contradictory findings. For example, Cai et al. (2018) tested the Pollution Haven Hypothesis (PHH) by comparing carbon emission embodied in imports and exports of the BRI countries. Among the 31 developing countries under examination, the PHH was found to hold between China and 19 developing countries, partially supporting the PHH. Han et al. (2018), on the other hand, examined the effects of the BRI on energy efficiency convergence. It is found that trade integration and regional cooperation, the two major functions of the BRI, may have a positive influence on the convergence process especially among middle- and low-income countries. It means that the lagging countries may “catch up” in terms of energy efficiencies and environmental standards by participating in the BRI. Indeed, the TI projects under the BRI may facilitate trans-border information sharing, knowledge spill-over, and technology transfer, which ultimately lead to desirable environmental outcomes (Qi and Xu, 2018). In addition, a series of studies were conducted to determine the relationship between foreign investment and environmental degradation. Rauf et al. (2018) showed that the BRI mega projects lead to environmental degradation in the partnering countries, whereas Saud et al. (2018) found that trade openness may enhance the environmental quality. Liu and Hao (2018) suggested that the mega infrastructure projects may have differentiated impacts on energy-importing and energy-exporting countries. To this end, no definite conclusion could be drawn from the empirical studies. The environmental impact of the TI projects under the BRI, as revealed from the empirical evidence, is by far mixed.

Some scholars are particularly concerned with China’s environmental standards domestically and those governing the mega infrastructure projects under the BRI. As critically pointed out by Tracy et al. (2017), on the domestic front, China has undergone “a green shift” by strengthening its environmental regulations, phasing out polluting industries, and investing in cleaner technologies. Yet, these changes do not seem to resonate with the infrastructure development under the BRI. Gransow and Price (2018) further commented that the environmental performance of China-funded overseas projects is generally assessed using non-mandatory guidelines, none of which have been translated into mandatory regulations (Xie, 2017). As a consequence, the negative environmental impacts may disproportionately affect the less developed regions, which defeats the purpose of the initiative (Ascensão et al., 2018).

To this end, the (inter)-governmental agencies may play a key role in providing standardised environmental regulations (Xue, 2016). Accordingly to Liu and Hao (2018), this may encompass two dimensions. On the one hand, the local governments of the BRI partnering countries may incorporate the international environmental regulations into the local environmental legislation when collaborating with Chinese entities. On the other hand, countries with lower environmental standards may choose to

adopt Chinese environmental standards to avoid becoming the “pollution haven”. In fact, the Guidance on Promoting Green Belt and Road (yidaiyilu, 2017) has identified key tasks regarding formulation of environmental standards and implementation of environmental protection agreements. With the Guidance as the guiding principle, the governing agencies from various levels should work towards the shared vision and collectively contribute to the standardisation of environmental regulations.

In addition, it is worth pointing out that the financing institutions may also contribute in this regard. Asia Infrastructure Investment Bank (AIIB), one of the main financing institutions of the BRI, published a detailed Environmental Social Framework (ESF) in 2016 (AIIB, 2016). In the ESF, mandatory environmental and social requirements are attached to each project that the bank funds. By doing this, the bank is able to “enforce” the standardised requirements among the funded projects. However, the funding sources are also highly diverse, which not only include national banks such as China Development Bank and Chinese Import-Export Bank, but also private banks and corporate investors. The large number of financing institutions makes the adoption and implementation of standardised regulations challenging (Ascensão et al., 2018). While the financing institutions may facilitate the standardisation process by providing relevant experiences and expertise, it is the governing agencies that take the decisive role in ensuring observance of standardised environmental regulations. Therefore, the following Propositions are proposed:

Proposition 1a) The (inter)-governmental agencies play a key role within the environmental governance framework by providing standardised environmental regulations across the BRI countries. The standardised environmental regulations act as a coercive pressure that leads to green TI development under the BRI.

Proposition 1b) The financial institutions facilitate the process by providing relevant experiences and expertise.

Table 1: Relevant articles supporting Proposition 1

Source	Focus	Key point
Ascensão et al. (2018)	Environmental challenges in implementing the BRI	The mixture of international, national, and private funds makes the standardisation process challenging both in terms of financing and project implementation in general.
Cai et al. (2018)	Empirical validation of “pollution haven hypothesis”	The “pollution Haven Hypothesis” is partially supported between China and the BRI partnering countries.
Han et al. (2018)	Energy efficiency convergence as an indirect measure of environmental impact of the BRI	The BRI may promote convergence of environmental standards among the partnering countries through trade integration and regional cooperation.
Tracy et al. (2017)	China’s domestic ecological civilisation vs. outward environmental stance	The BRI creates environmental risks especially in countries with poor environmental governance as China’s domestic “green shift” is unlikely to influence its global outreach projects.
*(Xie, 2017)	Environmental challenges and opportunities for implementing the green BRI	Lack of mandatory regulation regarding China’s foreign investment is identified as a major environmental challenge of the green BRI.
*Xue (2016)	Establishment of international rules in support of the green BRI	The promotion and implementation of the green BRI is dependent on the establishment of a series of international rules, treaties and laws, which shall be enforced by multilateral institutions.
*Literature published in Chinese		

3.2 General public – Participation in stakeholder consultation

In view of the wide impacts of the environmental problems, the governance mode dominated by governments seems to be insufficient to address the complexity (Lemos and Agrawal, 2006; Morrison et al., 2019). In particular, effective involvement of the general public is increasingly realised as a prerequisite to a successful transportation project (Guo et al., 2017; Guo, 2016; Jones et al., 2015). This is especially true given the popularity of social networking channels, which empower the general public to influence the planning and implementation of TI projects (Martin et al., 2014; Wei et al., 2016a). Therefore, projects without incorporating due considerations to the general public, especially the local communities, may cause distrust and protests by the public which leads to project failures in some extreme cases (Ploywarin et al., 2018). For example, the potential pitfall of failing to consider the needs of the local communities has been evidenced in the projects of Bandung high speed rail and Hambantota Port, both resulting in environmental problems and social conflicts. In a recent report released by Friends of the Earth (2017), weak channels of communication and engagement with local communities were identified as key factors that significantly undermine the implementation of the green BRI.

Table 2: Relevant articles supporting Proposition 2

Source	Focus	Key point
Guo et al. (2017)	Public's trust	Public's risk perception and trust towards the government need to be understood especially for transportation projects with new technology.
*Guo (2016)	Consideration of local people's livelihood ('minsheng' in Chinese) in the BRI	One of the fundamental aim of the BRI is to improve living conditions of people within the region and people's livelihood has to be taken into consideration when implementing the BRI.
Huang et al. (2017)	Strategic environmental assessment of infrastructure projects under the BRI (in Pakistan)	Financing institutions may play a role in facilitating the Strategic Environmental Assessment, which is necessary to safeguard the environmental interests so as to generate a win-win outcome.
Jones et al. (2015)	Indigenous knowledge from local communities	Indigenous knowledge needs to be incorporated into the decision-making process when screening transportation projects.
Martin et al. (2014)	Public involvement via online forum	Local communities and expert groups should be involved in government-led projects and their opinions can be effectively captured via online forum.
Wei et al. (2016a)	Conflicts and consensus of various stakeholders	Different stakeholders of transportation projects (system designers, providers and users) have different priorities, resulting in conflicts and consensus.
*Literature published in Chinese		

In addition, some scholars argue that the lack of stakeholder participation may be especially serious for TI projects led by Chinese investors (Fu and Geng, 2019). For example, in studying a domestic TI project, Guo et al. (2017) suggested that the Decide-Announce-Defend approach prevails in China where involvement of the general public and other interest groups is neither encouraged nor required. To a certain extent, environmental management in China is still largely state-driven (Guo et al., 2017). Among others, Chinese political culture and values of compliance were cited as key contributing factors (Shan and Yai, 2011; Wei et al., 2016b). However, it is not clear whether such a top-down approach domestically is also applied to the TI projects in the BRI partnering countries. Essentially, it is often recognised that the transportation planning methods as matured in industrialised nations may be weak

in public involvement when applied in developing countries (Jones et al., 2015). As a consequence, the methods may not be able to sufficiently identify the local issues which impacts the long-term sustainability of the TI projects. To this end, the importance of effective public participation should be specially emphasised when planning and implementing TI projects in the BRI partnering countries.

Furthermore, public participation is also a unique way to explore the indigenous knowledge for sustainable development possessed within the local community (Jones et al., 2015; Morrison et al., 2019; World Bank, 1998). Comparing with scientific knowledge which is mainly experiment-driven, indigenous knowledge often exists as tacit knowledge, which is personal, experiential and difficult to communicate formally. While both streams of knowledge are vital components for the development issues, indigenous knowledge may be especially crucial in the context of developing countries. Essentially, indigenous knowledge is the local residence's interpretation of the local conditions and the projects' impacts. In some cases, indigenous knowledge may form the basis of environmental impact assessment, which can only be obtained through personal communications with the local representatives during the public participation process. As such, there is growing recognition on the values of indigenous knowledge with regards to sustainable transport planning in developing countries (Jones et al., 2015).

Notably, the major financing institutions may be a critical player in facilitating the public's participation. This is achieved by mandating the public consultation process as part of the environmental impact assessment for project evaluation. For example, the World Bank requires the projects under consideration to properly consult the people who may be potentially affected (Tracy et al., 2017; World Bank, 2013). In the ESF released by the AIIB, a set of safeguards are laid out including stakeholder engagement and consultation, in order to avoid, minimise, or mitigate adverse environmental impacts (Huang et al., 2017). Considering the critical roles played by the general public and the financing institutions, we thus propose the following propositions:

Proposition 2-a) The local communities (as well as other interest groups representing the public, such as the public media) play a key role within the environmental governance framework by actively participating in the stakeholder consultation sessions related to the TI development. The voice of local communities expressed acts as a normative pressure that leads to green TI development under the BRI.

Proposition 2b) b) The financing institutions facilitate the process by mandating the consultation process in their environmental policies.

3.3 Financing institutions - financial resources allocation and knowledge management

In the earlier sections, we have conceptualised the facilitator role of the financing institutions within the governance framework. The financing institutions may be granted more responsibility especially in view of the declining public budgets for infrastructure investments.

More specially, by requiring adherence to their environmental policies, the financing institutions are able to selectively fund projects that have minimum environmental impacts or address the impacts properly. For example, the World Bank requires all proposed projects with environmental and social impacts to implement the Environmental and Social Assessment and Management System (ESMS). A similar ESMS is also required for projects funded by the Asian Development Bank (Huang et al., 2017). In the case of the AIIB, a classification scheme is applied to submitted proposals. Based on the potential environmental and social impacts, proposals assigned to the first category (Category A) are estimated to have significant adverse impacts, which are thus required to undergo a full environmental and social impact assessment and to present a detailed management plan to address the impact. On the other hand, proposals falling under the last category (Category C) are deemed to have minimal adverse impact and may proceed to the next stage directly (AIIB, 2016; Brombal, 2018). To this end, the financing institutions play a critical role in allocating resources by prioritising environmental considerations when making investment decisions.

Furthermore, the financing institutions may go one step further by contributing to the functions of capacity building and knowledge transfer (Brombal, 2018; Gransow and Price, 2018; Wang et al., 2017). According to Gransow and Price (2018), the financing institutions can increase knowledge-based learning by utilising the extensive expertise from independent panels at the project level. They can also build knowledge management and a dynamic learning programme with transparent public disclosures, which in turn strengthens feedback to policy and practice. By so doing, it helps to improve understanding, uptake, and outcomes of sustainability of the TI projects. It is often believed that the environmental goals can only be achieved when the stakeholders are well informed of the essential concepts, knowledge, and expertise (Vergragt and Brown, 2007; Yigitcanlar et al., 2015). Indeed, the uneven distribution of knowledge among the participant countries has been identified as a critical drawback of the transnational environmental governance mechanism (Lemos and Agrawal, 2006). Herein, the financing institutions, via knowledge management, bring in industry consensus, develop capacity, communicate decisions, and ultimately promote sustainability in TI project (Yang et al., 2015). Summarising the dual functions of the financing institutions, the following proposition is proposed:

Proposition 3: The financing institutions as well as other investors play a key role within the environmental governance framework by prioritising environmental considerations when making investment decisions and contributing to capacity building and knowledge transfer when implementing environmental standards. The financial resource along with knowledge created acts as an enabler which leads to green TI development under BRI.

Table 3: Relevant articles supporting Proposition 3

Source	Focus	Key point
Brombal (2018)	An appraisal of the AIIB's environmental policy	Opinions vary regarding the potential of the AIIB in fostering sustainable development.
Gransow and Price (2018)	AIIB's environmental and social policies VS. international standards	AIIB's ESF shares more international characteristics than national characteristics, which may be an instrument to enhancing the UN Sustainable Development Goals.
*Wang et al. (2017)	The supportive role of the financing institutions in promoting the Green BRI	Banks should act more than a creditor, but a mature provider of financial services who actively involves in the monitoring and management of the funded projects.
Yang et al. (2015)	Knowledge management in sustainable transport projects	Knowledge management improves understanding, uptake, and sustainable outcome, which is essential in infrastructure industry.
*Literature published in Chinese		

3.4 NGOs – facilitation with expertise and resources

In addition to the three key actors identified in the framework, the involvement of ~~non-government organisations~~ (NGOs) in environmental governance is also increasingly recognised (Guttman et al., 2018). Herein, environmental NGOs refer to social organisations including local, national, regional, and international groups that are dedicated to environmental protections. In particular, the Silk Road NGO Cooperation Network has been established with more than 300 NGO members from over 60 countries (China SCIO, 2017). To a smaller scale, the One Belt One Road South East Asian NGOs Alliance (OBORSEANA) is also formed (<http://oborsea.org/>). By affiliating with government agencies, the alliance is dedicated in providing a collaboration platform. As commented by President Xi, the environmental NGOs “have a crucial role to play” in implementing the BRI (Wang, 2017). They can

enhance mutual understanding among people along the BRI countries, promote development, and build a community of shared future.

However, some scholars pointed out the lack of involvement of the NGOs in China-led investment projects (Dong et al., 2016). Some studies have further argued for the differences in the governance mechanism of the NGOs in China. More specifically, Guttman et al. (2018) pointed out that China's government plays a key role in all sectors of society and thus most "NGOs" in China retain strong ties to government formally or informally. They are not independent social organisations and sometimes are even "delegates" of government (Hsu, 2014; Lu, 2007). In a sense, the "NGOs", whose licences to operate are government dependent, are limited in capacity and resources (Guttman et al., 2018). While the extant BRI research focusing on the environmental NGOs is limited, their critical role in the broader research context is well established.

According to Gemmill and Bamidele-Izu (2002), the involvement of environmental NGOs has strengthened the governance outcomes in a number of ways. For example, they can provide up-to-date research and data on the most pressing environmental issues when the inter-governmental agencies lack the relevant analytical capacity or are constrained by other obligations to do so. To this end, the environmental NGOs assist the governments by filling the knowledge gaps that may stand in the way of effective decision-making. Such is the case of *WWF*, which conducted a series of research regarding the potential environmental impacts of the TI projects under the BRI, and guidelines and recommendations are thus provided (WWF, 2017, 2018). Furthermore, the environmental NGOs can mobilise the public opinions through campaigns and outreach activities. On the other hand, they can also vocalise the public interests when the public are not well-represented in policymaking. For example, *Friends of the Earth* has been effective in this regard. By critically assessing the local impacts of some TI projects in the BRI countries, they strongly advocate for environmental justice by highlighting disparities as to who bears environmental burdens (local communities) and who enjoys the benefits (investors) (Friends of the Earth, 2017). As such, the environmental NGOs act as a way to ensure connectedness to the public which a government-led framework may be lacking. To a certain extent, the environmental NGOs contribute to a form of governance beyond governments (Sparks, 2010). With the flexibility, technical capability, and entrepreneurial nature, the environmental NGOs can greatly supplement the environmental governance framework of the BRI.

Proposition 4: The environmental NGOs facilitate the decision-making / actions taken within the environmental governance framework by providing relevant expertise and resources.

Table 4: Relevant articles supporting Proposition 4

Source	Focus	Key point
*Dong et al. (2016)	Lack of collaborative platforms in the green BRI	Most green investment projects are promoted by the Chinese government, where the involvement of NGOs and local communities is severely lacking.
Gemmill and Bamidele-Izu (2002)	NGO's role in general	Major roles that NGOs may play in global environmental governance, including analysing information, providing input to policy development, and advocating environmental justice.
Guttman et al. (2018)	Non-state actors in environmental governance in China	The "shadow of the state" affects the role of NGOs, whose operations is government dependent.
Wang (2017)	NGOs' role in BRI	The Silk Road NGO Cooperation Network is established aiming for better coordination among the BRI countries.

WWF (2017)	NGO's expertise in environmental impact assessment	The BRI economic corridors greatly overlap with the regions which are environmentally sensitive and more vulnerable to environmental risks.
*Literature published in Chinese		

4. Conclusion

Mega TI projects come along with both environmental challenges and opportunities, such is the case of China's BRI. With reference to Figure 2, this study conceptualises the environmental governance framework of the TI projects under the BRI stressing the distinctive roles played by (inter-)governmental agencies, general public, financing institutions, and Environmental NGOs. Respectively, they contribute to the environmental governance by providing standardised environmental regulations across the BRI countries ([Proposition 1](#)), participating in stakeholder consultation and offering indigenous knowledge within the communities ([Proposition 2](#)), and prioritising environmental factors when making financing decisions and contributing to green capacity building and green knowledge transfer when implementing environmental standards ([Proposition 3](#)). The environmental NGOs, being a more versatile player, facilitate the overall governance process by providing essential expertise and resources ([Proposition 4](#)). With the synthesised framework, this study makes several contributions which are elaborated as follows.

Figure 2: Synthesised framework of environmental governance

4.1 Research contributions

Theoretically, this paper advocates a multi-mode governance mechanism, where: 1) the inter-governmental agencies and the general public collectively form the *core governance structure*, 2) the financing institutions provide the fundamental *enabling factors* to the structure, that is, the necessary resources and knowledge, and 3) the environmental NGOs further complement the three-pronged governance mechanism with a variety of *facilitating expertise*. To this end, our proposed framework seems to coincide with the governance mechanism characterised by “co-management”, where the governments at various levels collaborate with the local communities in managing environmental issues (Carlsson and Berkes, 2005; Foggin, 2018). While co-management literature stresses the sharing of power and responsibility between the government and local community groups (Berkes, 2009), our findings confirm their complementary roles where the government acts as a coercive pressure and the local communities as a normative pressure, collectively contributing to greener outcomes of the BRI.

Furthermore, we identify three major resources which are crucial in addressing the environmental challenges associated with the mega TI projects, that is, regulation-based resource, financial resource, and knowledge-based resource (including both indigenous knowledge and expert knowledge). The resources also interact to create synergies. For example, the financing institutions' knowledge on formulating and implementing environmental policy may provide valuable guidance to the governments in setting up standardised regulatory framework, thus enhancing the regulation-based resource. The indigenous knowledge may be integrated with the expert knowledge to provide more financially viable solutions which further brings out the value of the financial resources as a result. In this regard, our conceptualisation implies a resource-based governance mechanism, where the key actors influence the environmental actions by making use of the unique resources in their possession. The resources are synergised during the interactions among the key actors, which positively contribute to the environmental outcomes.

Finally, this study distinguishes three sources of knowledge within the governance framework. On the one hand, the local communities accumulate rich informal knowledge through generations of interactions and co-existence with the environment. It is often the most direct interpretation of the environment and the potential impact of the TI projects. On the other hand, the financing institutions are equipped with the experts in evaluating, implementing, and monitoring the TI projects. These experts are thus a source of formal knowledge of managing environmental issues. In addition, the environmental NGOs, while also possessing the expert knowledge, are often in close contact with the general public. As such, they are more able to apply the expert knowledge to a local context and integrate the indigenous knowledge into it. To this end, the environmental NGOs act a versatile knowledge agent in between. Therefore, in line with the environmental governance literature, we argue for the importance of environmental knowledge in promoting more sustainable implementations of the BRI. It is the knowledge generation, knowledge integration, and knowledge diffusion process that steers the TI projects towards more greener outcomes.

4.2 Future research agenda

The research on the environmental aspects of mega TI projects is still emerging, especially in the context of the BRI. Overall, most extant studies are descriptive analysis or data-driven case studies, whereas theory-based research is currently limited. In this regard, our review study provides the initial conceptualisation of the governance framework of the TI projects under the BRI by adopting the theoretical concept of environmental governance. For future research, we invite scholars in this field to operationalise our proposed framework and validate the propositions. Meanwhile, it is further encouraged that future scholars develop new conceptualisations from different theoretical perspectives. For example, it would be a meaningful attempt to integrate the knowledge-based co-management governance mechanism into the study in managing the TI project under the BRI. More specially, who are the key actors and what is their essential knowledge that contribute to the effective governance? How do the key actors collaborate and to what extent the collaborations contribute to knowledge integration? Under what conditions the created knowledge would be effectively transferred into positive environmental outcomes? Will there be situations where conflicting knowledge leads to detrimental environmental effects? These are all potential research questions that may be further addressed. We would like to draw future research attention in this regard.

Second, while many studies recognise the government as a critical authoritative player in the governance framework, it must also be realised that the government is seldom of a monolithic structure. In fact, from local government, central-state government, or even to trans-national governmental agencies, the government itself is a complex multi-level composition. This is especially true for regional development projects such as those under the BRI. To further complicate the matter, government at each level is also vested with varied functions regarding transport planning, land planning, environmental protection, finance, etc. In fact, the same is true for local community groups, financing institutions and environmental NGOs. None of these actors consist of homogenous groups with compatible needs and interests. As such, it would be an over abstraction to view each of these actors as one unified organisation. Therefore, for future research, special attention may be paid to decompose the

complex structure of the key organisations involved in TI development. From the perspective of the government, some potential research questions can be as follows: How the governments at different levels coordinate among themselves? To what extent their overarching agenda conflict with each other? Under what conditions the power play among the governmental agencies assist / obscure the effective governance? How do the government agencies at different levels with different functions collaborate with other actors? Research effects can be devoted in answering these questions.

Finally, this study calls for a more balanced discussion regarding the BRI in general. Although not explicitly stated, some research took an especially critical stance when investigating the topic, whereas some research ignored the negative side of the initiative and presented an overly optimistic viewpoint. Essentially, future researchers should realise that such an unprecedented scale of TI projects come with both challenges and opportunities. The future prospect is not shadowed by the challenges lying ahead, nor is the success guaranteed by the promising opportunities. In fact, it is the objective investigations on both the challenges and opportunities that would contribute to a clearer understanding. To this end, we encourage future researchers to further examine the topic without pre-conceived prejudice and contribute to balanced discourse based on factual evidence.

4.3 Limitations

The findings of this review study have to be interpreted with its limitations. First, the BRI is currently under rapid development, thus the proposed framework of environmental governance is subject to changes in future. For example, in the proposed framework, the (inter)-government agencies act as a coercive force by providing standardised environmental regulations. However, their roles may change when a comprehensive regulatory scheme is established and they may exhibit a lesser presence in the governance framework. Therefore, a constant review of the implementation status of the BRI is required and future researchers are encouraged to adjust our proposed framework by incorporating new elements and discarding factors that are no long relevant. In addition, as the BRI is still at a vigorous stage of implementation, a considerable amount of studies is being conducted utilising the qualitative methods based on conceptual discussion, while empirical studies are currently lacking in assessing the direct impacts of the BRI. As a result, this review study is largely based on conceptual insights rather than empirical evidence. This limitation may be overcome by future researchers following the future development of the BRI.

Formatted: Font: Bold

References

- AIIB, 2016. Environmental and Social Framework.
- Ascensão, F., Fahrig, L., Clevenger, A.P., Corlett, R.T., Jaeger, J.A.G., Laurance, W.F., Pereira, H.M., 2018. Environmental challenges for the Belt and Road Initiative. *Nature Sustainability* 1(1), 206-209.
- Berkes, F., 2009. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *J Environ Manage* 90(5), 1692-1702.
- Brombal, D., 2018. Planning for a sustainable Belt and Road Initiative (BRI): an appraisal of the Asia Infrastructure Investment Bank (AIIB) Environmental and Social Safeguards, In: Shan, W., Nuotio, K., Zhang, K. (Eds.), *Normative Readings of the Belt and Road Initiative* Springer, Cham.
- Cai, X., Che, X., Zhu, B., Zhao, J., Xie, R., 2018. Will developing countries become pollution havens for developed countries? An empirical investigation in the Belt and Road. *Journal of Cleaner Production* 198(1), 624-632.
- Carlsson, L., Berkes, F., 2005. Co-management: concepts and methodological implications. *J Environ Manage* 75(1), 65-76.
- China SCIO, 2017. Chinese solution leads NGO cooperation along Silk Road, In: Chengqiong, Z. (Ed.).
- Davarzani, H., Fahimnia, B., Bell, M., Sarkis, J., 2016. Greening ports and maritime logistics: A review. *Transportation Research Part D: Transport and Environment* 48, 473-487.
- Dong, Z., Ge, C., Wang, J., Yan, X., Cheng, C., 2016. Strategic implementation framework for the greening development of the Belt and Road Initiative (in Chinese: "一带一路"绿色发展的战略实施框架). *中国环境管理* 8(2), 31-41.
- Driessen, P.P.J., Dieperink, C., Laerhoven, F., Runhaar, H.A.C., Vermeulen, W.J.V., 2012. Towards a Conceptual Framework for The Study of Shifts in Modes of Environmental Governance - Experiences From The Netherlands. *Environmental Policy and Governance* 22(3), 143-160.
- Foggin, J., 2018. Environmental Conservation in the Tibetan Plateau Region: Lessons for China's Belt and Road Initiative in the Mountains of Central Asia. *Land* 7(2), 52.
- Friends of the Earth, 2017. Investing in a green Belt and Road? Assessing the implementation of China's green credit guidelines abroad, Washington DC.
- Fu, J., Geng, Y., 2019. Public participation, regulatory compliance and green development in China based on provincial panel data. *Journal of Cleaner Production* 230, 1344-1353.
- Gemmill, B., Bamidele-Izu, A., 2002. The role of NGOs and civil society in global environmental governance, In: Esty, D.C., Ivanova, M.H. (Eds.), *Global environmental governance: Options & opportunities*. Yale Center for Environmental Law and Policy, New Haven, CT.
- Gokkon, B., 2018. Environmentalists are raising concerns over China's Belt and Road Initiative, *Pacific Standard*.
- Gransow, B., Price, S., 2018. Social risk management at AIIB - Chinese or international characteristics *Journal of Chinese Political Science* In press.
- Guðmundsson, H., Hall, R.P., Marsden, G., Zietsman, J., 2016. Governance and decision-making in transportation, *Sustainable Transportation: Indicators, Frameworks, and Performance Management*. Springer.
- Guo, D., He, G., Lian, Z., 2017. Environmental risk perception and public trust—from planning to operation for China's high-speed railway. *International Journal of Sustainable Transportation* 11(9), 696-706.
- Guo, D., Wang, Y., 2017. Research and suggestions on the construction of green "Belt and Road" (in Chinese: 绿色"一带一路"建设研究及建议). *中国环境管理* 3(1), 15-19.
- Guo, X., 2016. Build green development into the Belt and Road Initiative (in Chinese: 打造绿色发展的"一带一路"). *社科纵横* 31(9), 36-39.
- Guttman, D., Young, O., Jing, Y., Bramble, B., Bu, M., Chen, C., Furst, K., Hu, T., Li, Y., Logan, K., Liu, L., Price, L., Spencer, M., Suh, S., Sun, X., Tan, B., Wang, H., Wang, X., Zhang, J., Zhang, X., Zeidan, R., 2018. Environmental governance in China: Interactions between the state and "nonstate actors". *Journal of Environmental Management* 220(1), 126-135.
- Han, L., Han, B., Shi, X., Su, B., Lv, X., Lei, X., 2018. Energy efficiency convergence across countries in the context of China's Belt and Road initiative. *Applied Energy* 213(1), 112-122.
- Hoare, A., Hong, L., Hein, J., 2018. The role of investors in promoting sustainable infrastructure under the Belt and Road Initiative. Chatham House, London.
- Hsu, J.Y.J., 2014. Chinese Non-Governmental Organisations and Civil Society: A Review of the Literature. *Geography Compass* 8(2), 98-110.
- Huang, Y., Fischer, T.B., Xu, H., 2017. The stakeholder analysis for SEA of Chinese foreign direct investment: the case of 'One Belt, One Road' initiative in Pakistan. *Impact Assessment and Project Appraisal* 35(2), 158-171.
- Jones, S., Tefe, M., Appiah-Opoku, S., 2015. Incorporating stakeholder input into transport project selection – A step towards urban prosperity in developing countries? *Habitat International* 45(1), 20-28.

Lawer, E.T., 2019. Examining stakeholder participation and conflicts associated with large scale infrastructure projects: the case of Tema port expansion project, Ghana. *Maritime Policy & Management* 46(6), 735-756.

Lee, P.T.-W., Hu, Z.-H., Lee, S.-J., Choi, K.-S., Shin, S.-H., 2018. Research trends and agenda on the Belt and Road (B&R) initiative with a focus on maritime transport. *Maritime Policy & Management* 45(3), 282-300.

Lemos, M.C., Agrawal, A., 2006. Environmental governance. *Annual Review of Environment and Resources* 31(1), 297-325.

Li, M., Ding, H., 2016. Research on green financial system building under the framework of one belt and one road (in Chinese: "一带一路"框架下的绿色金融体系构建研究). *Environmental Protection* 44(19), 31-35.

Liu, Y., Hao, Y., 2018. The dynamic links between CO2 emissions, energy consumption and economic development in the countries along "the Belt and Road". *Science of the Total Environment* 645(1), 674-683.

Losos, E., Pfaff, A., Olander, L., Mason, S., Morgan, S., 2019. Reducing Environmental Risks from Belt and Road Initiative Investments in Transportation Infrastructure. World Bank Group, Macroeconomics, Trade and Investment Global Practice Duke University.

Lu, Y., 2007. Environmental civil society and governance in China. *International Journal of Environmental Studies* 64(1), 59-69.

Ma, Z., 2016. Xi calls for building "green, healthy, intelligent and peaceful" Silk Road. *Xinhua*.

Maliszewska, M., van der Mensbrugghe, D., 2019. The Belt and Road Initiative: Economic, Poverty and Environmental Impacts. World Bank Group, Macroeconomics, Trade and Investment Global Practice Washington DC.

Martin, N.J., Rice, J.L., Lodhia, S.K., 2014. Sustainable development planning: a case of public participation using online forums. *Sustainable Development* 22(1), 265-275.

Middlehurst, C., 2018. The Silk Road paves the way for green tech, *HKTDC Research*. China-Britain Business Council.

Morrison, T.H., Adger, W.N., Brown, K., Lemos, M.C., Huitema, D., Phelps, J., Evans, L., Cohen, P., Song, A.M., Turner, R., Quinn, T., Hughes, T.P., 2019. The black box of power in polycentric environmental governance. *Global Environmental Change* 57, 101934.

Newig, J., Fritsch, O., 2009. Environmental Governance: Participatory, Multi-Level – and Effective? *Environmental Policy and Governance* 19(1), 197-214.

Öberg, M., Nilsson, K.L., Johansson, C., 2016. Governance of Major Transport Corridors Involving Stakeholders. *Transportation Research Procedia* 14, 860-868.

Öberg, M., Nilsson, K.L., Johansson, C.M., 2018. Complementary governance for sustainable development in transport: The European TEN-T Core network corridors. *Case Studies on Transport Policy* 6(4), 674-682.

Ortolani, G., 2018. China's Belt and Road poised to transform the Earth, but at what cost to the environment?, *Eco-Business*.

Paavola, J., 2007. Institutions and environmental governance: A reconceptualization. *Ecological Economics* 63(1), 93-103.

Pike, L., 2017. Explainer: Will China's new Silk Road be green? , *Chinadialogue*

Ploywarin, S., Song, Y., Sun, D., 2018. Research on factors affecting public risk perception of thai High-Speed Railway projects based on "Belt and Road Initiative". *Sustainability* 10(6), 1978.

Qi, S., Xu, J., 2018. Influence of trade openness on green TFP of countries along the Belt and Road (In Chinese: 贸易开放对"一带一路"沿线国家绿色全要素生产率的影响). *中国人口资源与环境* 28(4), 134-144.

Qiu, X., Wong, E.Y.C., Lam, J.S.L., 2018. Evaluating economic and environmental value of liner vessel sharing along the maritime silk road. *Maritime Policy & Management* 45(3), 336-350.

Rauf, A., Liu, X., Amin, W., Ozturk, I., Rehman, O.U., Hafeez, M., 2018. Testing EKC hypothesis with energy and sustainable development challenges: a fresh evidence from belt and road initiative economies. *Environmental Science and Pollution Research* 25(1), 32066–32080.

Saud, S., Chen, S., Haseeb, A., 2018. Impact of financial development and economic growth on environmental quality: an empirical analysis from Belt and Road Initiative (BRI) countries. *Environmental Science and Pollution Research* In press.

Shan, C., Yai, T., 2011. Public involvement requirements for infra- structure planning in China. *Habitat International* 35(1), 158-166.

Shi, W., Xiao, Y., Chen, Z., McLaughlin, H., Li, K.X., 2018. Evolution of green shipping research: themes and methods. *Maritime Policy & Management* 45(7), 863-876.

Solmecke, U., 2017. Multinational enterprises and the 'One Belt, One Road' initiative: sustainable development and innovation in a post- crisis global environment. *The Copenhagen Journal of Asian Studies* 34(2), 9-27.

Sparks, M., 2010. Governance beyond governments: the role of NGOs in the implementation of the FCTC. *Global Health Promotion* Supp(1), 67–72.

Tracy, E.F., Shvarts, E., Simonov, E., Babenko, M., 2017. China's new Eurasian ambitions: the environmental risks of the Silk Road Economic Belt. *Eurasian Geography and Economics* 58(1), 56-88.

UN environment, 2018. International coalition for green development on the Belt and Road.

Vergragt, P.J., Brown, H.S., 2007. Sustainable mobility: from technological innovation to societal learning. *Journal of Cleaner Production* 15(11-12), 1104-1115.

Wang, J., Dong, H., 2017. The green upgrading path exploration on the made in China Strategy targeting the Belt and Road market (in Chinese: 面向“一带一路”市场中国制造的绿色升级路径探索). *当代经济管理* 39(6), 44-49.

Wang, Q., 2017. President hails work of NGOs on Belt, Road. China Daily.

Wang, Y., Fan, G., Xia, H., 2017. Research on the path of green finance supporting the Belt and Road Initiative (in Chinese: 绿色金融支持“一带一路”建设与发展的路径研究). *环境保护* 45(12), 56-59.

Wei, H.-H., Liu, M., Skibniewski, M.J., Balali, V., 2016a. Conflict and consensus in stakeholder attitudes toward sustainable transport projects in China: An empirical investigation. *Habitat International* 53(1), 473-484.

Wei, H.-H., Liu, M., Skibniewski, M.J., Balali, V., 2016b. Prioritizing Sustainable Transport Projects through Multicriteria Group Decision Making: Case Study of Tianjin Binhai New Area, China. *Journal of Management in Engineering* 32(5), 04016010.

World Bank, 1998. Indigenous knowledge for development: a framework for action. Knowledge and Learning Centre, Washington DC.

World Bank, 2013. Operational Manual-Environmental Assessment.

WWF, 2017. The Belt and Road Initiative: WWF recommendations and spatial analysis pp. 1-14.

WWF, 2018. Greening the Belt and Road Initiative: WWF's recommendations for the finance sector. WWF-UK in partnership with HSBC, UK.

Xie, R., 2017. Promoting the green Belt and Road Initiative: opportunities, challenges and solutions (in Chinese: 绿色“一带一路”建设的机遇、挑战与对策). *国际经济合作* 4(1), 10-13.

Xue, Z., 2016. The dependent factors of the green "One Belt One Road" (in Chinese: 绿色“一带一路”的若干依托因素). *重庆社会科学* 9(1), 39-47.

Yang, J., Yuan, M., Yigitcanlar, T., Newman, P., Schultmann, F., 2015. Managing Knowledge to promote sustainability in Australian transport infrastructure projects. *Sustainability* 7(7), 8132-8150.

Yang, Z., Shen, E., 2016. Discussions on promoting green investments in countries along the Belt and Road Initiative (in Chinese: “一带一路”战略下加快沿线国家绿色投资的探讨). *Practice in Foreign Economic Relations and Trade* 9(1), 21-24.

yidaiyilu, 2017. Guidance on Promoting Green Belt and Road, In: Liuyue (Ed.).

Yigitcanlar, T., Dur, F., Dizdaroglu, D., 2015. Towards prosperous sustainable cities: A multiscalar urban sustainability assessment approach. *Habitat International* 45, 36-46.

Zhang, R., Shi, G., Wang, Y., Zhao, S., Ahmad, S., Zhang, X., Deng, Q., 2018. Social impact assessment of investment activities in the China-Pakistan economic corridor. *Impact Assessment and Project Appraisal* 36(4), 331-347.

Zhou, L., Gilbert, S., Wang, Y., Muñoz Cabre, M., Gallagher, K.P., 2018. Moving the green Belt and Road Initiative: from words to actions (working paper). World Resources Institute, Washington, DC.

Appendix 1: A summary of Chinese studies under review

Source	Method	Key point
Dong et al. (2016)	Viewpoint / conceptual discussion	Greening the BRI forms the basis for further economic cooperation with partner countries; Green development planning, risk control, regulating foreign investment behaviours, and establishing an effective safeguard mechanism are four essential components in promoting the green BRI.
Guo and Wang (2017)	Viewpoint / conceptual discussion	Bilateral dialogues, big-data based service platforms, and international alliance for green development are essential in achieving the green BRI, which is in line with the 2030 Sustainable Development Goal proposed by the United Nations.
Guo (2016)	Viewpoint / conceptual discussion	The concept of green development must be integrated into the BRI, where green infrastructure building, sustainable industry transfer, and cooperation in clean energies and renewable resources should take place.
Li and Ding (2016)	Viewpoint / conceptual discussion	Green finance is an important tool in addressing the imbalanced development and strengthening the environmental standard along the partner countries of the BRI; innovation, coordination, green, open and benefit-sharing are the key principles of developing a green finance system.
Qi and Xu (2018)	Empirical validation	Economic development, infrastructure building, institution quality and financial development significantly impact on the green technology spill-over effect among the BRI countries; However, the threshold level must be met before the positive impacts take effect.
Wang and Dong (2017)	Viewpoint / conceptual discussion	Economic cooperation among the BRI countries should take the path of green upgrading, including improvement of production technologies, labour productivity, equipment utilisation and etc.
Wang et al. (2017)	Viewpoint / conceptual discussion	The BRI should be supported by diversified and multi-level approaches of green finance schemes; Fostering green consciousness and social responsibilities of the investors is the driver for green finance of the BRI.
Xie (2017)	Viewpoint / conceptual discussion	The green BRI will be a strong driver for the UN 2030 Sustainable Development Goals and the global green finance sector; however, challenges exist which include environmental controversies of infrastructure projects and lack of environmental governance schemes for foreign investments.
Xue (2016)	Viewpoint / conceptual discussion	A standardised international regulatory scheme is essential in implementing the green BRI; However, lack of international regulations and weak institutions currently impede the implementation of the green BRI.
Yang and Shen (2016)	Viewpoint / conceptual discussion	Renewable resources, clean energies, wastewater treatment and seawater desalination are the key areas for technological cooperation in the BRI; Green investment, strong corporate governance, and green big-data platform are key elements in such cooperation.