

**PUBLIC-PRIVATE PARTNERSHIP IN THE
DEVELOPMENT OF INFRASTRUCTURE UNDER THE
'BELT AND ROAD' INITIATIVE**

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**A thesis submitted to the University of Oxford in partial fulfilment of the
requirements for the degree of Doctor of Philosophy**

Trinity Term 2018

ABSTRACT

Infrastructure is a fundamental physical asset for a successful functioning economy and society. Its development and investment have emerged as critical economic and public policy issues because the public sector is confronted with the challenges of limited financing capacity and expertise that result in insufficient infrastructure provision. In order to cope with these challenges, the involvement of the private sector stakeholders in the investment, construction and operation of infrastructure is essential, particularly in emerging economies. The blueprint of the Chinese Belt and Road Initiative (BRI), widely recognised by many countries globally, is to create the circumnavigate route connecting and supporting the economic and social development of the countries along the Silk Road Economic Belt and the 21st Century Maritime Silk Road. As infrastructure is the fundamental basis of connectivity and collaboration of BRI, it is necessary to link the public and private sector stakeholders to provide infrastructure in the context of the BRI jointly.

This study is one of the first scholarly attempts to systematically analyse how the utility of the public-private partnership (PPP) model can be improved to meet the demand of infrastructure provision in the context of the BRI. Its contribution is three-fold. Firstly, it constructs a contextualised and integrated theoretical framework to extend the applicability and explaining capacity of new institutional economics, contract and principal-agent theories for the infrastructure provision PPP in the context of the BRI. Secondly, it provides an instructive, theoretical and empirical analysis as well as solutions to improve the contractual ability and contract enforceability of the BRI infrastructure PPP from the perspective of benefit and risk-sharing. Last but not least, the thesis provides an in-depth understanding of the infrastructure provision PPP model led by the Chinese stakeholders in the BRI and how it functions as a trigger for motivating international public and private sector stakeholders to develop, invest in and operate infrastructure in a more sustainable and long-term manner, especially in emerging markets.

This thesis is organised into four substantive chapters, and each of the chapters investigates one of the critical aspects of the BRI infrastructure PPP, including institutional framework, stakeholder relationship, capital structure and risk management. Both quantitative and qualitative approaches are employed to conduct the analysis. Chapter Three demonstrates that the changes of the institution and socio-economic norm lead to the development of PPP governance in infrastructure provision and explores how the public sector can provide an enabling institutional environment for the BRI infrastructure PPP based on the systematic review and comparison of the institutions, policies, and projects from the Chinese domestic angle and BRI angle. Chapter Four scrutinises how private sector stakeholders should collaborate to deliver BRI infrastructure collectively in various scenarios and probes into the feasible strategies to optimise the contractual ability and enforceability of PPP. Chapter Five classifies the asset classes and profiles of the sponsors and summarises the typical capital structures. In addition, it identifies the major determinants of the capital structure design as well as the feasible framework to support the decision-making process of the equity structure and debt level of BRI infrastructure PPP projects in order to assist the alignment of the objectives and interests of different stakeholders. Chapter Six provides a risk management framework that supports the risk identification, assessment, and allocation for BRI infrastructure PPP projects.

ABBREVIATION

BRI	Belt and Road Initiative
ASEAN	Association of Southeast Asian Nations
BOO	Build-Operate-Own
BOOT	Build-Operate-Own-Transfer
BOT	Build-Operate-Transfer
CBRC	China Banking Regulatory Commission
CCECC	China Civil Engineering Construction Corp
CDB	China Development Bank
China Re	China Reinsurance Corporation
DBFOT	Design-Build-Finance-Operate-Transfer
DFL	Degree of Financial Leverage
DOL	Degree of Operating Leverage
DSCR	Debt Service Coverage Ratio
ESG	Environmental, Social and Governance
EPC	Engineering, Procurement, Construction
EXIM Bank of China	Export-Import Bank of China
FCF	Free Cash Flow
FDI	Foreign Direct Investments
IBRD	International Bank for Reconstruction and Development
ICBC	Industrial and Commercial Bank of China
ICSID	International Centre for Settlement of Investment Disputes
IDA	International Development Association
IFC	International Finance Corporation
IRR	Internal Rate of Return
LLCR	Loan Life Coverage Ratio
MDB	Multilateral Development Bank
MEP	Ministry of Environmental Protection
MIGA	Multilateral Investment Guarantee Agency
MIIT	Ministry of Industry and Information Technology
MOF	Ministry of Finance
MOFCOM	Ministry of Commerce
MOHURD	Ministry of Housing and Urban-Rural Development
MOT	Ministry of Transport
MWR	Ministry of Water Resources
NCCPC	National Congress of the Communist Party of China
NDRC	National Development and Reform Committee
NEA	National Energy Administration
NIE	New Institutional Economics
NPV	Net Present Value
NRA	National Railway Administration
O&M	Operation and Management
OFDI	Outward Foreign Direct Investments
PBOC	People's Bank of China
PCT	Political Coase Theorem

PICC	People's Insurance Company of China
POE	Private-Owned Enterprise
PPP	Public-Private Partnership
QFII	Qualified Foreign Institutional Investors
ROA	Return on Assets
ROE	Return on Equity
SAFE	State Administration of Foreign Exchange
SASAC	State-Owned Assets Supervision and Administration Commission
Sinosure	China Export Credit Insurance Corporation
SOE	State-Owned Enterprise
SPV	Special Purpose Vehicle
TCE	Transaction Cost Economics
VFM	Value for Money
VNM	Von Neumann-Morgenstern
WACC	Weighted Average Cost of Capital

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ACKNOWLEDGEMENTS

There are many people whom I should sincerely express my thanks for their help and support towards this doctoral thesis. This doctoral thesis would not have been possible without their help and support.

Firstly, I must thank my supervisor, Professor Gordon L. Clark, who is an intelligent and patient academic adviser, a role model, and an understanding and encouraging friend. I am extremely grateful to him for his kind support and inspiring discussions over the last few years that helped me to develop and shape this thesis.

I would like to further thank the people who guided and supported my doctoral research in various ways. They include Professor Dariusz Wójcik, Dr. Alex Money, Professor Thomas Noe, Dr. Pam Berry, Dr. Xiaoyan Zhou, Dr. Yin Yang and Dr. Xi Hu at the University of Oxford, and Professor Shouji Sun at the University of International Business and Economics. I would like to make a special mention Mr Lv Bo at China Development Bank, Mr Guangrui Xiao at BRI Data Technology Co., Ltd and Ms Lei Luo at China Communications Construction Company, Ltd. who met and discussed with me many times along the progress of the project to help me shape the research direction and my career path. I would also like to thank all of the respondents who responded to my interview invitations and kindly introduced me to their colleagues and friends during my fieldwork, who provided the most important frontline insights for this research.

In addition, I am very grateful for the financial assistance I have received that has made the doctoral research possible, including the China Scholarship Council Scholarship, the Mansfield Graduate Research Fund, and the Caird Fund from the University of Oxford.

Last but not least, I would like to thank my parents, family members, and friends, who have made the challenging DPhil process more bearable for me. Without their love, guidance, encouragement, and support, I would not have had the opportunity to complete this thesis.

CHAPTER ONE: INTRODUCTION

'Plants with strong roots grow well, and efforts with the right focus will ensure success. Connectivity is vital to advancing Belt and Road cooperation. We need to promote a global partnership of connectivity to achieve common development and prosperity. Infrastructure is the bedrock of connectivity, while the lack of infrastructure has held up the development of many countries. High-quality, sustainable, resilient, affordable, inclusive and accessible infrastructure projects can help countries fully leverage their resource endowment, better integrate into the global supply, industrial and value chains, and realise inter-connected development.'

Xi Jinping, President of the People's Republic of China, Working Together to Deliver a Brighter Future for Belt and Road Cooperation-- Keynote Speech at the Opening Ceremony of the Second Belt and Road Forum for International Cooperation, 2019

'Just like our history, our modern financial landscape reveals the enormous potential of better connections between nations and between financial institutions across borders. These financial connections can lead to new construction, new jobs, new opportunities, and, ultimately, the ability to achieve economic security. If we find ways to harness the potential, we can build more prosperous, inclusive economies that benefit all.'

Christine Lagarde, IMF Managing Director, Belt and Road Initiative: Two Key Channels to Achieving Financial Connectivity-- Opening Remarks for the Belt and Road Forum Session on Financial Connectivity, 2019

1.1 Introduction

The Belt and Road Initiative (BRI), also known as the Silk Road Economic Belt and the 21st Century Maritime Silk Road, was put forward by China in 2013 (The State Council Information Office of the PRC, 2017). Geographically, OBOR can be interpreted with reference to its two vital tangible cornerstones. The first is an overland route from China through to Western Europe, sweeping through South and Southeast Asia, Russia, the Middle East, North Africa, the Mediterranean and in between, which is dubbed as the New Silk Road Economic Belt. The Maritime Silk Road comprises a maritime route from the east coast of China heading westbound through the Indian Ocean and the Mediterranean Sea to Europe. Its blueprint is the creation of a circumnavigate route ‘connecting the vibrant East Asia economic circle at one end and the developed European economic circle at the other, and encompassing countries with huge potential for economic development’ (NDRC, 2015). The BRI sets out five priorities, including the construction of more integrated transport, energy and information infrastructure networks, lower barriers to trade and investment, more robust financial cooperation, the encouragement and facilitation of closer partnerships, and stronger policy coordination. Among the five priorities, infrastructure development and investment can be regarded as the fundamental basis for achieving of other priorities.

Infrastructure investment and development is at the centre of the BRI as infrastructure is the fundamental basis of connectivity, collaboration and economic development. The vast majority of studies report the economic effect of infrastructure on output (Lin et al., 2016), productivity (Melo et al., 2013), or long-term growth rates (Munnell, 1992). Meanwhile, infrastructure investment is complementary to other investment in the sense that insufficient infrastructure investment limits other investment and leads to bottlenecks for sustainable growth and poverty

reduction. The diversity and complexity of the BRI context require the existence of a cross-border partnership of investment, construction, maintenance and operation.

BRI infrastructure investment demand is significant, challenging the investment capacity of the public sector. According to the World Bank (Ruta et al., 2019), for 70 Belt and Road corridor economies outside China, the demand for the infrastructure is estimated to be US\$575 billion, which includes projects in all sectors that are already executed, in implementation and planned. However, the public sector in many BRI countries is burdened by increasing financial deficit and lack of expertise. The task of financing BRI infrastructure demands becomes more complex and challenging due to constraints on the budgets of the public sector, accumulated debt pressure, political conflicts, and increasing concerns about climate change, sustainability and low carbon transition (Benyon and Sharma, 2018; Hoare et al., 2018).

In order to address this challenge, the public-private partnership (PPP), as a provisioning form, can be utilised as it leverages the financing capacity and engineering/management expertise of the private sector. Public-private partnerships (PPPs) have been widely applied for the provision of infrastructure goods and public services on the basis of long-term cooperation between the public and private sectors for the past two decades in mature and emerging markets. Since their emergence in the 1980s in the UK, PPPs have been rapidly applied in many fields including transport, energy, water and others, which can also be seen in many other countries worldwide (Akintoye et al., 2003). Involving the private sector in infrastructure development is expected to have longer-term benefits, such as ‘value-for-money’, and shorter-term benefits, such as a reduction in cost and the time taken to deliver infrastructure services, higher quality service delivery, lower administrative costs, and the transfer of risks to the private sector (Bovaird, 2004; Little, 2011). PPP can be defined as cooperative institutional and long-term contracts between the public and private sectors that involve the sharing of resources, risks,

responsibilities, and rewards for the provision of public assets and services (Hodge and Greve, 2005; Linder, 1999). PPP contracts are characterised by the bundling of activities across the life cycle, including design, construction, operation and maintenance, representing a relatively new but increasingly ubiquitous organisational arrangement with international acceptance (Wettenhall, 2003).

Conceptually, there is a continuum of options ranging from public emphasis at one extreme to private emphasis at the other. As PPP arrangements are project-specific and dependent on many factors such as the expertise of the public and private sector stakeholders, capabilities, limitations, project characteristics and also the environment in which the project is going to proceed, the allocation of responsibility may differ and the partnership may take different forms such as build-operate-transfer (BOT), build-own-operate-transfer (BOOT), leasing, joint ventures or operation, and management contracts, etc. (Table 1).

Table 1 Overview of public-private partnerships vs. public and private project delivery

Public	Public-Private Partnership				Privatisation
-Reconstructing and corporatisation -Civil works contract: DBB ¹ , DB ² -Service contract	-Management and operation contract	-Lease contract -Affermage contract	-Concession -BOT ³ -DBO ⁴ -DBFO ⁵	-Joint venture -Partial divestiture	-Full divestiture
Public ownership and finance			Mix of public and private ownership and finance		
Public operation	Private operation				

The differing economic and political contexts of the constituent countries that make up the Belt and Road route likely result in uncertainties and risks in infrastructure development and investment. The

¹ DBB: Design-Bid-Build

² DB: Design-Build

³ BOT: Build-Operate-Transfer

⁴ DBO: Design-Build-Operate

⁵ DBFO: Design-Build-Finance-Operate

uncertainties and risks will range from the fundamental legal and financial challenges of accessing emerging markets to political and social instability and regional disputes. Apart from the complexities derived from the diverse economic and political contexts, further challenges are also generated from the complex relationship in PPPs. For instance, the PPPs preparation process involves large teams and multiple stakeholders (including ministries, financial institutions, contractors, operators and users), as well as a multitude of interfaces between the functional feasibility studies and the contract design (Rothballer and Gerbert, 2015).

Meanwhile, stakeholders will participate in different phases at different levels along the life-cycle holding unique interests, which increase the complexities of PPP governance (Berrone et al., 2019; South et al., 2015). Given the fact that infrastructure projects are long-term and the dynamic complexities of the BRI context, the terms and conditions of contracts may be subject to revision and renegotiation over time as circumstances change and as parties seek to rebalance separate and mutual benefits within the contract (Clark and Monk, 2014). Although the benefits of the PPP are widely recognised, given the sophisticated features of infrastructure assets and the difficulties of the alignment of the objectives of different stakeholders in the partnership, problems such as how to improve the contracting ability and contract enforceability of the PPP remain to be solved and continue to be regarded as central to this research.

The thesis examines the PPP in BRI infrastructure development and investment with a specific focus on investigating the factors affecting the contracting ability and contract enforceability of the PPP, including the governance, private stakeholder relationship, the design of the capital structure and risk management. Each one of these is key in determining the contracting ability and contract enforceability of the BRI infrastructure PPP provision. This thesis is structured into four substantive chapters, with each comparing and analysing a specific aspect of PPP in the context of the BRI. The overarching theoretical context for the thesis is firstly introduced in Chapter Two. Chapter Three analysed the institutional governance framework of PPP in the domestic Chinese and BRT context respectively, in order to explore how the public sector can provide a facilitating institutional environment for the BRI

infrastructure provision in the form of PPP. Chapter Four investigates the relationships of the key private sector stakeholders and how the private sector stakeholders can cooperate to deliver the BRI infrastructure. Chapter Five identifies and analyses the factors affecting the capital structure design and how it can be designed to align the objectives of the critical stakeholders in the BRI infrastructure PPP. Chapter Six explores the risk allocation and management approaches in the BRI infrastructure PPP. Through a detailed analysis of these issues, this thesis aims to contribute to a better understanding of the application of PPP to infrastructure development and investment in the context of the BRI.

1.2 Research aim and significance

This thesis is situated in the new institutional economics to investigate the application of the PPP to infrastructure development and investment in the context of the BRI. It is also the first and most in-depth doctorate research that studies the application of PPP mode in the BRI infrastructure investment and development. The thesis introduces institutional governance, transaction cost, contract, game, and principal-agent theories into the unfolding of PPP. The overarching aim of this study is to explore how the contracting ability and contract enforceability of the PPP can be guaranteed and improved in the context of the BRI. This aim is realised through the analysis from four core perspectives: the governance, private stakeholder relationship, the design of the capital structure and the risk management. Each of these is key in determining the contracting ability and contract enforceability of the BRI infrastructure PPP provision. Four research questions will be discussed, drawing each of them from the corresponding research perspectives, respectively.

Aim 1. To examine how the public sector can provide a facilitating institutional environment for the BRI infrastructure provision in the form of PPP

The first aim of the thesis is to analyse and compare the PPP governance institutional framework in domestic Chinese and BRI markets, as the public sector stakeholders in PPP play pivotal roles in ensuring the successful development of the PPP infrastructure (Kumaraswamy and Zhang, 2001). The experiences of the PPP governance institutional framework transition in the domestic Chinese market from the 1990s would be able to provide the analytical basis and implications for the structuring and capacity building of the PPP governance institutional framework in the BRI. Firstly, based on the systematic analysis of the institutions, policies and projects in the Chinese domestic market under the analytical framework of New Institutional Economics (NIE), this thesis aims to illustrate how the application of the PPP in infrastructure provision facilitates the change of the socio-economic development, governmental institution framework, policy and project axes in China. Secondly and importantly, this thesis aims to disclose the current PPP governance institutional framework in the context of the BRI and compare it with the Chinese domestic framework in order to identify the differences and commonalities between them.

The significance of the study in this chapter lies in the following aspects. Theoretically, by the integrated analysis of both domestic and BRI infrastructure PPP governance, this study would be able to assist the understanding of the underlying differences and commonalities and thus ensure better law and policy-making in order to facilitate the involvement of private stakeholders in infrastructure provision overseas. Practically, this study can provide the potential international stakeholders in the BRI with a more comprehensive view of the principles of PPP governance adopted by relevant Chinese administrative institutions in order to bridge the knowledge gap.

Aim 2. To explore how private sector stakeholders should collaborate to deliver the BRI infrastructure

The second aim of the thesis is to look into the relationships among the key private stakeholders through the lens of contract, as relationships are central to affecting the performance of infrastructure investment (Sharma, 2012). Given that the infrastructure financial product has materialised out of an increase in the demand for global infrastructure investment, and the rise of private sector involvement continues due to the constraints on the public budget (Sharma, 2012; Torrance, 2006), the thesis aims to explore how private sector stakeholders should collaborate to deliver the BRI infrastructure by identifying the key private stakeholders, illustrating their connections based on contractual relations and providing scenario analysis for the interactions among stakeholders.

The significance of this research lies in its implications for PPP-related guidance, especially in the context of the BRI. The analytical perspective can be used by the private sector players to select strategic options under different sets of contractual terms and to assist the choice of a realistic set of contractual terms, as well as allow the potential participants from the public sector to obtain a more comprehensive angle to partner with and design the governance strategy.

Aim 3. To understand how the capital structure should be designed so as to align the objectives and interests of critical stakeholders in the PPP

The third aim is to explore the key factors affecting the capital structure design and how these factors are integrated into the project financing in BRI infrastructure PPP as capital structure directly influences the benefits and risks sharing throughout the project life cycle. From the perspective of the BRI PPP sponsors, it is beforehand that the sponsors should assess their investment and expertise capacity, investigate the asset features, identify the critical

determinant factors to establish the BRI PPP stakeholder framework, and design the capital structure accordingly.

This thesis intends to contribute to identifying the determinants for the capital structure design of BRI infrastructure PPP, analysing their impact on the behaviours of investors. Based on the analytical results, a practical approach will be provided to support the decision-making of the BRI infrastructure in the form of PPP.

Aim 4. To provide a risk management framework that supports the risk identification, assessment, and allocation for the BRI infrastructure PPP project development and investment

The fourth aim of this thesis is to provide a feasible and effective risk management framework for the BRI infrastructure PPP. Appropriate risk allocation has also been recognised as critical to successful PPP projects (Chan et al., 2010; Zhang, 2005) and should be done at the early stage of the projects. It is, therefore, necessary to develop risk allocation for BRI infrastructure PPP via effective risk identification and fair risk allocation. Together with the study of capital structure design, the thesis will be able to provide a comprehensive view and also integrated practical approach to support the decision-making process of benefit and risk-sharing in BRI infrastructure PPP.

1.3 Scope and structure of thesis

Each of the substantive four chapters represents a key aspect of BRI infrastructure PPP embedded with their sub-theoretical basis, literature, empirical study, findings and implications. Although each chapter has a different focus on institutional governance, stakeholder relationship, capital structure, and risk management, the four chapters have a coherent and

overarching objective for better understanding the application of PPP to infrastructure development in the context of the BRI. Figure 1 illustrates a schematic overview of the thesis.

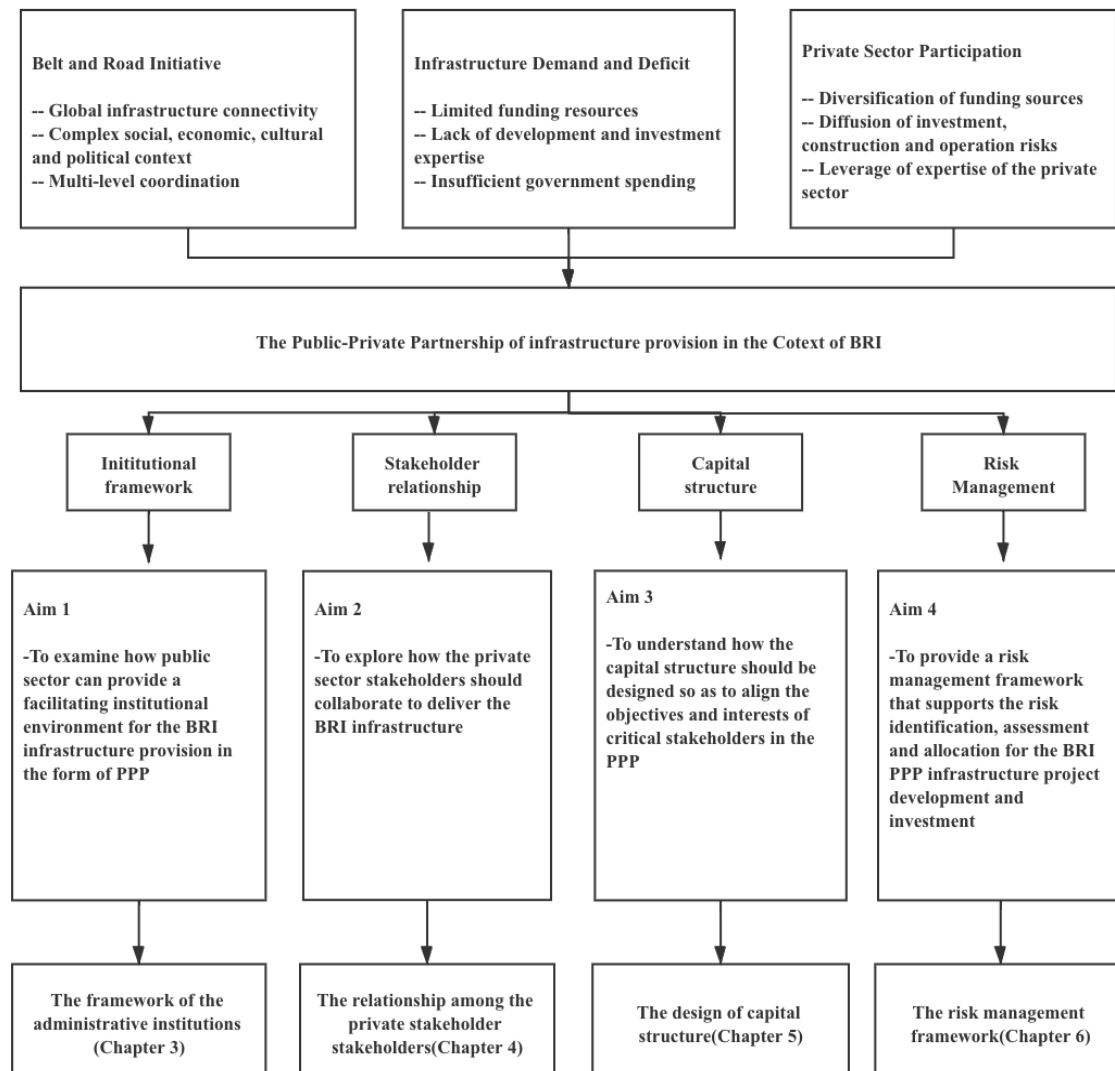


Figure 1 Schematic Overview of Thesis

The first core chapter of the thesis, Chapter Three, starts with the systematic review of the transition of the Chinese domestic PPP administrative framework and compares it with the current BRI PPP governance framework as the Chinese public sector plays an essential role in the BRI infrastructure. Experiences are drawn from domestic governance to provide implications for the establishment of the administrative framework to support the infrastructure PPP and the governance coordination in the context of the BRI. Chapter Four focuses on the relationship of the private sector stakeholders in BRI infrastructure PPP and how they can form

an effective contractual relation to deliver the infrastructure projects collectively. The various scenarios representing the strategies selected by the private sector stakeholders are investigated, particularly considering the two critical domains of PPP, payoff sharing and risk allocation. This chapter intends to contribute to a better aggregate conceptualisation and theory building and generate more meaningful practical guidance for the private sector stakeholders to choose the strategies that can improve their contractual ability and enforceability. Following the previous chapters, Chapter Five analyses the capital structure level in order to investigate how it should be designed to ensure the benefit sharing and improve the overall project return. Chapter Six focuses on the second dimension of PPP and looks into the risk identification, allocation and management process in order to provide a risk management framework to achieve a fair risk-sharing among the stakeholders in BRI infrastructure PPP. In addition to the core analytical chapters, Chapter Two reviews relevant literature in this field, including the theories of NIE, contract, game and principal-agent in order to set up the overarching theoretical framework for the thesis. Chapter Seven collates the findings of the thesis by assessing the broader theoretical and practical implications of the research.

1.4 Methodology

According to the four research aims outlined above, both qualitative and quantitative approaches are employed for the in-depth understanding and investigation of the application of PPP to infrastructure development and investment in the context of the BRI. The qualitative approach is multi-method, consisting of case studies and close dialogues (semi-structured interviews). These qualitative methods are commonly adopted for observing and analysing the diversity of economic activities and institutional behaviours in diverse contexts (Clark, 1998; Flyvbjerg, 2007; Ragin and Becker, 1992). The quantitative approach is based on the questionnaire review, the statistical analysis of questionnaire results and the theoretical model derivation analysis of the principal-agent model. This section introduces the main methods used in this thesis – case study and close dialogue.

1.4.1 Case study

The case study is a recognised and widely used research method in studies of social science (Ragin and Becker, 1992) and regarded as an empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 2014). The case study is advantageous for exploring new processes and behaviours that are not well-researched in organisations (Hartley, 2004). Nonetheless, controversy considers the case study as a subjective method which gives excessive scope for researchers' own interpretations and may be well suited for pilot studies rather than full-fledged research schemes. In addition, the primary concern for the case study method is that it is often regarded as less rigorous than the quantitative, hypothetic-deductive method. Flyvbjerg (2006) responded to these concerns by highlighting that the function of the case study and context-dependent knowledge is more valuable than the vain search for predictive theories and universals. Stake (2006, 1995) also recognised that the case study is no less rigorous than quantitative methods. Having recognised that the organisations, stakeholders

and infrastructure projects in this study are highly focusing on the context of the BRI, this thesis employs the case study method to investigate infrastructure projects and to understand the interactions among different stakeholders and identify the factors affecting the performance of the PPP.

Case study is crucial as it is able to generalise the features of diverse cases and view issues from a holistic perspective. Case selection is thus critical as the generalisability of case studies can be increased by the strategic selection of cases and demonstrates its benefits in theoretical generalisation, identifying disconfirming cases as well as providing useful information for assessing the empirical generalisability of results (Tsang, 2014). Even extreme cases can reveal more information when the objective is to achieve the most considerable possible amount of information on a given phenomenon and analyse the underlying causes behind the results (Flyvbjerg, 2006). Consequently, the case study is highly compatible with studying the complex PPP associated with the complexities of infrastructure projects in a diverse and dynamic context of the BRI. In the analytical chapters, the BRI PPP cases in the planning, construction and operation phases are analysed to investigate various issues pertaining to the BRI.

1.4.2 Close dialogue

Together with the case study, the other main qualitative method employed in this thesis is close dialogue (Clark, 1998) to move beyond the traditional, structural and static analysis as well as provide a more in-depth view of the BRI. The close dialogue method is a mode of case-study research, which ‘uses structured and unstructured interviews in the context of relationships between nominal equals to reveal the actual logic of decision making’ (Clark, 1998). As close dialogue can involve complex relationships between interviewers and interviewees, the close dialogue is often guided by a set of preconceived questions rather than being allowed to wander

question-by-question following the respondent. The interview technique has been used to understand the embeddedness and behaviours of the firms as institutional agents in a complex network of BRI infrastructure PPP.

In order to unfold and understand the relationships among the public and private stakeholders and their decision-making process of the BRI infrastructure PPP, 66 semi-structured interviews with experts in local governments, development banks, policy banks, insurance companies, reinsurance companies, state-owned infrastructure companies, private-owned infrastructure companies and academia were conducted. Before conducting interviews and fieldwork, research ethics should be approved by the University of Oxford. With the focus of research in this thesis primarily being the China-initiated infrastructure PPP projects in emerging countries along the Belt and Road, the interviews were conducted with interviewees from the institutions mentioned above located in Chinese BRI hub provinces including Beijing, Liaoning, Guangxi, Xinjiang and Yunnan as well as the overseas representatives of these institutions located in Pakistan, Myanmar, Cambodia, Malaysia, Indonesia, Saudi Arabia, South Africa, Nigeria, Ethiopia, and Tanzania.

Gaining access to the interviewees in these institutions can be difficult due to the confidential nature of the material and the reluctance of professionals to talk about their internal decision-making process. Many of the respondents for the interviews were approached through the network of the China International Contractors Association by attending the training and conference in Beijing in 2017 and my internship at the headquarter of China Development Bank. Once some initial contacts had been made, snowballing became very helpful in acquiring more diverse information sources and interviewees (Kirchherr and Charles, 2018).

1.4.3 Database and document review

The Outward Investment Database of Ministry of Foreign Trade and Economic Cooperation, the Project Database of China Public-Private Partnership Centre and the database of Bridata Technology were used primarily to analyse the transition of the PPP governance institutional framework in the China domestic and BRI contexts. Very limited research has been conducted in academic literature on the BRI infrastructure PPP. Therefore, the documents, policy paper and reports released by the government authorities and non-disclosed contracts of the private-owned infrastructure companies were reviewed in addition to the database review in order to extract more comprehensive data and fill the information gap.

1.4.4 Questionnaire investigation

For the study of capital structure design in Chapter Five, data was obtained from the questionnaire in order to examine the determinant factors associated with capital structure selection and the characteristics of sponsors' financing behaviours. The analytical results of the questionnaire also lay the foundation for the discussion addressing the equity and debt structure decision-making in Part II of Chapter Five. The experts selected as the questionnaire survey recipients have in-depth practical experience in the actual BRI PPP projects, particularly those who are familiar with project finance and cooperate governance.

The experts identified as the questionnaire recipients have had at least three years of industrial experience or above and hold senior positions the financial institutions and the infrastructure companies which have been intensively involved in the BRI infrastructure investment. Drawn upon the research of Chinese infrastructure project capital structure (Sheng, 2013), the questionnaire design considers the context of BRI and aspects of debt repayment capacity, project profitability, stakeholder interest and management strategy in order to provide a more comprehensive spectrum of the determinant factors affecting capital structure.

1.4.5 Cross-check and validation

This study interacts with a wide range of representatives from both the public and private sectors, and each of them holds a different standpoint. An important consideration when conducting such research is whether we can rely on the data as an accurate portrayal of the views or position of the interviewees and respondents. Therefore, the triangulation approach is employed to cross-check the data in order to overcome the intrinsic biases that come from a single method and single source. Triangulation is broadly defined by Denzin (1978) as the combination of methodologies in the study of the same phenomenon. Assisted by triangulation, researchers can improve the accuracy of their analysis based on multiple reference points (Lewis-Beck et al., 2004). Case study, close dialogue, database, document review, and questionnaire surveys are leveraged to collect data to support this study. Using the close dialogue and questionnaire survey approaches, I ask different respondents the same question and the same respondents the same question but in more than one way, and also compare the results with case studies and documents to validate the outcome of this research. By using triangulation, this study is able to search for regularities and consistency of the findings and control any threats to the validity of the results (O'Donoghue and Punch, 2003).

1.5 Thesis limitation and consideration

This thesis aims to explore the application of PPP to infrastructure investment and development, especially the China-initiated projects in the context of the BRI. It should be acknowledged that there are limitations to the analysis conducted and the generalisation made from the findings. These limitations are considered below.

Firstly, this research mainly analyses the transport and energy infrastructure in the BRI countries. However, this thesis does not have comprehensive coverage of all types of

infrastructure given that the other types of infrastructure, such as water, environment, hospitals and schools are still not very common. In fact, although these infrastructure types, including water, energy and transport have common characteristics, the development, investment model and governance framework thereof vary from sector to sector due to different developing requirements, financing models, business models and regulatory standards. Nonetheless, since the overall aim of the thesis is to understand how PPP can be utilised to serve the infrastructure development, and investment in the context of the BRI and different types of infrastructure inherently have similar fundamentals in this respect; the study of the application of PPP to the transport and energy infrastructure is sufficient to explain the form and function of PPP in the specific context of PPP.

Secondly, although both qualitative and quantitative methodologies utilised in this thesis contribute to the analysis of institutions underlying PPP governance institutional frameworks, stakeholder relationships, capital structure design and risk management for infrastructure PPP projects in the context of the BRI, the quantitative analysis based on a bigger data pool can provide more breadth to this burgeoning research area. Due to the unavailability of reliable BRI infrastructure project-level data in the early stages of this burgeoning research field, this thesis primarily focuses on the key stakeholders to appraise the incentives behind their behaviours and conceptualise these behaviours by building the theoretical model. The quantitative method is mainly used in the study of the determinants of capital structure based on the data collected from the questionnaire. The project-level data is very limited currently, it is not only the bottleneck for this study but also the challenge for other research focusing on the BRI.

Finally, this thesis primarily focuses on the BRI infrastructure PPP projects initiated by Chinese stakeholders. Although there are also some BRI infrastructure projects initiated by other international stakeholders, such as the solar power plant in Senegal initiated by Vinci and

financed by the German bank KFW and Senelec⁶ and the high-speed train project in Morocco led by French company TGV and funded by the governments of Morocco, France, Saudi Arabia and Kuwait⁷, this research chooses to predominantly focus on the China-led BRI infrastructure PPP due to the limitation research spectrum and accessibility of research resources. More importantly, as the BRI is an initiative proposed by the Chinese government, this research will be able to provide a unique perspective to understand the PPP led by the Chinese stakeholders and lay the foundations for future multilateral collaborations.

⁶ VINCI Energies, via its brand dedicated to energy transition-Omexom, has been awarded by the Société d'Electricité du Sénégal - Senelec - a contract to build eight photovoltaic power plants with a combined capacity of 17 MW in Senegal within 10 months. The project represents a €26.8 million investment, financed by the German bank KFW and Senelec. The handover was scheduled in July 2018.

⁷ The French-made double-decker TGVs have been tested and launched connecting Tangier with Morocco's economic capital Casablanca. The new trains are made by manufacturer Alstom and can reach speeds of 200 miles per hour. They will cut the journey time between the two cities by more than half. This is double the speed of South Africa's Gautrain, launched in 2012, which falls short of the criteria for high-speed rail. The \$2 billion project has been in development for a decade, funded by the governments of Morocco, France, Saudi Arabia, Kuwait, and the UAE.

CHAPTER TWO: THEORETICAL CONTEXT

The purpose of this chapter is to outline the overarching theoretical context in this thesis and review the existing studies about PPP. It starts with outlining the theoretical concept of PPP, followed by emphasising its relevance to the theories of institutional economics, contract, game and principal-agents and argues that understanding the complex and heterogeneous infrastructure investment, development and governance requires an integrated theoretical framework based on the theories above. In addition, this chapter summarised the scholarly research of PPP governance and contract so as to provide a more comprehensive review in order to underpin the theoretical basis for the subsequent analytical chapters.

This thesis defines PPP as a long-term contractual relationship initiated by the government for specific public projects, mainly infrastructure projects, between the public and private sectors, involving project financing, construction, and operation. The aim of PPP is to integrate the capacity of the private sector in order to better provide infrastructure and public services that are traditionally accountable to the public sector. In PPP, the government first develops quality and pricing standards for infrastructure and services, and on this basis, tenders are initiated to identify suitable private sector consortia and establish formal PPP contracts.

2.1 PPP — a hybrid organisation in New Institutional Economics

From the perspective of institutional economics, the PPP is a hybrid organisation. On the one hand, there is an interdependent relationship between the public and private sectors that make up the PPP. The consortium responsible for the project may even be funded by government and private sector agencies, but at the same time they remain relatively independent, and each has full decision-making power. On the other hand, the establishment of PPPs can enable both public and private partners to achieve higher quasi-surplus. This is the main incentive to

promote resource sharing and long-term cooperation. PPP allows private sector institutions to participate in investment and financing, not only to share the benefit but also the risks. Common forms of heterosexual organisation include strategic alliances, joint ventures, partnership sourcing, and franchise, etc (Ménard, 2004).

The new institutional economics is also closely related to PPP and can be seen as the application of incentive theory in the provision of public service. In order to ensure efficient delivery of public services through infrastructure, the core is to provide incentives and governance. As for the incentive mechanism design theory, the new institutional economics is mainly based on three key assumptions: the asymmetry of information, lack of commitment and imperfect system. The reform of governance and the introduction of competition are essential to reduce information costs and provide appropriate incentives. The methods adopted by the incentive system usually include inter-regional competition, franchise bidding system, price cap system, social contract system, etc. Many methods are covered in the PPP system framework. In fact, the PPP itself is an extension of the incentive system to the private sector.

2.2 PPP governance and its embeddedness in the administrative institutional framework

The emerging consensus of the new institutional economics (NIE) pathfinders, including Ronald H. Coase, Douglass C. North, and Oliver E. Williamson, is that ‘institutions matter’ when analysing economic performance over time and space. They focus on the underlying causes of the emergence of new institutions, the evolution of existing institutions, and the correlation between institutions, and economic performance (Coase, 1984; North, 1991; Williamson, 1998a). Frequently cited NIE concepts in other research studies consist of transaction costs, information asymmetry, enforcement mechanism, asset specificity, moral hazard, and governance structure (Alston et al., 1996b; Aoki, 2008; Williamson, 1985, 1996).

In addition, the institutions are the norms and rules that affect the performance of economies by reducing uncertainty in structuring incentives in such exchange (North, 1990). These institutional rules are rooted in and reflected by the informal institutions such as society and culture. On the other hand, the legal and administrative systems are regarded as the formal institutions. Neoclassical economics suggests that inefficient institutions will be replaced, thus leading to the institutional transition. During this transition, the transaction costs are influenced by institutions and institutional development is accordingly path-dependent (North, 1990).

Governmental institutions play pivotal roles in ensuring the successful development of the PPP infrastructure. For example, the public sector needs to establish a broad and comprehensive PPP legal framework, in order to assess the value for money when selecting a delivery system, create a PPP unit for policy development, maintain transparency over the course of the selection process, standardise procedures and contracts, and use performance specifications (Ahmed, 2007). Meanwhile, the government is also required to create a central counselling unit, in order to develop a set of guidelines and tools, to select a set of pilot projects and to subsidise feasibility studies (Koch and Buser, 2006). Wibowo et al. (2015) analysed the government-led critical success factors for the PPP in infrastructure provision. Not only are many critical success factors government-led, but the government also plays indispensable roles in the life-cycle of the infrastructure development in the form of PPP, which requires the establishment of a well-defined, but not overregulated, regulatory framework (Pongsiri, 2002).

PPP was introduced to China over the course of two decades in the early 1990s in order to release the public finance pressure of infrastructure investment (Chan et al., 2009). As a result, the delivery of infrastructure in China has been moving from the realm of government to that of the private sector. In the same period, governments from the central to the regional levels were actively involved in the institutional transition by redefining the function and

devising/enacting new laws and policies. The PPP has also experienced different stages during the social and economic development of China. It is argued that the adoption of Public-Private Partnerships in China is a path-dependent process. The specifics of Chinese political and institutional context are recognised as important factors that influence the performance of Public-Private Partnerships (Mu, Jong and Koppenjan, 2011). Zhang et al. (2015) conducted an in-depth analysis from the institutional perspective, demonstrating the relevance of culture and law with the Chinese institutional framework and its implication for PPP governance in China.

Laffont (2004) analyzed the development, institutions and competition of developing countries and studied the reform process in China. Relative to developed countries, developing countries are less mature in terms of infrastructure provision, such as telecommunications, electricity, gas, water, transportation, etc., and these industries are characterised by huge investments and long payback periods. Therefore, the main challenge for developing countries is how to attract domestic and international capital. In developed countries, the network is more mature. Inefficiency remains in mature markets, causing high incentives, such as the restrictions on prices, privatisation and so forth. Although competition is generally beneficial to the economy, the governance thereof is still in need of development. In developing countries, the introduction of competition should be monitored and consider institutional insufficiencies, such as tax inefficiencies, inadequate regulation and low levels of education and expertise. Therefore, the establishment of a compatible and efficient institution is necessary. Laffont and Zhang's research on the application of the institution bears a constructive implication for the study of PPP in the BRI context.

2.3 PPP in the form of contract: transaction and collaboration

The application of contract theory to study the PPP is one of the important footholds of this thesis. Therefore, it is necessary to sort out the development of contract theory and understand the key concepts and theoretical foundations. The premise of the development of contract theory is transaction cost economics (TCE) (Williamson, 1989). Transaction cost economics has so far been the most widely used theory in the fields of economics, management, and political science. It regards all economic activity as a transaction, and all transactions are governed by a contract that is either explicit or implicit. By assuming that participants have bounded rationality and opportunistic tendencies, transaction cost economics stipulates that the relationship-specific investment between the parties is the key to the formation of the surplus. The main conclusion of TCE is that different transaction types should match different governance structures. In other words, the optimal governance structure can optimise the cost of *ex-ante* and *ex-post* transactions.

PPP, as one of the forms delivering infrastructures, is defined as cooperative and long-term contracts between the public and private sectors that involve the sharing of resources, risks, responsibilities, and rewards for the provision of public assets and service (Hodge and Greve, 2005; Linder, 1999). The performance quality standards, the delivery of service and the 'health' of contracting stakeholders are also important factors in the governance of contractual relations (Grimsey and Lewis, 2004). Contract theory deals with a fundamental problem of economic cooperation, which is closely related to the PPP given it is a cooperative partnership among different institutions.

The theory of contract design can be subdivided into the theory of complete contracts and the theory of incomplete contracts. Complete contract theory focuses on how the principal who has

the residual claim rights but is at a disadvantage in obtaining the information can identify, filter, and effectively incentivise the agent by designing the optimal contractual arrangements. It is hence, also called incentive theory (Holmstrom and Milgrom, 1991; Laffont and Martimort, 2002; Laffont and Tirole, 1991). In the cooperation, two (or more) parties can jointly generate a surplus in addition to what each of them can generate on their own. The amount of the surplus depends on the actions that each of the parties takes. The risk is that each party has the incentive to behave opportunistically such as to maximise its pay-off rather than the joint surplus. If the parties can form a complete contract that specifies all the contingencies and actions that each of them will take at every possible stage and if this contract can be enforced, then the risk can be controlled.

However, in practice, and especially in the long-term PPP contract, it is often impossible to form complete contracts. The uncertain and non-observable actions taken by the parties raise the risks of moral hazard and adverse selection and demand the renegotiation process (Hart and Tirole, 1988; Grossman and Hart, 1983). Thus, the theory of incomplete contract can describe the real situation better. In incomplete contract theory, the contract cannot enforce the desired behaviour directly; rather, it offers incentives that induce the parties indirectly to behave more efficiently. The incentives include but are not limited to financial payoff, the control right and property right (Schmidt, 2017). Hart (2003) states that if the bundling investment of both the construction and the operation phases provides incentive along the project life cycle, then it would be possible to apply the PPP. Meanwhile, due to the incompleteness of the contract, the renegotiation will be adopted to optimise the distribution of the return of the investment as well as the ownership arrangement.

2.4 Principal-agent theory and capital structure design

The principal-agent theory emphasises asymmetric information and its impact on the PPP arrangement. The optimal mechanism should promote proper investment with minimum incentive cost, which can also illustrate the desired relationship between the stakeholders involved in the PPP. The application of the principal-agent model covers a broad range of issues, such as the interlinking of agrarian contracts, the design of incentive schemes according to the aggregate performances, and finally the choice of integration of firms and its incentives (Laffont and Martimort, 2002). However, problems still remain in practice. For example, what has been observed from the institutional investment practice indicates that the extended chain of principal-agent relationships is problematic. In particular, the introduction of new incentives at each link of the chain served to change the original motives of the asset owners. It is often the case that the ultimate investment decisions made maximised the utility of the asset managers but not the principal. This broken agency phenomenon (Sheffer and Levitt, 2010) stemmed from a misalignment of interests due to an inappropriate distribution of risks and expected returns among the principals and agents. In infrastructure projects, the broken agency issue results in some contradictions of risks and rewards between the short-term and long-term parties that can lead to suboptimal outcomes (Clark and Monk, 2017). It is thus necessary to address the conflicts and align the key parties' interests in the PPP, especially in the key processes that determine the payoff distribution and risk allocation.

As a new form of public goods supply in the past decade, PPP has been actively promoted by the government, largely because the introduction of capital from the private sector can alleviate the government's financial constraints. As far as the cost of capital is concerned, the government has a strong risk-distributing ability and a reliable credit level, so the financing cost is lower than that of the private sector. Bettignies and Ross (2004) argue that the put option of

private sector borrowers is one of the reasons why there is a higher financing rate for them. Signing a long-term contract with the government helps private sector borrowers to obtain a favourable interest rate from the lender. In addition, the contractor has the strongest control over the completion time of the construction, so it is beneficial if the contractor takes responsibility for project financing. Moszoro et al. (2008) argue that PPP can be seen as a public-private joint venture, in which the public sector and private sector equity proportion sector is a key variable. The cost of capital for public sector investment is lower than that of the private sector, but the involvement of the private sector in investment can promote technology transfer and thus reduce the development costs required for the project. Therefore, the joint ownership structure of the public and private sectors has the potential to reduce investment cost.

PPP also has different financing channels, which will affect the remaining distribution and incentives of each participant, and thus affect the outcome of the project. As the most common form of financing, external financing helps PPPs transfer financial risks to third parties and provides regulation and supervision for project evaluation and implementation. Vaaler et al. (2008) proposed a multi-level theoretical framework for understanding the factors shaping credit risk and capital structures through the assessment of 238 projects in the Asian infrastructure market from 1995 to 2004. These factors include countries related to macroeconomic theory, agency theory, and transaction cost theory. However, studies on other factors affecting capital structure are still rare.

2.5 Managing the risks of PPP

An important feature of PPP over traditional forms of public supply is that the government transfers risk to the private sector to a certain extent. Therefore, the proper allocation of various risks between the public and private partners is a key concern to achieve PPP efficiency. The management of risk is the underpinning requirement of the contract negotiation in addition to

the design capital structure. Risk identification, risk assessment and risk allocation are considered as the three core components of risk management. The success of project management depends on the extent to which the risk involved can be identified, understood, measured and allocated to the appropriate parties (Tah and Carr, 2010). In addition, investigating the risk allocation preferences of the stakeholders prior to the contract negotiation is vital for driving value creation as well as balancing rewards in line (Delmon, 2017; Villani et al., 2017.).

Many studies have been conducted in order to explore the risk management approaches for PPP projects in various regions, especially from the perspective of risk allocation. The preferred risk allocation in PPP projects in the UK was examined using a questionnaire survey, the findings of which indicate that the risk factors should be handled on a case-by-case basis (Li et al., 2005). The governance example of a toll way PPP project in the Indonesian market was analysed to provide the best local experience (Abednego and Ogunlana, 2006). The decision-making process of an Australian rail project was examined by Ng and Loosemore (2007). Ke et al. (2010) identified the principal risk factors and the risk allocation preference between the public and private sectors in the Chinese PPP market. The risk allocation questionnaire survey initiated by Hwang et al. (2013) provided the risk allocation preference from the perspective of the contractors. A comparative analysis of the cross-country risk allocation was conducted in order to summarise the commonalities and differences regarding the PPP allocation of infrastructure projects (Chou and Pramudawardhani, 2015). Based on a case study of the ‘big battery’ in South Australia, Clark (2019) analysed why and how private investors may require that the public sector bears the costs of infrastructure outside the range of ‘normal’ risks and emphasised the implication for infrastructure investment in the change of climate. However, there is still a significant research insufficiency pertaining to risk management, particularly the risk allocation of infrastructure provision in the form of PPP under the context of the BRI.

2.6 Partnership strategy selection of games

In PPP, conflicts and strategic interactions between the key stakeholders are common and influence the performance of PPP infrastructure projects. Game theory can be defined as the interactive decision theory, which can more accurately express the essence of the theory (Ho, 2011). The application of game theory in the construction field, although limited, confirms its value as a systematic conceptual framework for strategy selection. Certain rules of the game may be considered self-enforcing and may thus become institutionalised; given that these rules are endogenously created through the strategic interactions of agents, they are held in the minds of agents. Since conventional NIE methodologies tend to be empirical and descriptive, a common criticism is their lack of scientific rigour. Alston et al. (1996a) claimed that the unique circumstances of institutional change often limit the number of data points, while quantitative measures such as conventional statistical analysis are barely possible. The advantage of introducing a game-theoretical approach is the intuitively appealing and plausible notion that institutional interdependencies, coherence, and robustness are considered analytically tractable. Combining the case study and the game-theoretical perspective has further completed the NIE research.

There are two types of games: non-cooperative games and cooperative games (Nash, 1953, 1951). The two basic conditions for the existence of cooperative games are: (1) For the coalition, the overall payoff is greater than the sum of the payoff of each of its members when they operate alone; (2) Within the coalition, there should be an allocation rule with a Pareto improvement nature, that is, each member can obtain more payoff than if they did not join the coalition (Cooter, 1998; Moulin, 2014). The existing application of game theory to the analysis of PPP mainly focuses on the relationship between the public and private parties in the non-collaborative scenarios. Ho (2006) established a non-cooperative game model in order to study

the decision-making process of bidding compensation from the perspective of the public sector. Medaa (2007) analysed the bargaining process of risk allocation between public and private sectors in transport infrastructure agreements through a game framework when the players are confronted with opposite objectives in the allocation of risks. Bettignies (2009) assessed the controversial situation of when the private financing of public projects is more suitable than public investment. Boukouras et al. (2016) proposed the selection of private players in the bidding process in the game theory framework. However, little research has been conducted to analyse the collaborative game, and there is a lack of focus on the partnership among the private stakeholders.

2.7 Institutional and relational turns in infrastructure investment—an observation from the lens of Economic Geography

Institutional turn recognises that various institutions on which economic activity depends should be given due attention for a full understanding of the form and evolution of the economic landscape (Martin, 2011). Contrary to the mainstream economics in abstracting the economic concept from the social, political and cultural context, there is a shift in the economic geography that focuses on the background factors including the ‘soft’ socio-cultural, relational and contextual aspects of economic behavior (Martin and Sunley, 2007). Subsequently, concepts from institutional economics and economic sociology received increasing attention from economic geographers to unfold the processes of regional development in the context of globalization (Mackinnon et al., 2009).

The institutional turn in economic geography derives from the shift of social regulation mode, increasing recognition of the socio-cultural construction and growth in institutionalism (Lee and Wills, 1997; Martin, 2000; North, 1990). Within the trend of institutional turn, economic geographers have summarised that economic activity is socially and institutionally situated,

requiring to be understood as enmeshed in wider structures of social, economic, and political rules, procedures and conventions (Mitchell 2000). Hence, the institutionalist approach to economic geography is needed for a better understanding of the characteristics of infrastructure investment and governance in different geographical and institutional contexts.

The rise of a relational approach to economic geography coincides with the extensive restructuring of market production in global economies together with the institutional turn. In addition to treating the formal as well as informal interrelationships among agents in the activities of infrastructure investment as mere contractual exchanges for the purpose of minimizing the transactional cost, the inter-firm linkages also facilitate the collaboration in expertise and resources sharing to create added value for competitive advantage (Maskell, 2001). Given that the past theoretical models in economic geography were not fully able to account for the micro-level dynamics among economic agents in the emergent forms, the relational turn can be viewed as a response to the theoretical limit of economic geography and analyse the transactional behaviours in a specific context (Bathelt and Glückler, 2003).

2.8 Conclusion

Research gap of the BRI infrastructure PPP

This chapter has briefly outlined the overarching theoretical context and the relevant research about the governance, investment, and development of infrastructure PPP. Although there are many studies about each of the topics in different contexts, in-depth research related to BRI is still limited. The research gaps include:

1. A lack of systematic institutional governance for PPP transition. The current research on the institutional governance for PPP transition still focuses on the national scale and

the establishment of the new multilateral financial institutions, for example, the Asian Infrastructure Investment Bank. These studies offer us a certain level of understanding of the current status, problems and constraints encountered in the infrastructure PPP in different countries and the importance of institution. However, there is still a lack of systematic institutional analysis, especially from the dynamic evolution perspective and the BRI context, in order to fully address the question: how have China's institutional arrangements evolved to facilitate and govern the infrastructure PPP and how is it relevant to infrastructure PPP in the context of the China-led BRI?

2. A lack of research about the partnership between the private sector stakeholders. There is extensive research on the relationship between public and private sector stakeholders, exploring the optimal strategy for the public sector to select the private sector bidder. However, the internal relationship between the private sector stakeholders has not been explored yet. Given the fact that most of the private sector stakeholders will form a private consortium to bid for the infrastructure PPP and implement obligation in the PPP and the private consortium plays a critical role in enforcing contracts, hence it is necessary to address the question: how should we understand the dynamics among the private stakeholders and how can their partnerships be optimised so as to facilitate the implementation of BRI infrastructure PPP?
3. The factors affecting the capital structure design of BRI infrastructure PPP projects are not comprehensively considered and systematically studied. Although there are many studies about improving the financial performance of infrastructure projects, there is a lack of comprehensive analysis of the behaviour of key stakeholders, investment structure, financing channels, sources of capital and nature. Infrastructure projects have their own characteristics, especially in terms of weak profitability, the large scale of

capital demand, and the long cycle. Planning the investment structure, financing channels and matching of capital with their characteristics is the key to the project's smooth operation. At the same time, the investment behaviour characteristics of different stakeholders are also crucial. Thus, it is necessary to address the question: what are the determinants required to design the capital structure of the BRI infrastructure in the form of PPP, and how can the collective and individual benefit be improved?

4. There is a lack of systematic risk allocation and management research for BRI infrastructure PPP projects. The principle of PPP risk sharing has been deepened, but in practice, these principles overlap and contradict each other, causing unfairness in the actual risk management strategy. Problems, such as low efficiency, have hindered the participation of the private sector. Therefore, in the BRI context, the existing risk management principles and frameworks should not be directly copied, but the risk identification, allocation and management should be based on the actual situation of the BRI PPP infrastructure project. Thus, it is necessary to address the question: what are the risks in BRI infrastructure PPP, and what is a fair and sustainable risk management framework for the stakeholders?

BRI infrastructure PPP research: a multi-level analytical framework

The academic enquiry on infrastructure PPP from the perspective of institutional, contract, game, and principal-agent theory is an important and growing field. These theories provide a useful lens to answer the questions about economic and managerial phenomena on infrastructure PPP due to the infrastructure investment and governance consisting of significant information asymmetries, long-term contracts, repeated transactions, and complicated

interrelationships among the stakeholders. In addition, the diverse geographic, political and economic contexts of the countries along the Belt and Road further increase the complexity of the research. Therefore, a multi-level analytical framework and an integrated theoretical framework are necessary to be compatible with the features of BRI infrastructure PPP.

As a hybrid organisational structure, the PPP is expected to leverage the advantage of both the public and private sectors given that neither the public nor the private provision of infrastructure is uncontested. Building upon the institution and integrating the nature of the infrastructure provision in the form of PPP, this study selects the Williamson analytical framework (Williamson, 2000) under the new institutional economics (NIE), which guides the flow of the analysis. It focuses on the underlying causes of the emergence of new institutions, the evolution of existing institutions, and the correlation between institutions, and economic performance (Coase, 1984; North, 1991; Williamson, 1998a). In this framework, there are four levels of factors associated with institution governance and economic transactions (Fig.2).

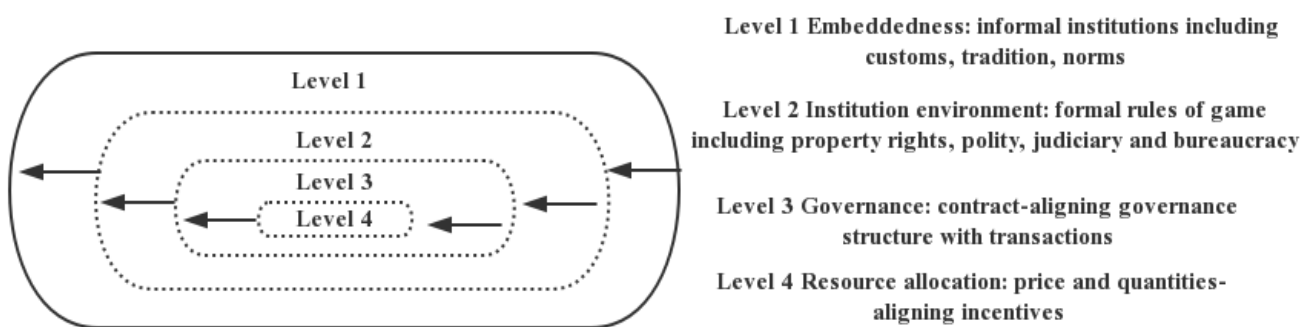


Figure 2 Multi-level NIE analytical framework

The first level, the informal level, refers to social embeddedness, including informal institutions such as customs, traditions, norms, and so forth. The determinant factors are regarded as difficult to quantify but indeed exert an impact on the inner levels. The second level is formal

and consists of formal rules, such as property rights, polity, the judiciary and bureaucracy, which eventually provides the institutional environment. The third level refers to governance or the so-called rules of the 'game'. This level aligns governance structures with the purpose of lowering the transactions and improving the project performance. The fourth level is the allocation of resources and employment that concerns prices, quantities and incentive alignment. This level particularly emphasises the project-level execution and management.

Among these four levels, on the one hand, each superior level imposes constraints on the interior level from level 1 to level 4. On the other hand, each interior level provides feedback to each superior level from level 4 to level 1. Guided by this framework, the analysis of this study first focuses on the governmental institution framework of BRI infrastructure provision in the form of PPP from the perspective of the public sector at levels of 1, 2 and 3 (Chapter Three). Then it transitions to the stakeholder relationship and the contracting ability and enforceability in the private sector with the game theory as levels of 1, 2 and 3 (Chapter Four). The capital structure (Chapter Five) and risk management (Chapter Six) of BRI infrastructure PPP projects are discussed to address the issues at level 4.

Considering that the research subject in the PPP hybrid organisation at each level of the NIE varies, therefore, a theoretical framework based on contract theory (Holmstrom and Milgrom, 1991; Hart and Tirole, 1988; Tirole, 1999), cooperative game theory (Harsanyi and Selten, 1988) and principal-agent theory (Ross, 1973; Grossman and Hart, 1983; Rogerson, 1985) is proposed (Fig. 3). In the PPP hybrid organisation, the public sector provides institution as the basis of function and governance. Meanwhile, the private sector stakeholders usually participate in the PPP in the form of a consortium. PPP can be interpreted as a game due to a set of interactions involving public and private sector players with complex characters, particular strategy, behaviour, interest, and so forth. The cooperative game of the public and private sector

stakeholders in the BRI infrastructure provision means that all game participants are moving in the same direction in order to maximise the overall return of infrastructure development and minimise the risks from the initial construction phase to the operation phase until the end of the partnership. The incentive mechanism is another critical theoretical standpoint of the partnership between the public and private stakeholders.

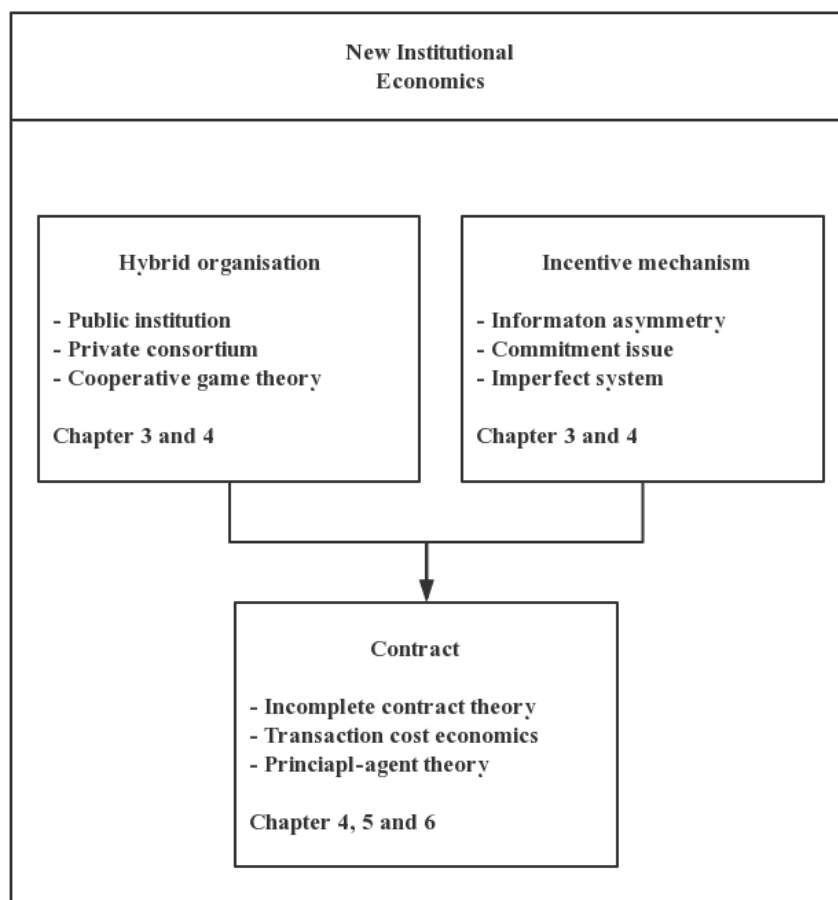


Figure 3 Integrated theoretical framework

Given the context of the BRI and the features of infrastructure, the application of the PPP model to infrastructure provision will be inevitably confronted with the issues of information asymmetry, commitment and imperfect systems. The leverage and balance of the incentive mechanism therefore become the core for improving the governance and motivating the

involvement of private sector stakeholders. Chapters Three and Four aim to discuss how the public sector can provide an enabling facilitating institutional environment and how private sector stakeholders should collaborate to deliver the infrastructure in the context of the BRI, respectively. The incentive mechanism and cooperative game provide the theoretical basis for Chapters Three and Four as the reduction of information costs and appropriate incentives are essential to the reform of governance and the introduction of PPP.

The practical aim of PPP is benefit and risk sharing via contract. In contract theory, the optimal contract is one form of the contracts, the complete contract. However, in reality, the contract is inevitably incomplete due to the *ex-ante* contract lacking the full spectrum capacity of defining remedies for all unforeseeable contingencies and outcomes in the long term. Moreover, drafting a complete contract is costly. From the ownership perspective, when it is expensive to list all specific rights over assets in the contract, the optimal solution may be to let one party purchase all residual rights (Grossman and Hart, 1986). Therefore, the transactional cost and issues of the principal-agent are the core factors affecting the preference of stakeholders, which also eventually influence the contractual ability and contract enforceability of the PPP. Chapters 5 and 6 aim to understand how capital structure is designed and how risks should be managed so as to align the objectives and interests of critical stakeholders in the PPP. In order to achieve the optimal solution of benefit and risk sharing in the PPP, the decision-making process for capital structure design and risk management are scrutinised based on the equilibrium of the preferences of different stakeholders.

CHAPTER THREE: THE TRANSITION OF THE ADMINISTRATIVE INSTITUTION FRAMEWORK OF PPP IN INFRASTRUCTURE DEVELOPMENT

3.1 Introduction

PPP models have been widely applied for the provision of infrastructure goods and public services on the basis of a long-term cooperation between the public and private sectors for the past three decades in mature and emerging markets. Since their emergence in the 1980s in the UK, PPPs have been rapidly applied in many fields, including transport, energy, water and others, which can also be seen in many other countries around the world (Akintoye et al., 2003).

In the case of a PPP, there are two parties seeking to establish a partnership together, namely the public sector and the private sector. It is stated that governmental institutions play pivotal roles in ensuring the successful development of the infrastructure PPP (Kumaraswamy and Zhang, 2001). The inappropriate involvement of the government or the incapability may lead to project failure. Scholars have also attempted to clarify the roles of the government in facilitating PPP projects. For example, the public sector is expected to establish a broad and comprehensive PPP legal framework, create a PPP unit for policy development, maintain transparency over the course of the selection process, standardise procedures and contracts, and to use performance specifications (Ahmed, 2007). Meanwhile, the government is also required to create a central counselling unit, in order to develop a set of guidelines and tools, to select a set of pilot projects and to subsidise feasibility studies (Koch and Buser, 2006). Wibowo et al. (2015) analysed the government-led critical success factors for the PPP in infrastructure provision. In their research, meso-level and micro-level factors are defined as those factors

specific to PPP business areas and project activities, respectively, that are under the control of the public sector. Other factors that affect economies as a whole, such as the general investment climate (e.g., macroeconomic and political stability), are considered to be macro-level factors that are closely related to the public sector as well. In addition to many critical success factors are government-led, double confirming that the government plays an indispensable role in the life-cycle of infrastructure development in the form of PPP, which requires the establishment of a well-defined, but not overregulated, regulatory framework (Pongsiri, 2002).

PPP models have been introduced to China in the early 1990s over the course of two decades (Zhang et al., 2015) in an attempt to release the public finance pressure of infrastructure investments (Chan et al., 2009). In consequence, the delivery of infrastructure in China has been moving from the realm of government to that of the private sector. In the same period, governments from the central to the regional levels were actively involved in the institutional transition by redefining the function and devising/enacting new laws and policies. The PPP has also experienced different stages along the social and economic development process taking place in China. It has been argued that the adoption of PPP in China is a path-dependent process. The specifics of the broader Chinese political and institutional context are recognised as important factors that influence the performance of Public–Private Partnerships (Mu et al., 2011). The impacts and effects of the decisions made under transitory conditions are related to the administrative institutions, policies and socio-economic environment. Hence, unfolding the institutions, policies, projects and the corresponding socio-economic status may assist the understanding of the transition of the application of Public-Private Partnerships in infrastructure provision in China, as well as in a broader jurisdiction under the BRI.

This chapter starts with a systematic analysis of the institutions, policies and projects from the Chinese domestic angle based on the analytical framework of Williamson’s New Institutional

Economics, which has been elaborated in Chapter Two. Guided by the Williamson framework, the following sections investigate the development of PPP in China's infrastructure sector based at levels of 1, 2 and 3.

The first level refers to social embeddedness, including informal institutions, such as customs, traditions, norms, and others. The second level is formal, and consists of formal rules, such as property rights, polity, judiciary and bureaucracy, which eventually provides the institutional environment. The third level refers to governance structure alignment with the purpose of lowering transactions and improving project performance.

Section 3.2 provides a general overview of the institutional framework in China and the relations between the evolution of institutions and the country's socio-economic development. The changes affecting both institutions and the socio-economic norm have led to the subsequent development of the governance of infrastructure provision in the form of PPP, which can be classified into four major phases with distinct features based on the core evidence from the socio-economic development, policy and project axes. Following the analytical approach adopted in Section 3.2, the BRI infrastructure PPP governance framework is disclosed in Section 3.3.

The features of the institutional framework in China leading cross-border PPP infrastructure projects are presented alongside the domestic PPP governance characteristics. Findings indicate that the application of PPP goes in tandem with the evolution of China's institutional structure, and the performance of PPP is closely related to its institutional environment. The BRI infrastructure PPP governance structure demonstrates certain independencies from the current domestic framework, but it also shares some commonalities. The synthesis of results and

relevant implications are put forward in order to enhance China's institutional arrangements for PPP promotion, particularly with reference to the BRI cooperation in Section 3.4.

The significance of the study in this chapter lies in both theoretical and practical aspects. Theoretically, based on the integrated analysis of both domestic and BRI infrastructure PPP governance, this study may assist the understanding of the underlying differences and commonalities. Practically, this study can offer the potential stakeholders in the BRI a more comprehensive view of the philosophy and principles of PPP governance adopted by relevant Chinese administrative institutions in order to bridge the knowledge gap. After all, this chapter provides a fundamental basis to further the research attempting to unfold the dynamics between the private stakeholders at the same levels and analyse the capital structure and risk management at levels 3 and 4 in the NIE framework (Williamson, 1998).

3.2 The administrative institution framework of infrastructure PPP governance—domestic angle

Institutions are constituted by regulative, normative, and cultural-cognitive elements that are taken together to become relevant to social activities and material resources. These elements are informal or formal and serve as the crucial pillars of the structure of institutions (Scott, 2008). According to the Political Coase Theorem (PCT), the national character is determined by material fundamentals that may be reflected in the social, political and economic dimensions. The PCT also implies that the policies in line with the society's best interest will be prioritised with consideration of the social, political and economic status. This will contribute to the transition and optimisation of institutions over the long run. Moreover, the institutional framework is often reformed to be more conducive to the new norm of social, political and economic fundamentals (North, 1990). Structured on the basis of these theories, this section

aims to illustrate how the social, political, and economic fundamentals affect the institutional framework and how the institutional framework can facilitate the development of these fundamentals retrospectively in China.

3.2.1 Institutional transition throughout the process of socio-economic development with Chinese characteristics

Since its reform and opening up in 1978, the Chinese government has been undergoing rapid change due to the drastic development of the economic fundamentals, which resulted in the subsequent institutional reform and transition. However, the reform and transition are determined dynamically through a long-term trial and error process, rather than achieved at once. So far, reference may be made to eight institutional reforms in 1982, 1988, 1993, 1998, 2003, 2008, 2014 with the latest one taking place in early 2018 (Poeples.cn, 2018; The People's Congress, 2008). These institutional reforms were implemented during different phases of the economic reform and market opening up process. Meanwhile, the institutional reforms are in line with the elections as the general election of the People's Committee is held every five years.

From 1978 until 1992, the economic reform and market opening up included the opening up of the domestic market to foreign investment, the permission for initiating privately-owned businesses to complement the market, which was by then monopolised by state-owned enterprises (SOEs) and the decentralisation of the government planning economy at that time. Meanwhile, the aim of the reform includes institutional streamlining to adapt to the rapid social and economic development, indicating the tendency towards a simpler and more efficient administration. For example, the Fifth National People's Congress passed a resolution on the institutional reform in 1982 and stipulated the streamlining goal. As a result, the number of departments under the State Council was reduced from 100 to 61.

From 1993 to 2003, the reform of institutions was continuously carried out in the context of establishing the marketised economic system with Chinese characteristics. Streamlining institutions, separating the functions and responsibility of the government and enterprises constitute the core approaches of this reform. In 2003, the background of the institutional reform was China joining the WTO (World Trade Organization). The significant progress of this reform lies in grasping the prominent problems in the social and economic development at that time and further transforming the functions of the government. For example, the establishment of the SASAC (State-owned Assets Supervision and Administration Commission) aims to further consolidate the reform of the state-owned assets management system, and the formation of the Ministry of Commerce in an attempt to promote the reform of trade and commerce while the State Development Planning Commission was reorganised into the National Development and Reform Commission (China News, 2013).

In 2008, the State Council established five new ministries, including the Ministry of Industry and Information Technology, the Ministry of Transport, the Ministry of Human Resources and Social Security, the Ministry of Environmental Protection, and the Ministry of Housing and Urban-Rural Development in order to better address the existing social and economic problems, such as stimulating the country's economic development after the financial crisis, overcoming the housing and land supply crisis and combating environmental pollution (People's Congress, 2008).

In 2013, the Twelfth National People's Congress voted to pass the program of a mega institutional reform. During this reform, the State Council reduced the ministries to 25 constituent departments, for example, an initiative that included the abolition of the Ministry of Railways aiming at the separation of the government from enterprises and the upgrade of the integrated transportation system. The marketisation of the railway system directly contributed

to the rapid growth of the high-speed train in China starting with the year of 2013 (People's Congress, 2013). The most recent reform took place in March 2018. The number of state-level ministries and departments under the State Council has decreased by eight, with the Ministry of Land and Resources, the Ministry of Environmental Protection, the Ministry of Agriculture, the Ministry of Culture, and the National Health and Family Planning Commission being no longer in operation (Xinhua, 2018). The significant features of this reform indicate a tendency of improving institutional management by means of a merger of institutions based on functions and the transition of institution functions conforming to the new social and economic norm.

3.2.2 The institutions related to infrastructure PPP governance

The State Council, representing the People's Central Government, is the highest administrative authority in all types of economic activities related to infrastructure provision in the form of PPP. As the leading institution of all administrative ministries and organisations countrywide, it is in charge of planning national economic activities, leading and managing urban and rural construction, and allocating administrative functions to the local governments. Under the governance of the State Council, several ministries and administrations are relevant in this context based on their jurisdictions and functions. These institutions include the National Development and Reform Commission, the Ministry of Finance, the Ministry of Housing and Rural-Urban Development, the Ministry of Commerce and others. Their specific functions are explained in Table 2.

Table 2 The administrative institutions of domestic Chinese PPP infrastructure projects

Institution	Function
State Council	Governs the subordinate ministries and provides general PPP guidance for the related policy-making of the ministries in different sectors
Ministry of Finance (MOF)	Issues specific PPP governing policies under the guidance of the State Council, initiates public service PPP projects, provides the subsidy, supervises projects, operates and maintains the National PPP Centre and the National PPP Projects Demonstration Pool
National Development and Reform Committee (NDRC)	Issues specific PPP governing policies, initiates and plans infrastructure PPP projects, supervises projects, provides subsidies, and launches the National PPP Project Base
Ministry of Environmental Protection (MEP)	Responsible for the regulation, management and preservation of environmental protection and relevant industries, such as water treatment, civil engineering, clean energy and so forth; issues sector-specific policies, initiates and supervises the project in its jurisdiction
Ministry of Housing and Urban-Rural Development (MOHURD)	Responsible for the regulation and management of urban planning and of the construction industry; issues sector-specific policies, initiates and supervises the project in its jurisdiction
Ministry of Transport (MOT)	Responsible for the supervision and management of railway, road, air and water transportation regulations; issues sector-specific policies, initiates and supervises the project in its jurisdiction
National Railway Administration (NRA)	Responsible for regulation and management specifically in the railway sector; issues sector-specific policies, initiates and supervises the project in its jurisdiction; assists the Ministry of Transport
Ministry of Water Resources (MWR)	Responsible for the regulation, management and exploitation of water resources; issues sector-specific policies, initiates and supervises the project in its jurisdiction, such as hydraulic engineering project construction
National Energy Administration (NEA)	Responsible for the regulation, development and planning of the energy industry; issues sector-specific policies, initiates and supervises the project in its jurisdiction including nuclear power, electricity generation from natural gas, coal, renewable energy, oil extraction and so forth
Ministry of Commerce (MOFCOM)	Responsible for the regulation, management, international cooperation of all trade- and commerce-related industries; issues sector-specific policies, initiates and supervises the project in its jurisdiction, such as the import-export of large engineering devices, multilateral business collaborations and so forth
Ministry of Industry and Information Technology (MIIT)	Responsible for the regulation and development of the postal service, internet, wireless, broadcasting, communications, production of the electronic and information industry; issues sector-specific policies, initiates and supervises the project in its jurisdiction.

Depending on the scope and location of the project, a PPP project can be proposed or initiated by the local governments or by the departments/bureaus under the ministries of the specific sector at each level of the administrative structure. After that, an implementation authority involved in the coordination and interaction with other governmental departments will oversee selecting the project sponsor (concessionaire bidding) and managing the design, construction, operation, and transfer stages in order to ensure the intended performance outcome.

According to the systematic review of the policy documents related to the governance of PPP and the close dialogue with the interviewees from the relevant ministries, it can be summarised that the various infrastructure sectors have been governed dually by different levels of governments horizontally and by the ministries of the State Council vertically in China. However, the MOF and the NDRC also regulate the other ministries in terms of infrastructure provision and domestic PPP-related affairs in China. Therefore, the hierarchies derive from the decision-making processes and policy-making procedures between the State Council, MOF and NDRC, between different levels of provincial and municipal governments led by the State Council vertically and by the local departments of finance under the MOF and local development and reform committee at the corresponding and horizontal levels. These public authorities are in charge of the PPP relevant affairs, such as the policy and regulation making, approval of the concessionaire, monitoring the design, construction, operation and transaction supervision to ensure the project performance and value for money. Based on the review of massive policies issued by the State Council, MOF, NDRC, relevant ministries and governments at all levels from 1984 until 2018, the administrative

institutions' framework for infrastructure provision in the form of PPP in China at the domestic scale is summarised (Fig. 4).

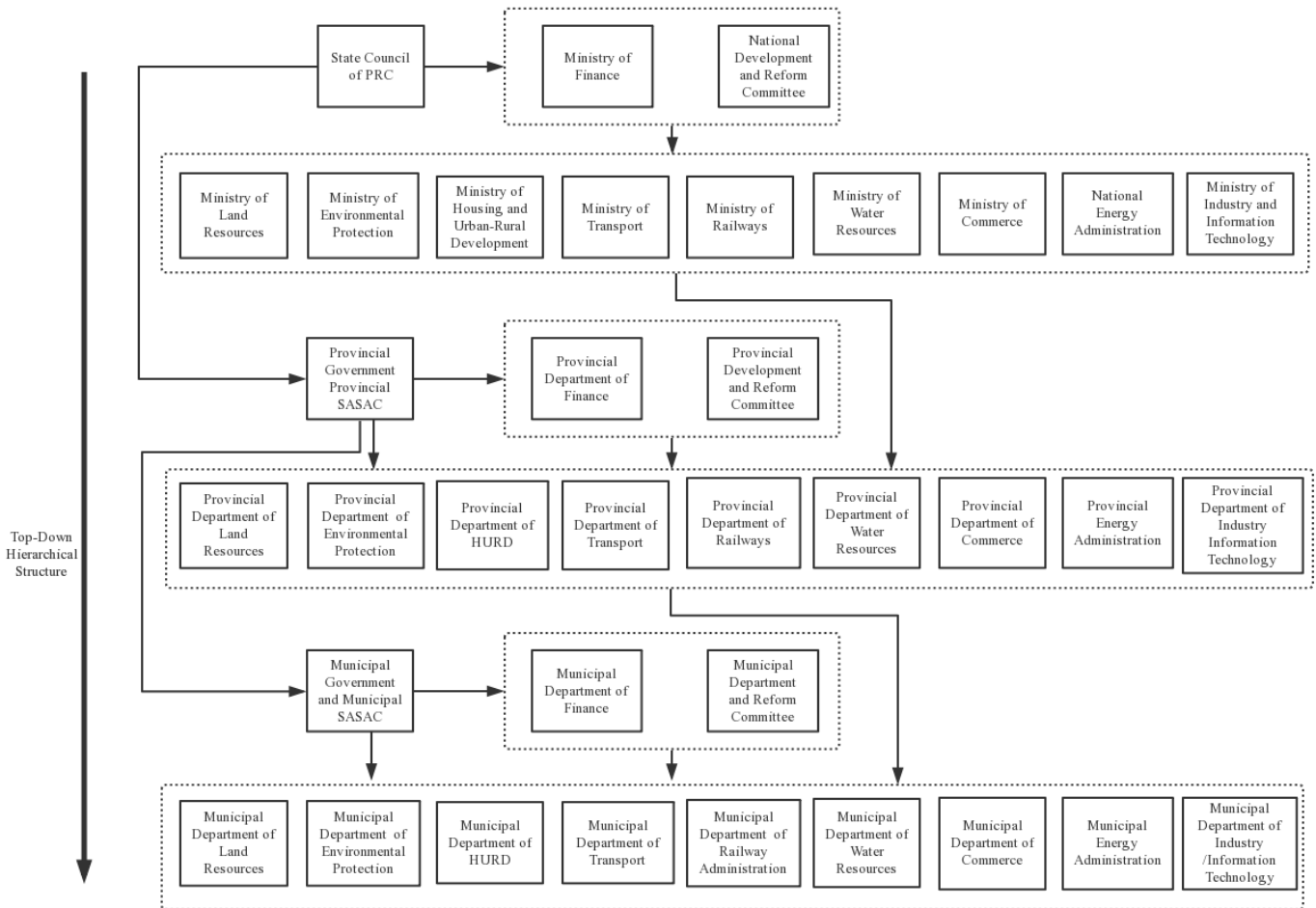


Figure 4 The administrative institutions' framework for infrastructure provision in the form of PPP in China—domestic scale

Source: The author

Such administrative institutions' framework initially intends to coordinate and govern the PPP relevant affairs. However, due to the boundary and function are not explicitly clarified, the conflicts of coordination arise from the top of the framework and subsequently transmit to the lower levels in this framework. For example, both the MOF

and the NDRC issued the guidance for the governance of PPP in infrastructure provision, which led to administration conflicts, overlapping duties and repetitive procedures, not only horizontally but also vertically. In 2015, the NDRC issued a detailed guidance for the PPP practice, which attenuates the requirement for the fiscal affordability or value for money (VFM) of each PPP project whereas emphasising the requirement for the feasibility report (NDRC, 2015). Conversely, the MOF PPP guidance requires a much stricter checking of both VFM and fiscal affordability prior to the government approval of the project (MOF, 2015).

Apart from the conflicts in the guidance, the ambiguous governance boundaries of the NRC and MOF also rise administrative problems. The NDRC is assigned to govern the infrastructure PPP related affairs (NDRC, 2016), the MOF is responsible to the public utilities (MOF, 2016a). However, there is no clarified boundaries to distinguish the public utility from the infrastructure given the nature thereof. These problems in the current administration framework will lead to disorganised governance and causes market instability, eventually increasing the transactional cost for both public and private sectors in practice. Therefore, the reallocation of responsibilities and jurisdiction is expected to simplify the excessive hierarchies in the current framework and to reduce the complexity and transaction cost along the project life cycle.

Another issue present in the current framework is that the ministries in different sectors are incapable of creating efficient synergies with the central and local government. Different levels of local governments performed far from satisfactory with a significant proportion of project failures. The top-down policies issued by the ministries rapidly attracted the PPP investments and motivated local governments to adopt the PPP approach. However, they fail to guarantee the sustainability of such projects, as these

policies are of low legal order and quite general. Besides, the local government is yet to adapt to the new situation or to align their objectives with the central government and ministries. It is observed that the local government exercises less control over the PPP infrastructure provision, sometimes even neglecting the guidance from the ministries and central government. The reason behind this is that the pressure to achieve annual fiscal targets through infrastructure investment forces the local government to adopt an aggressive plan to stimulate the application of PPP without a rounded assessment.

3.2.3 The evolution of PPP in infrastructure provision in China: socio-economic status, administrative institutions, policies and projects

The application of the PPP model in China has undergone three stages, which can be defined as the exploratory phase, the rapid development phase, and the adjustment phase. With the attention and promotion of the central government in recent years, PPPs have already entered a booming phase. The four stages demonstrate different features along the time series. The mechanism behind these changes is embedded in the momentum of socio-economic development, relevant policies, the transition of the administrative institution, as well as project performance. The division of the four phases is also based on the aforementioned factors.

Exploratory phase (pre~2002): After China implemented the reform and opening up, attracting foreign capital to promote domestic economic development quickly became one of the country's priorities. Foreign Direct Investments (FDI) has become an important funding source for China's infrastructure provision. During this period, PPPs have been mainly conducted in the form of a BOT model with foreign investment. From 1984 to 2002, the primary type of investors in the PPP infrastructure were foreign

investors. In 1984, Hong Kong Hopewell Power Co., Ltd. and the Shenzhen Special Economic Zone Power Development Company cooperated in the construction of the Shajiao B Power Plant, the first Chinese BOT project, which was then transferred to the local government after a 15-year concession period. In 1994, the pilot sectors, such as water, energy, and transport were selected by the government for the trial of the BOT (build-operate-transfer) model. Representative projects include the Dachang Water Plant BOT Project run by the consortium led by Thames Water in 1996 (China Water, 2004) and the Tenth Water Plant of Beijing BOT Project run jointly by the Mitsubishi Group and UK Anglian Water in 1998 (The Paper, 2014). Even though the trial process is not flawless, the involvement of foreign capital and expertise still built up the foundations for the localisation of the application of PPP. Cheng et al. (2016) collected existing urban infrastructure projects adopting the PPP model in this phase and summarised the features from a project-based perspective as follows: (1) the main players were foreign investors with mature technologies and management skills; (2) BOT was the most common contract type.

Apart from the socio-economic demand and the project-based evidence, the mainstream macro-guidance and PPP policies in this phase mainly demonstrated the focus on encouraging foreign investment due to the strong capital demand for conducting the opening up and marketisation reform. However, a specific and detailed PPP implementation guiding policy was lacking. These two governance issues are reflected by the objectives of serial policies and governing documents, such as the Provisions on Encouraging Foreign Investment issued by the State Council in 1986 (MOFCOM, 1986). Institutional arrangement-wise, the State Council, the State Planning Commission (the predecessor of the National Development and Reform Committee) and the Ministry of Foreign Economic and Trade Cooperation (the predecessor of the

Ministry of Commerce) rather than the sector-specific ministries were the major administrative institutions. The Circular Concerning Relevant Issues in Attracting Foreign Investments by Means of BOT (MOFCOM, 1995) was issued by the then Ministry of Foreign Economic and Trade Cooperation of China (MFETC) in 1995 as a policy call with the main purpose of attracting foreign direct investment in infrastructure. Efforts in terms of trying to introduce new policies or to change the existing rules were made by the central government and implemented by the local government, focusing on investments rather than governing of this new mode of project development. During the exploratory phase, most PPP projects were foreign capital funded projects led by the Ministry of Commerce of the People's Republic of China (Wang, 2006), whereas the participation of the ministries of the specific sectors was absent.

Many problems were exposed after this stage since there were insufficient policy guidance and specific regulations in project implementation, and the central direct policy regarding sector-specific PPP governance lagged behind local PPP practice. A follow-up document, entitled 'The Circular on Several Issues Concerning Review, Approval and Administration of Pilot Foreign-invested Concession Projects', was issued jointly in 1995, by the then State Planning Commission (SPC, predecessor of the National Development and Reform Commission), the then Ministry of Electric Power (later decomposed into several major state-owned electric power enterprises) and the Ministry of Transportation. This document governs the issue of unproved guarantees and commitments of the local government to projects. Moreover, this document was less of a restriction and more of an encouragement. The first wave of PPP in China gradually receded with the 1998 financial crisis, coupled with the collaborative issues

between the central government, ministries, and local government in the implementation process of the PPP projects.

During this phase, the demand for foreign capital, engineering capacity, and technology in the prioritised sectors provided a global map of investment opportunities, differentiated according to their expected risk-adjusted rates of return in the various geographic jurisdictions. The policy-making, administrative institutions and project features are in tandem with the demand. The phenomenon of this phase demonstrates that ‘glocal’ infrastructure products are owned by international private owners and regulated by local actors. It facilitates the socio-economic development and forges new styles of ‘glocal’ governance of the urban infrastructure (Torrance, 2009).

Rapid development phase (2003~2008): At the end of 2002, the 16th National Congress of the Communist Party of China (NCCPC) set up the goal of encouraging social capital with foreign capital to participate in various forms of the municipal public construction facility. The Amendment of the Constitution passed in 2004 by the National People’s Congress, stated the importance of protecting private property rights, by the clarification of ‘the State, protects the legal rights and benefits of non-stated-owned businesses, including individual business and private business’ (National People’s Congress, 2004). In 2004 and 2005, two additional administrative documents were issued consecutively by the State Council and regarded as the guiding policies used in order to consolidate the reform of the infrastructure investment provision mode in China. The main purpose is to enhance efficiency, widen the spectrum of financing resources and loosen the market entry constraints for private-owned enterprises (POEs) in domestic infrastructure development (NDRC, 2004; People.com, 2005). Following the policies of the top institutions in the hierarchal framework, ministries in different

sectors and local governments at lower levels issued policies in their administrative scope. For instance, the then Ministry of Construction (predecessor of the Ministry of Housing and Urban-Rural Development at present) issued the PPP guidance for the PPP project implementation in the urbanisation process.

Compared with the previous phase, the policy objective in this phase was to attract the domestic POEs to invest and become involved in the infrastructure provision in other fields. Subsequently, more and more projects in the sectors of energy, telecommunication, transport and environment service became open to private investors. Together with the transition of the legislation and political support for asset ownership, the governance pattern also transited into a more tentative mechanism with the adoption of a stepwise approach. The government authorities at each vertical level of the hieratical framework played the roles of project initiators, responsible for managing issues, such as project bidding, investment, construction, operation/management and transfer. Meanwhile, the development and reform committee and the departments/bureaus under the ministries in specific sectors at the corresponding horizontal level played the roles of policy-makers and overseers. They were also in charge of the approval and assessment of the different steps of the project, which was overlapping with the roles of the government at the vertical level. Given the close relationship and the ownership link between the public sector and the SOEs, the transaction cost at each step of the process was lower for the SOEs. Thus, compared with previous phases, the proportion of foreign capital fell drastically, accompanied by the surging involvement of the SOEs and domestic private enterprises.

In this phase, the representative projects include the National Stadium, the Hangzhou Ring Expressway, the Beijing Metro Line 4 and so forth. The tendency was related to

the demands of the urbanisation process. The features of this period are as follows: (1) PPPs were mainly applied in the urban infrastructure, for example, urban water, urban transport and other civil engineering projects; (2) PPP policies are more sector-specific than in the first phase; (3) the project share of SOEs and domestic private investors surpass the foreign investors; (4) a more comprehensive and a relatively more standardised implementation procedure of PPP projects starts emerging based on the outcome of the phase prior to 2002.

Adjustment period (2009~2013): Since the Chinese economy was impacted by the financial crisis in 2008, the Chinese government launched a 4 trillion RMB investment plan in response to the crisis. Given that the local government could not participate as direct investors, the local government financing platform was therefore promoted to serve the investment and financing for urban infrastructure and other types of public service. However, the excessive growth of local government financing platforms deteriorated the situation of local debt. The reason behind the explosive increase of the local debt was deeply rooted in the economic development mode in that period and constrained by socio-economic status. In order to achieve the targeted gross domestic product (GDP) rate given the frailty of the external economic condition globally, the importance of the domestic infrastructure investment was restated and even regarded as more effective compared to the import-export trade.

From 2009 to 2012, the State Council and the China Banking Regulatory Commission (CBRC) introduced a series of policies regulating the local government financing platform (Hui Jin, Isabel Rial, 2016). In 2010, the ‘Directives of Promoting and Guiding the Healthy Development of Private Investment’ (State Council, 2010) were issued in order to further promote the implementation of PPPs, in which all government levels

(central-provincial-municipal) are required to facilitate the involvement of the private sectors and increase the market liberalisation in most infrastructure sectors, such as transport, mining, energy, environment, and telecommunication. In 2013, the central government officially announced that PPP constitutes an important means of resolving local government debt problems. Since then, the PPP policies have presented specific features such as the high frequency of issuing, the wide coverage of sectors, and more specifically, the coverage for each sector. The intensity of promotion is reflected by the number of policies issued in each period. 2014 and 2015 became intense years in terms of the introduction of PPP-related policies. There were 28 and 58 policies issued in 2014 and 2015, respectively (Zheng Cheng, Dan li, 2017). Moreover, in this period of PPP development, the policies focused on macroeconomic adjustment for addressing local debt and social problems as well as the transition of the administrative institutions.

Apart from the establishment of local financing platforms, the project-level transition also went along with the policy transition. Due to the affinitive relations between the SOEs with the central and local governments, SOEs played the dominant role in this phase by endorsing more financial resources from the finance platforms, including the development banks, commercial banks and others. The downside impact of this tendency is the drastic increase in the default of bank loan due to the SOEs overleveraging their credibility. The vast amount of public funding and credit-based funding from the local financing platforms led to a severe crowding-out effect on private capital. Many early-stage infrastructure projects derived directly from the PPP model and turned into government investments. This, in turn, exacerbated the situation of local government debt. The features extracted from the institution, policy and project axes of this period are as follows: (1). State-owned enterprises were supported by government resources and were highly favoured by local governments and financial

institutions. The main PPP mode in this phase is the partnership between the government and the SOEs; (2). With the rapid increase of capital demand from the private sector and the maturity of the financial market, more diversified PPP project financing channels, such as bonds and trusts emerged; (3). Administrative institutions in the specific sectors are further involved in the governance.

Thrive on the new norm (2014 up until today): According to the Ministry of Finance and the National Development and Reform Committee (Ministry of Finance, 2014; NDRC, 2014), PPP is defined as a long-term partnership between the Chinese government and social capital in infrastructure provision and public service in the infrastructure. More specifically, social capital will take responsibility for the financing, design, construction, operation and maintenance of the infrastructure. The Reasonable revenue will be generated from the ‘user charge’ and the necessary ‘government payment’. The government is responsible for the regulation of public goods pricing and quality control in order to ensure maximum public interest. The overarching goal of this round of reform is to release the problem of local government debt and further standardise the regulation of the PPP market.

There are two dimensions requiring further explanation regarding the definition of PPP in China.

1. The public sector in the defined PPP refers explicitly to government departments, while the other non-public sectors (such as societies, industry associations, private non-enterprise entities, government financing platform, and others) are not included, that is, the scope of the definition of the public sector is relatively stricter and narrower.

2. The social capital in the defined PPP refers to an enlarged scope, generally comprising international and domestic profit-based legal cooperate entities (Notice on Issuing the Guidelines for the Government and Social Capital Cooperation Model (Trial Implementation) (No. 113 [2014] of the MOF)(2014), hereinafter referred to as the ‘Guide’). The enterprise or a consortium in a PPP project is deemed to be the ‘private party’, even if state-owned. For example, in the Nanjing across the Yangtze River Tunnel Project, a typical BOT project in China, the public party is the Nanjing Municipal Government, and the ‘private’ party is the China Railway Construction Corporation Ltd., a purely state-owned enterprise under the administration of the State-owned Assets Supervision and Administration Commission. PPPs in China, in a stricter sense, refer to Government–Social Capital Partnerships. Social capital is either state, private or foreign. What is worth noting is that the government financing platform is excluded from the scope of social capita, given the remaining debt issue from the previous phase.

Apart from the definition, a series of PPP-related policies were issued, and the application of PPP in infrastructure provision was encouraged with significant effort. The PPP concession law was proposed by the 12th National People’s Congress, looking to serve as the first national law to resolve the conflicts resulted from the PPP practice and existing by-laws and regulations, as well as to manage the relations of the public and private sectors. There are also other guidelines issued by the MOF, such as the VFM assessment and public fiscal capacity evaluation. The features of this phase reflected by the projects and policies are towards a stricter rule of law governing the system. As required by the socio-economic development demand, facilitated by the institutional transition and encouraged by the policies, the PPP infrastructure projects witnessed a sharp increase. However, the rapid proliferation of PPP projects raises the

concern about excessive investment, financing compliance failure, and the efficacy of releasing the deficit of public finance.

Over the past three decades, the economy's structure of factor endowments evolved from one level of development to another. The demand derived from the new development level and the allocation of resources entail significant externalities to transaction costs and returns to capital investment. Meanwhile, the Chinese market is more open and provides the underlying mechanism for effective resource allocation despite reflecting a certain crowding-out effect. In addition to a valid market mechanism, the government should play an active role in facilitating industrial upgrading and infrastructure improvements (Lin, 2011). Given the current socio-economic development stage, China is facing more uncertainties and challenges. PPPs are therefore introduced and promoted by the government in the field of infrastructure provision. In this arena, a more compatible, effective, and efficient institution governance framework is desired.

The aims and functions of the governing institutions are reflected by the issued policies. In 1984, China's first batch of PPP projects emerged. By project practice, the central government successively issued policy documents to encourage and standardise the development of the PPP. The BOT was the most common PPP model and laid the basis for the PPP application in infrastructure by foreign capital. Nevertheless, the adverse outcomes of government non-principal guarantees and commitments in the BOT model are gradually recognised.

In 1995, the central government issued the 'clear-up' policy in order to exert control over these problems and regulate the market. Since 2000, China has increased its efforts

to promote the development of the non-public economy and liberalised many areas where traditional non-public ownership was prohibited; thus, the private participation in the infrastructure and public utility sectors has developed rapidly.

In 2002, the Ministry of Construction encouraged the marketisation of municipal public utilities, after which more industrial areas were opened to private capital. After the financial crisis in 2008, the government implemented a four trillion investment stimulus policy, and the development of the non-public economy was inhibited. However, as a result, the local debt problem intensified. The State Council, the then China Banking Regulatory Commission, and the Ministry of Finance issued a series of policies to regulate the financing platform of local governments.

In order to achieve the economic development target after 2013, the central government explicitly stated that PPPs were used as an essential means to accelerate supply-side structural reforms, increase new momentum for public goods and services, and advance the modernisation of national governance systems and governance capabilities. Since 2014, the central government has innovated the concept of the PPP model, attached importance to its inherent VFM, and adopted policies to regulate the implementation of the PPP model.

In 2014, it was influenced by multiple factors, such as the promotion of China's comprehensive consolidation of reforms, the strengthening of local government debt management, and the transformation of financing platforms. The summarised features of the socio-economic, administrative institution, and policies in different PPP development phases at the domestic scale can be observed in Table 3.

Table 3 The features of the socio-economic, administrative institution, and policies in different PPP development phases at the domestic scale

Exploratory phase (pre~2002)	Socio-economic development status	Strong demand for foreign capital and technology for market opening
	Administrative institutions	State Council, SPC ¹ , MFET ²
	Relevant policies and regulations	<ul style="list-style-type: none"> • Provisions on Encouraging Foreign Investment issued by the State Council in 1986 (SPC, 1986) • The Circular Concerning Relevant Issues in Attracting Foreign Investments by Means of BOT (MFET, 1995)
Rapid development phase (2003~2008)	Socio-economic development status	The participation of social capital was encouraged to meet the urbanisation demand
	Administrative institutions	State Council, MOC ³
	Relevant policies and regulations	<ul style="list-style-type: none"> • Several Opinions of the State Council on Encouraging Support and Guiding the Development of Privately-owned and Non-public Ownership Economy (State Council, 2005) • Measures for the Administration on the Franchise of Municipal Public Utilities (MOC, 2004)
Adjustment period (2009~2013)	Socio-economic development status	The Chinese economy was influenced by the financial crisis in 2008, facing the risks of severe local government debt
	Administrative institutions	State council, CBRC ⁴ , MOF ⁵
	Relevant policies and regulations	<ul style="list-style-type: none"> • Directives for Promoting and Guiding the Healthy Development of Private Investment (State Council, 2010) • Guidance on Strengthening the Loan Risk Management of Financing Platforms (CBRC, 2010) • Notice on Resolutely Curbing the Illegal Financing of the Local Governments in the Name of the Government Procurement of Services (MOF, 2012)
Thrive on the new	Socio-economic development status	The need to further release the local debt problem and achieve the economic development target by increasing the capacity and quality of public goods and services

norm (2014 up until today)	Administrative institutions	State Council, NDRC ⁶ , MOF, CBR, SRC ⁷ ministries in specific sectors, such as MOT ⁸ , MOWR ⁹ , and PBOC ¹⁰
	Relevant policies and regulations	<ul style="list-style-type: none"> • Guiding Opinions of the State Council on Innovating the Investment and Financing Mechanisms in Key Areas and Encouraging Social Investment (State Council, 2014) • Notice on Issuing the Guidelines for the Mode of Cooperation for Government and Social Capital (for Trial Implementation) (MOF, 2014) • Guidelines for the Contract of Cooperation for Government and Social Capital (NDRC, 2014) • Measures for the Administration of Concession for Infrastructure and Public Utilities (NDRC, MOF, MOT, MORW, PBOC, 2015) • Notice on Further Regulating the Debt Financing Behaviour of the Local Government (MOF, NDRC, PBOC, CBRC, and SRC)

Note: 1. SPC: State Planning Commission (SPC, the predecessor of the NDRC), 2. MFET: Ministry of Foreign Economic and Trade Cooperation (MFET, the predecessor of the Ministry of Commerce), 3. MOC: Ministry of Construction, the predecessor of the Ministry of Housing and Urban-Rural Development, 4. CBRC: China Banking Regulatory Commission, 5. MOF: Ministry of Finance, 6. NDRC: National Development and Reform Committee, 7. SRC: Securities Regulatory Commission, 8. MOT: Ministry of Transport, 9. MOWR: Ministry of Water Resources, 10. PBOC: People's Bank of China (China's central bank).

Aside from the features of the socio-economic, administrative institution, and policies in different PPP development phases at the domestic scale, the performance of the project also demonstrates the trend of governance impact. The number of PPP projects in China and the total investment amount have demonstrated an increasing trend. Particularly since 2014, the growth momentum has been significantly accelerated (Fig.5). In the exploratory phase (pre~2002), PPPs were predominantly applied in the energy, transport, and water sectors, then in the rapid development phase (2003~2008), the proportion of the water sector surpassed the energy and transport sectors, accounting for the most significant portion. Subsequently, in the adjustment period (2009~2013), the portion of the transport sector continued to decline and became the sector with the lowest number of projects reaching financial closure, whereas the energy sector rebounded and became the sector with the highest proportion of projects achieving financial closure. In the current phase, thriving on the new norm (2014 up until today), the energy sector continues a similar trend to the previous period (Fig.6).

From the aspect of the project investor type, the foreign investor once constituted the primary capital source in the first phase, given that the major policy force focuses on the introduction of foreign capital as well as the strong demand from external technology and management expertise (Fig.7). With the growing expertise and the accumulation of the capital advantage of domestic SOE and POE investors, the dominant position of the foreign investor was taken. Moreover, the SOE and POE investors demonstrated a similar level of participation in the PPP infrastructure project. In the next two phases, the SOE investors took the leading role over the POE investors due to their affinitive relations with the government at all levels and the credit guarantee advantage of receiving loans from the development and commercial banks. On the

contrary, the private enterprises face a challenging and competitive situation led by the unfair financing mechanism and risk allocation in cooperation with the public sector at all levels.

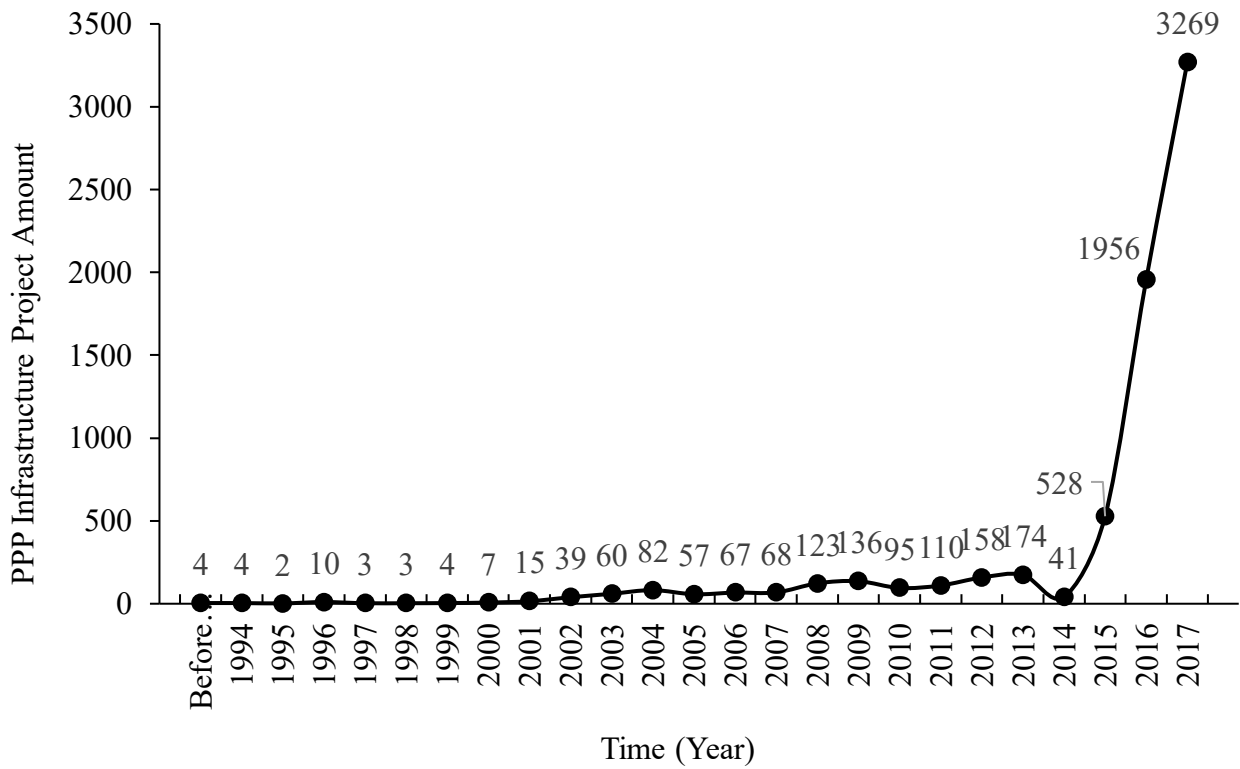
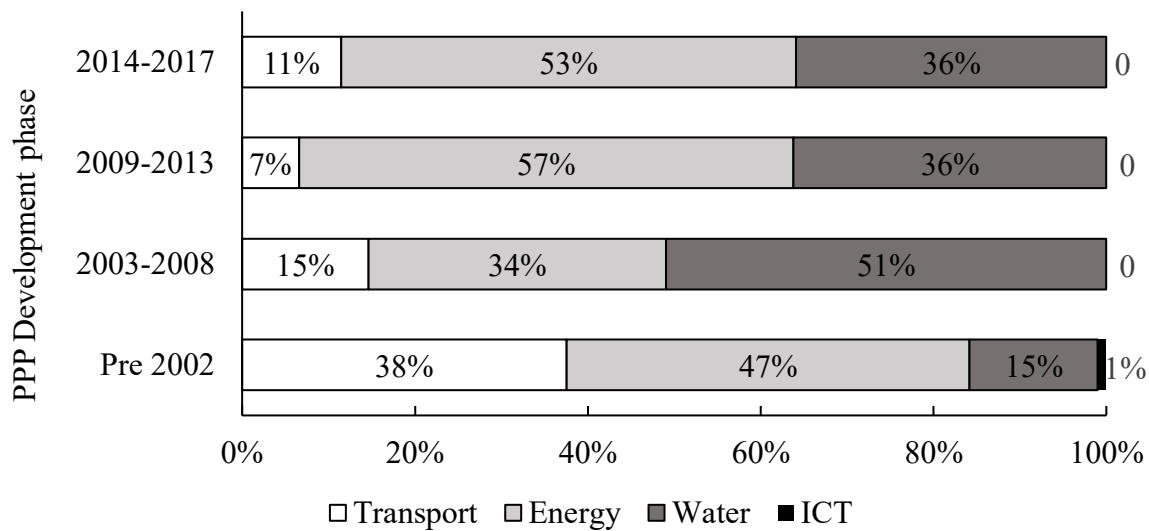


Figure 5 The number of PPP infrastructure projects in the Chinese market

Source: BRI Data



*ICT: Information and Communication Technology

Figure 6 The sectoral proportion of PPP infrastructure projects in the Chinese market

Source: Private participation in the infrastructure database, World Bank

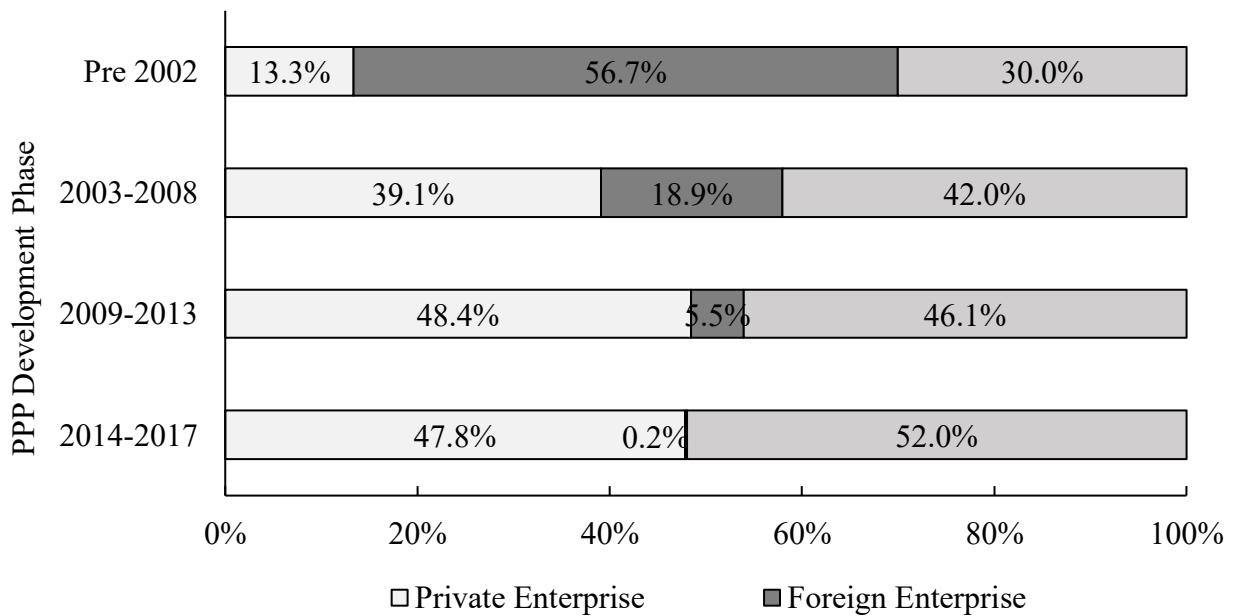


Figure 7 The distribution of PPP projects with different investors in different phases

Source: BRI data

The governing institutional framework for infrastructure provision in the form of PPP at the domestic scale changes according to the socio-economic development. The

institutional hierarchy and governance continue to evolve in order to meet the demand for infrastructure provision and have been shaped by a complex and highly coupled set of constraints, both socially and economically, thus creating a dynamic institutional environment. The relevant policies and the project level features are the outcomes of the transition institution framework and governance. They, in turn, reconfigure this administrative framework. The four axes (socio-economic development status, institution, policy, and project) influence each other and evolve together to a more facilitating direction in order to meet the infrastructure provision demand with the application of the PPP. Nevertheless, certain flaws remain, such as the excessive complexity of the institutional hierarchy, overlapping functions of the leading administrative institutions, issue of piecemeal policies, and irrational project investment.

3.3 The administrative institution framework of infrastructure PPP governance —BRI angle

In Section 3.3, the transition of the governmental institution framework in the Chinese domestic market is analysed from the perspective of the socio-economic, institutional, policy and project axes. The policy tendency reflected by the features of each phase evolved from attracting foreign capital to instituting the rule of law and controlling local debt issues, with the tendency of foreign capital dominant to SOEs to fluctuate with the increasing involvement of private enterprises, from a steady and moderate increase to an exponential growth. The institutional environment of the BRI is more complicated than the domestic market and is regarded as a more challenging barrier to governance. Following the previous analytical path, this section aims to look into and provide the rationale for the current governance mechanism of BRI infrastructure provision in the form of PPP.

3.3.1 The institutions related to BRI infrastructure PPP governance

The outward foreign direct investments (OFDI) framework is regarded as the current regulatory framework for the BRI infrastructure provision. It seeks to facilitate and support the OFDI in two distinct ways. First, the framework aims to facilitate and support OFDI to meet the demand of the domestic enterprises' internationalisation. Second, China's institutional framework for OFDI especially seeks to encourage OFDI that is consistent with the 'going out' political strategy and able to contribute most to the national development goal, such as broadening the scope and geography of investment, upgrading the value chain and optimising resource allocation through internationalisation by selectively supporting particular industries and activities (Sauvant and Chen, 2014). With significant OFDI starting a decade ago, overseas infrastructure investments have become one of the leading pillars of Chinese outbound

direct investments. In the promotion of the BRI, the investment in infrastructure overseas will continue to occupy an important position.

The governmental institution framework of overseas PPP infrastructure projects in China has its uniqueness compared with the domestic PPP administrative framework since the offshore infrastructure projects led by the Chinese government or enterprises are managed within the scope of OFDI (Fig 8).

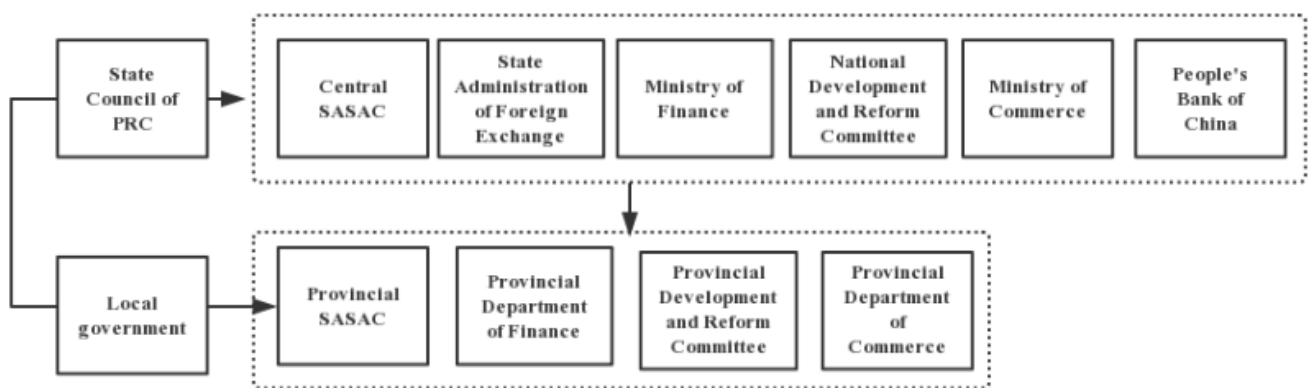


Figure 8 The administrative institutions’ framework of infrastructure provision—BRI scale

Source: The author

Based on the analysis of the existing BRI infrastructure PPP projects, there are six ministries involved over the course of the project approval and investment process, including the MOF, the MOFCOM, the Ministry of Foreign Affairs, the NDRC, the State Administration of Foreign Exchange (SAFE) and SAAC. In comparison with the governmental institutions introduced in Table 2 at the domestic scale, the most significant difference is represented by the involvement of the Ministry of Foreign Affairs, which specialises in the coordination of institutions at an international scale

and the SAFE, which acts as a regulator and provider of foreign exchange simultaneously.

Another prominent difference lies in the rights and functions of the administrative institutions. The administrative rights and functions of the ministries in specific sectors weigh much less compared with those in the domestic administrative framework. The actual direct management from the specific ministries is rare. For example, the Java No.7 power BOT project in Indonesia is China's first overseas million-kilowatt class independent power plant. However, there is no involvement of the National Energy Bureau from project initiation to the implementation of construction. Compared with the administrative framework in domestic infrastructure PPP administrative framework, the framework applied in the context of the Belt and Road overseas infrastructure investment is relatively succinct. There are fewer institutional layers and fewer institutions in the hierarchy. It is because the OFDI framework is relatively simpler compared to the domestic framework. In addition, the SOEs under the SASAC at the central and provincial levels constitute the major type of social capital players in overseas infrastructure projects.

The less hierarchical framework that governs the BRI infrastructure PPP provision seems to be able to govern the BRI investment in a more streamlined way. Nonetheless, problems that result from the practice of the BRI infrastructure PPP challenge the current administrative institution framework. A total of 24,000 Chinese enterprises had established 37,200 foreign affiliates in 190 countries for direct investment by the end of 2016 (MOFCOM, 2016). As Chinese OFDI continues to rise, more enterprises are becoming outward investors, and more foreign affiliates are to be established, leading

to a massive workload that would ultimately constitute a burden for administrative institutions. Meanwhile, due to the demand for structural finance, taxation arrangement, and risk isolation, engineering enterprises often design a multi-layer umbrella contract structure for overseas infrastructure development. The increasing workload and more sophisticated contract structure may increase the transaction cost for both the public and private sectors. Thus, a more efficient and specific framework is desired in order to prevent insufficiency in governance capacity.

3.3.2 The evolution of PPP in infrastructure provision under the BRI: socio-economic status, administrative institutions, policies and projects

Although the BRI was proposed in 2013, compared with the transition of PPP application in the domestic market, the development of the BRI infrastructure PPP has a much shorter history and is still in its budding phase. The rationale that defines this phase can be drawn from the socio-economic development, institutional, policy, and project aspects.

The BRI is designed to provide further momentum for investment and trade flows by linking countries and regions that account for almost 70 countries with a total population of over 4.4 billion people and 40% of the world's GDP across Asia, Europe, Africa and beyond (World Bank, 2017). As a fundamental aspect of the economic activity, infrastructure provision has always been the centre of focus. Only for the developing countries in the Asia Pacific, it is estimated that this region will require 22.6 trillion USD in infrastructure spending between now and 2030 to maintain growth momentum, or 26 trillion USD when climate-change mitigation and adaptation costs

are incorporated, while the current financing channels can only provide about 400 billion USD annually (Asian Development Bank, 2017).

Many BRI infrastructure PPP projects are currently developed and funded by leading Chinese government institutions, including the Asian Infrastructure Investment Bank, Silk Road Fund, China Investment Corporation, China Export-Import Bank, China Development Bank, and New Development Bank. Furthermore, regional and international organisations, such as the World Bank and Asian Development Bank also take part in funding the ‘Belt and Road’ infrastructure. However, these financing channels are limited and insufficient to bridge the significant funding gap. Although there are many overlapping international and regional institutions involved in energy, transport, water and telecommunications infrastructures, the institutional arrangements for the BRI infrastructure financing are still fragmented. These two phenomena demonstrate the need for better collaboration among such institutions and with private stakeholders for a more effective and more efficient BRI infrastructure provision in the form of PPP.

A series of previous government pronouncements and policy documents evolved to be consistent with the BRI socio-economic demand. The principal policy tools that define the current OFDI framework governing non-financial investments are: the Administrative Measures for Overseas Investment enacted by the Ministry of Commerce of China (MOFCOM, 2009), the Administrative Measures for Overseas Investment Project Approval and Management (NDRC, 2014b) and the Guiding Opinions on Further Directing and Regulating the Direction of Overseas Investments issued together by an array of administrative institutions (State Council, 2017). The

feature of the policies is instituting more facilitating procedures for OFDI to provide companies with greater independence in their decision-making. In order to better stimulate the infrastructure supply and motivate the involvement of the private sector, a series of policies have also been issued for the application of PPPs in the context of the BRI specifically.

The arrangement of relevant institutions moves with the policy trend. The State Council of China has indicated that the BRI aims to collaborate with the private sector in order to provide long-term foreign exchange financial support and engineering expertise for the ‘going global’ enterprises. In 2016, the People’s Bank of China and the National Development and Reform Commission, together with the relevant ministries, issued the ‘Several Opinions on Financial Support for Industrial Stable Growth and Structural Improvement’, and encouraged Chinese companies to apply the PPP model for overseas project development (MOF, 2016b).

Earlier in 2017, the NDRC led 13 ministries, including the Ministry of Foreign Affairs, the Ministry of Environmental Protection, the Ministry of Transport, the Ministry of Water Resources, the Ministry of Agriculture, the People’s Bank of China, the State-owned Assets Supervision and Administration Commission, the Forestry Bureau, the China Banking Regulatory Commission, the Energy Bureau, the Foreign Exchange Bureau, and the China Railway Corporation to jointly establish the ‘Belt and Road’ PPP working mechanism and thus strengthen the international cooperation in the field of infrastructure development (NDRC, 2017a).

Later in 2017, the National Development and Reform Commission and the United Nation Economic Commission for Europe signed a Memorandum of Understanding on the ‘Belt and Road’ PPP cooperation. The memorandum prioritises the establishment of a sound PPP legal system and framework system for the member countries of the EU along with the Belt and Road initiative (NDRC, 2017b).

In the meantime, the Ministry of Foreign Affairs, the NDRC, and the MOFCOM jointly issued the ‘Guiding Opinions on Promoting the Construction of the Green Belt and Road Initiative’, and comments were put forward to encourage green projects. According to the procedures, qualified projects are eligible to apply for support from existing government funds, such as the National Green Development Fund, the Chinese Government, and the Social Capital Cooperation (PPP) Financing Support Fund (MOFCOM, 2017).

The series of policies encourage the BRI infrastructure development and the involvement of the private sector. However, it still lacks the details regarding the specific issue or the stepwise guidance for project development. The governance for the BRI infrastructure PPP provision remains cumbersome. Meanwhile, the return rate and political risks remain the primary concerns for the involvement of the private sector.

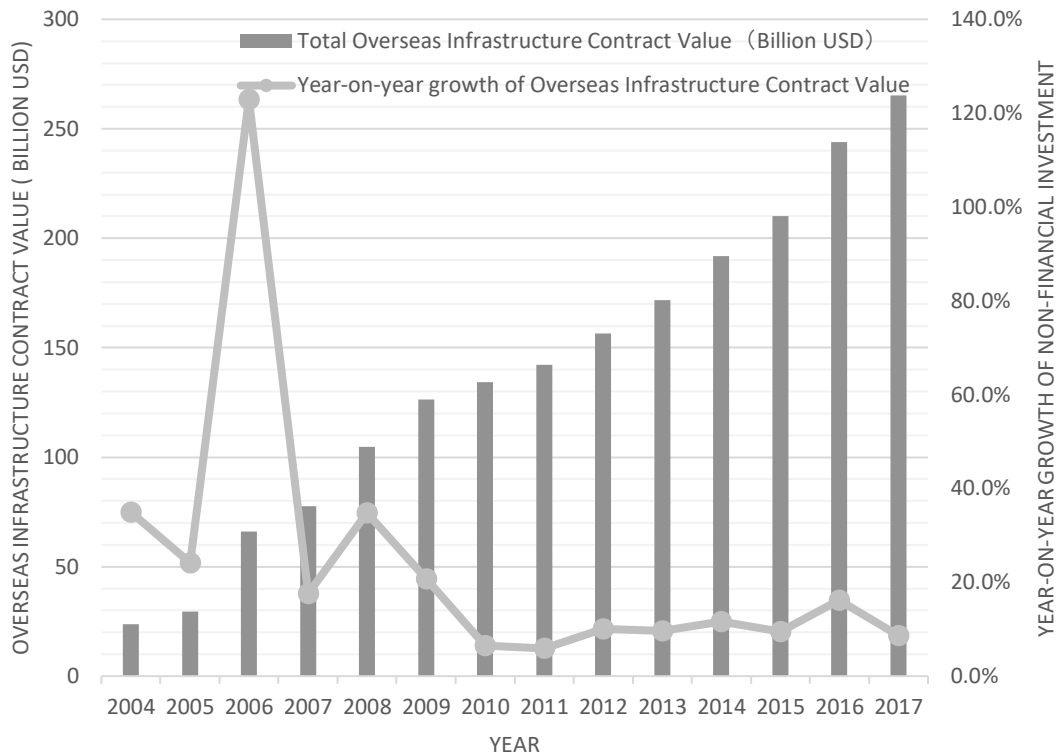


Figure 9 Total overseas infrastructure contract value

Source: Ministry of Commerce

China has over one decade of experience in overseas infrastructure projects, and the total investment has witnessed a constant and steady growth (Fig. 9). Since the BRI was proposed in 2013, the total value of the BRI infrastructure projects, consisting of energy, transport, utility, telecom and others has seen a continuous increase and has taken a more significant portion of the total overseas infrastructure project.

In 2017, Chinese companies signed 7,217 contracts with 61 countries within the framework of the Belt and Road. The contract value along the Belt and Road reached 144.32 billion USD, accounting for 54.4% of the total newly signed contract value of China’s overseas infrastructure projects during the same period. Compared with the contract value of the year 2016, it increased by 14.5%. The turnover of the BRI

infrastructure projects was 85.53 billion USD with a year-on-year increase of 12.6%, accounting for 50.7% of the total turnover of overseas non-financial investment for the same period.

In 2016, Chinese enterprises signed 8,158 overseas infrastructure contracts with 61 countries as part of the 'Belt and Road' initiative. The signed contract value along the Belt and Road was 126.03 billion USD, which accounted for 51.6% of the signed contract value of China's overseas infrastructure during the same period with a year-on-year increase of 36%. The BRI projects' turnover reached 75.97 billion USD, accounting for 47.7% of the total turnover of overseas infrastructure projects for the same period, witnessing an increase of 9.7%.

In 2015, Chinese enterprises signed 3,987 overseas infrastructure contracts with 60 countries in relation to the 'Belt and Road' initiative. The signed contract value along the Belt and Road was 92.64 billion USD with a year-on-year increase of 7.4%, accounting for 44.1% of the contract value of China's overseas infrastructure projects during the same period. The BRI projects' turnover was 69.26 billion USD, accounting for 45% of the total turnover of overseas infrastructure projects for the same period, an increase of 7.6 % (Fig. 10).

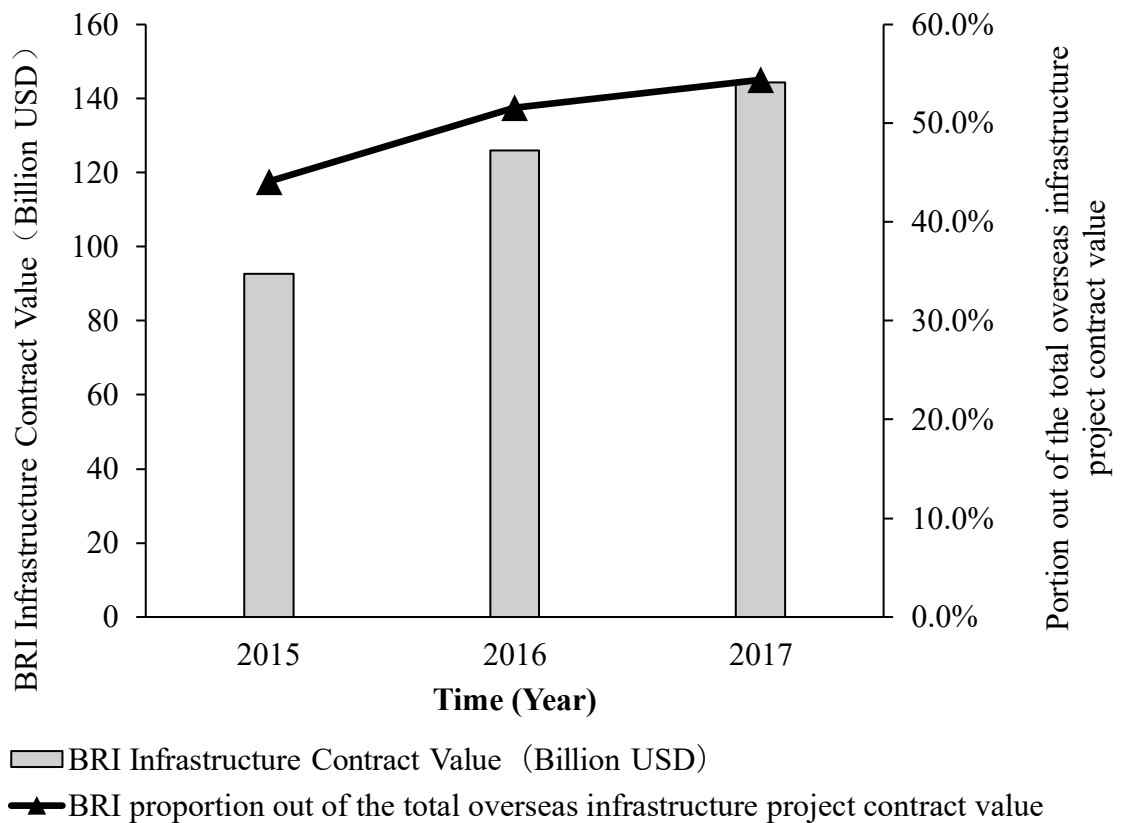


Figure 10 The trend of the BRI infrastructure contract value

Source: Ministry of Finance

The impact of governance framework on the PPP performance cannot be overstated. One can also reckon that the current transitional phase of the PPP infrastructure provision in the context of the BRI shares a series of commonalities with that of the domestic arena. For instance, in the exploratory phase (pre~2002) in the domestic context, most of the PPP infrastructure concentrated in the energy and transport sectors, concurring with the sectoral project distribution along the BRI at present. This pattern of project distribution is related to the profitability of the infrastructure type, in which the energy and transport projects are perceived as better guaranteed in comparison with other types of infrastructure. In the BRI infrastructure PPP provision, the SOE investors have occupied a predominantly important position. In contrast, in the less risky

domestic context, the POE investors played a more prominent role in delivering financial protection, and the role sometimes exceeded that of the SOE investors, such as the adjustment period (2009~2013).

The differences reflected at the project level imply that the infrastructure provision in the form of PPP in the transnational context is not simply a morphing of domestic governance structure in place, but an outcome of deliberate concerns of risk distribution and management surrounding complex investing circumstance overseas. This is distinguishable from the lazier-faire framework of infrastructure provision, in which the risk distribution has not involved extra considerations on the interests of investors backed by the state. As a result, despite a more secure provision being warranted, the trade-off between incentives of private sectors and ‘fair’ risk distribution in the high-risk context casts additional cost on the overall process of infrastructure provision. Nevertheless, this offers a crucial opportunity for private sectors to be rapidly mature through tackling the high-risk context for nurturing an experienced management team, meanwhile, balancing the interests of SOEs for enhancing the formal and informal relationships.

The features of the existing BRI infrastructure PPP projects demonstrate a rather similar phenomenon in the early stage of PPP infrastructure provision in the Chinese domestic market. The BRI infrastructure PPP development and governance are currently in their budding phase, with the current features suggesting that: (1). There is a lack of specific PPP laws or policies; (2). The stakeholders mainly consist of SOEs, whereas the involvement of POEs is still more limited; (3). The type of infrastructures is limited to the economic infrastructure sectors, such as energy and transport, rather than to social

infrastructures. There are complex determinant factors impacting the application of PPP, including credit rating, legislation, market liberalisation, financial market status, preferential taxation and political risk of the host countries (Delmon, 2009; Grimsey and Lewis, 2007; Henderson and McGloin, 2004; Li, 2006; Sachs et al., 2007, 2007; Settlements, 2006).

In summary, the upward trend of the BRI infrastructure contract value and turnover not only demonstrates the continuously growing infrastructure demand with economic development along the Belt and Road but also illustrate the effect of the related incentive policies. So far, there is no obvious sign of a turning point yet. Hence, the BRI infrastructure provision in the form of PPP is still in the budding phase. The current policies about the BRI infrastructure provision in the form of PPP are still rather general, and there is no detailed arrangement regarding which institution should carry out the PPP governance responsibility and where the boundaries of administrative rights should be lined out. Moreover, not only do the Chinese government institutions need to be coordinated, but the cooperation between the multilateral institutions should also be incorporated into the framework. The current administrative intuition framework needs to be compatible with the investment and project level fast-growing trend and adapt to the complex BRI context.

Table 4 Top 5 contract value BRI infrastructure PPP projects

Year	Project Name	Investor/Contractor	Ownership	Contract value (Billion USD)	Sector
2013	Pakistan Chashma Nuclear Power Plant	China Nuclear Engineering Group Co. Ltd.	SOE	6.50	Energy
2014	Nigeria Coastal Railway	China Railway Construction Co. Ltd.	SOE	6.81	Transport
2015	Argentina Nucleoeléctrica Nuclear Power Plant	China Nuclear Engineering Group Co. Ltd.	SOE	4.70	Energy
2015	Argentina Kirchner and the Cepernic Hydroelectric Complex	China Energy Engineering Corporation ; China Gezhouba Group International Engineering Co.	SOE	3.66	Energy
2015	Nigeria Ogun Light Rail Project	China Railway Construction Co. Ltd.	SOE	3.51	Transport

Source: Deloitte (2019)

3.3.3 Rethinking the path-dependence of BRI infrastructure PPP governance beyond the domestic framework

The PPP is argued to be shaped by the institutional framework and implemented differently in different regions where the PPP is used as one of the forms of the infrastructure provision (Jooste et al., 2011). Thus, it brings up the discussion regarding the concept of path-dependence in the transition of the administrative institutions' framework in a regional scale. In geographic economics, the economic evolution of path dependence is regarded as an ontology of regional growth and development (Scott, 2006). It is explained as:

The current state of affairs cannot be derived from current conditions only, since the current state of affairs has emerged from and has been constrained by previous states of affairs. Evolutionary theory deals with path-dependent processes, in which previous events affect the probability of future events to occur.

Boschma and Frenken (2006)

On the one hand, the commonalities observed show a certain level of dependence on the governance framework of the BRI infrastructure PPP provision on the domestic trajectory, which may potentially entail the lock-in problems, such as the overlapping management of governmental institutions and the inconsistency of the piece-meal policies. On the other hand, the differences in the geographic contexts, relevant policies and practices between the domestic and BRI infrastructure provision inevitably lead to the different composition of the administrative institutions and institutional environment. As Martin (2010) argues, the canonical path dependence model with the core concept of lock-in is restrictive and narrowly applicable to explain the industrial

evaluation at both regional and local scales. His idea that the path dependence is also a place-dependent process is intuitive for understanding the transition of the BRI infrastructure PPP governance framework, which emphasises the change of the path rather than the inertia, continuity, stability, and the total dependence of the domestic path.

In addition, the significant relevance of the BRI infrastructure PPP governance framework with the OFDI framework demonstrates that it simultaneously depends on the OFDI trajectory. Thus, the evolvement of the administrative institutions' framework that takes place is a function of a variety of context-specific variables. Its transition in both domestic and BRI contexts needs to cope with the challenges of prevailing socio-economic circumstances, *ad hoc* institution arrangement, self-reinforcing approach, as well as the international influences. In both arenas, it is a process of learning-by-doing. Moreover, the lessons learnt from the domestic context are able to be internalised to shape the administrative institutions' framework and adjust the practices along the changes of the BRI context.

There are three major implications can be drawn from the transitional path of the domestic framework for the BRI PPP governance framework. First, the administrative institutions, in charge of infrastructure provision and PPP, are still in a dynamically changing process along with the reform of general national institutions, which are subject to the experience of both domestic and transnational infrastructure provision. As China gradually becomes a mature provider in the global infrastructure market, the institutions are expected to be more streamlined to improve the efficiency and capacity and incentivise of both private and state-owned players. This process is dependent on

refining the governance philosophy and knowledge of the administrative institutions as well as a fair and transparent consensus of distributive rights and responsibilities between the public and private sectors. Second, the dearth of the specific PPP law and policy has implied the importance of governance and contract which can assist in the implementation of PPP. Such a contract as featuring a fair allocation of payoff and the risk between the private and the public sectors ought to be corresponding to the goal of governance philosophy and in service for producing a more explicit and standardised institutional environment. Third, given that the infrastructure PPP is a long-term contractual relationship between the public and the private sector, it is inevitably incomplete in a multidimensional context of risk management and project operation, such as the BRI. Therefore, a comprehensive analysis by looking at the past from the perspectives of the socio-economic status, institutions, policies and projects in a context that shares some commonalities will enable the stakeholders to assess the project viability better and prepare for the *ex-ante* and *ex-post* measures in case of disputes emerged.

3.4 Synthesis of results

There are three prominent factors defining the PPP and its application in the provision of infrastructure. The first factor refers to the first P in the PPP, namely the public sector. The second factor stands for the second P in the PPP, or more specifically the private sector. The third factor is the third P in the PPP, representing the partnership between the public and the private sector. As the first analytical building block of the thesis, this chapter first examines China's general institutional framework and its transition along the process of socio-economic development to lay a fundamental basis for the understanding of the specific governance framework of PPP infrastructure provision in

China domestically, and then move further and more specifically to the context of the BRI. The overarching aim of this chapter is to provide a holistic review of the administrative institution framework in the governance of BRI infrastructure provision in the form of PPP, including the rationales and some possibilities for its improvement based on the observed performance at both policy and project levels.

Given that the performance of the PPP model is closely related to its institutional environment, formally and informally, the roles and functions of the administrative institutions and their relationships are also assessed. The current domestic PPP administrative institutions' framework is constituted by multiple horizontal and vertical layers, which potentially increases the transaction cost along the PPP infrastructure provision process at the domestic scale. One of the findings is that this framework remains relatively unstable. It is often the case that the separate departments in the transformation of functions are re-merged after the institutional reform at the state level almost every five years. Most significantly, both the Ministry of Finance and the National Development and Reform Committee are at the top of the hierarchy in designing and implement the PPP policies simultaneously. This phenomenon increases the additional costs due to overlapping procedures and potential delays due to bureaucracy, to some extent, even resulting in a cumbersome institutional environment, decreasing the efficiency of governance. The kinks existing in the current administrative structure need to be improved by enhancing the vertical and horizontal coordination dually across government departments and clarifying the boundary of the administration.

The dynamic evolution of PPP in infrastructure delivery in China over the past three decades has followed an incremental but fast-changing trajectory, embedded in the socio-economic development and national institution reform and been influenced by policy-making, thus, reflecting the project delivery performance. The development of PPP infrastructure model in China has undergone four stages: the exploratory phase (pre~2002), the rapid development phase (2003~2008), the adjustment period (2009~2013) and the current booming and thriving in the new economic and social norm phase (2014 up until present). Due to the four stages demonstrating different features along the time series, the development phases are defined, and the rationale for such transition is therefore conducted along four axes, including the socio-economic development status, administrative institutions, policies and projects.

Subsequently, this chapter proceeds to investigate the infrastructure provision in the form of PPP in the context of the BRI by following the four-axis analytical approach adopted in the analysis in the domestic scenario. At present, China has become one of the world's largest outward investors. This study presents a holistic review of the OFDI-based BRI infrastructure PPP administrative institution framework as infrastructure investment accounts for a significant part of Chinese OFDI. There are fewer layers both vertically and horizontally in this framework compared with the domestic one. Nonetheless, institution arrangement still needs to be clarified. In the case of infrastructure non-financial OFDI, projects need to be reviewed by two layers of institutions, and when there is PPP involved, there is no explicit statement indicating which institutions will be in charge of what, let alone the specific procedures. A more precise definition of the administrative jurisdiction and functions is therefore desired. The implications can be drawn from the domestic experience due to the current budding

phase of the application of PPP to infrastructure provision in the context of the BRI sharing commonalities with the development phases in the domestic context.

Notwithstanding the PPP is shaped by the institutional and political frameworks and implemented differently in the domestic and BRI markets where the PPP is applied to infrastructure provision, the commonalities along the administrative institutions' framework are still significant. The adaptation of PPP in domestic and BRI contexts needs to cope with the challenges of prevailing socio-economic circumstances, *ad hoc* institution arrangement, and self-reinforcing approach, as well as international influences. In both arenas, it is a process of learning-by-doing and thinking beyond the canonical path dependence. Thus, the administrative institutions' evolvement that takes place is a function of a variety of context-specific variables. The evolvement path of the domestic administrative institutions' framework is intuitive for understanding the BRI PPP governance framework, whereas the details should be considered specific to the BRI context.

In summary, this chapter focuses on the institutional framework from the perspective of the public sector, its relevance with the socio-economic status, policy, and project performance at levels of 1, 2, and 3 in the NIE analytical framework, particularly in the formal scope. Given that the partnership involved many public and private stakeholders, the “rules of the game” (contract) among the key stakeholders and their interactions may offer more in-depth insights. Thus, the next chapter will discuss the interactions among private stakeholders in the BRI infrastructure provision also at levels of 1, 2 and 3, in order to answer the questions regarding the relation to the private sector. Taking the contracting ability and enforceability as the benchmarks, the private stakeholder

relationships are examined through the lens of the cooperative game theory under risk preference and payoff distribution lens. The private sector players can use it to select strategic options, allowing public-sector players to have a more comprehensive understanding of the BRI infrastructure delivery.

CHAPTER FOUR: PRIVATE STAKEHOLDER RELATIONSHIPS IN BRI INFRASTRUCTURE PPP PROJECTS

4.1 Introduction

As analysed in Chapter Three, the PPP of the infrastructure provision has entered a rapid development stage in the Chinese domestic and BRI markets. From the perspective of supply and demand, the overfilling capital and engineering capacity from the infrastructure investment pool of China outflows to the global infrastructure market, reconfiguring the global infrastructure landscape. Meanwhile, considering that global cooperation encourages states to open their various infrastructures to private owners through concessions, infrastructure is shifting from public-owned goods to a more ownership-diverse financial product in both the national and international spectrums.

Infrastructure assets are being increasingly offered as financial products to investors in order to capture the value of investing in the urban space while simultaneously allocating ownership risks globally (Babcock-Lumish and Clark, 2008). However, infrastructure assets present particular challenges in the global financialization process owing to the nature of infrastructure assets, for example, capital intensity, high upfront costs, lack of liquidity and a long asset life generating substantial financing requirements and the need for dedicated resources on the part of investors to understand the risks involved and to manage them (Croce and Gatti, 2014; Grimsey and Lewis, 2002; Regan Michael et al., 2011; Yehoue et al., 2006). The economy of scale and externalities also matter in the nature of infrastructure assets. Infrastructure often comprises natural monopolies (Gomez-Ibanez, 2003; Joskow, 2007; Posner, 1978), such as railways or power grids, which exhibit increasing returns to scale and can

generate social benefits. Although the direct return to the stakeholders of one infrastructure project may be inadequate for costs to be covered, the indirect externalities can still be beneficial for the economy as a whole.

Heterogeneity, complexity, and the diversity of stakeholders represent another important feature of infrastructure assets (Clark et al., 2018; Dooms et al., 2013; Salet et al., 2013). Infrastructure assets are heterogeneous and unique, with complex legal arrangements structured to ensure the proper distribution of payoffs and risk-sharing to align the incentives of all parties. However, regarding the involvement of different parties, the information asymmetry results in access barriers for participants beyond other more transparent asset classes and high requirements of relational resources, especially in the foreign direct investment practice (He, 2002), such as in the context of the BRI and other cross border investment.

PPP, as one of the forms delivering the infrastructure, is defined as cooperative institutional and long-term contracts between the public and private sectors that involves the sharing of resources, risks, responsibilities, and rewards for the provision of public assets and service (Hodge and Greve, 2005; Linder, 1999). The performance quality standards, the delivery of service and the 'health' of contractual stakeholders are also important factors in the governance of contractual relations (Grimsey and Lewis, 2004). Contract theory deals with a fundamental problem of economic cooperation, which is closely related to the PPP, given it is a cooperative partnership among different institutions. The theory of contract design can be subdivided into the theory of complete contracts and the theory of incomplete contracts. Complete contract theory focuses on how the principal who has the residual claim rights but is at a

disadvantage in obtaining the information can identify, filter, and effectively incentivise the agent by designing the optimal contractual arrangements. It is hence, also called incentive theory (Holmstrom and Milgrom, 1991; Laffont and Martimort, 2002; Laffont and Tirole, 1991). In the cooperation, two (or more) parties can jointly generate a surplus in addition to what each of them can generate on their own. The amount of the surplus depends on the actions that each of the parties takes. The risk is that each party has the incentive to behave opportunistically such as to maximise its pay-off rather than the joint surplus. If the parties can form a complete contract that specifies the all the actions that of each of them will take and contingencies at every possible stage. And if this contract can be enforced, then the risk can be controlled.

However, in real-world practice, and especially in the long-term PPP contract, it is often impossible to form the complete contract. The uncertain and non-observable actions taken by the parties raise the risks of moral hazard and adverse selection and demand the renegotiation process (Grossman and Hart, 1983; Hart and Tirole, 1988). Thus, the theory of incomplete contact can describe the real situation better. In the incomplete contract theory, the contract cannot enforce the desired behaviour directly; rather, it offers incentives that induce the parties indirectly to behave more efficiently. The incentives include but not limited to financial payoff, the controlling right and property right (Schmidt, 2017). Based on the canonical models for the analysis of the optimal design of incentive mechanisms built by Hart and Holmstrom (1987, 2010), the effects of the incentive mechanisms are clarified and can guide the contractual process. Meanwhile, due to the incompleteness of the contract and limited contractual ability *ex-ante*, the renegotiation will be adopted to optimise the distribution of the return of the investment as well as ownership arrangement.

In addition, the basic endowments of the BRI are the diverse legal and property rights system and uncertain economic environment. The possible outcomes include the high cost of the contractual, lack of compliance, and lack of law enforcement. These institutional characteristics have exacerbated the extent of the incompleteness of the contract. Not only would the previously agreed contracts between the public and private sectors become incomplete, but the contract terms that have been agreed upon would also face the *ex-post* default. A number of problems have been observed (Hodge and Greve, 2010, 2017), such as the stakeholder opposition leading to ineffective implementation of the project. The stakeholder opposition mainly emerges from the understanding gap and misaligned strategies between the different stakeholders involved in the PPP of the desired process or outcome of the project (Chan and Cheung, 2014). This observation highlights the importance of bridging the understanding gap of the infrastructure provision in the form of PPP, especially the dynamic aspects of stakeholder relations in the complex and diverse context of the BRI.

Torrance (2006) investigated the ownership relations of infrastructure and examined the interaction between institutional investors and fund managers. Subsequently, Sharma (2012) extends the research into the post-global financial crisis scenario and argues that relationships are central to affecting the performance of infrastructure investment. Good relational governance in the delivery of a multi-jurisdiction infrastructure will depend on finding the right partners and having the right support networks providing a thorough understanding of local conditions, regulators, market players, and more generally ‘ways of doing business’ in both China and the international jurisdictions. It will be essential to be able to adequately identify, quantify and overcome risks and seize opportunities. In order to do so, an on-the-ground

presence and knowledge of suitable stakeholders and relevant contacts constitute two of the main prerequisites.

As discussed in Chapter Three, the administrative and regulatory frameworks have been established for the governance of public-private partnerships practices in the domestic and overseas infrastructure market. Within the framework, the roles and relations between the public stakeholders were analysed to provide a comprehensive overview of the public element in the public-private partnerships. The public-sector stakeholders typically consist of national and local governments and ministries and/or departments under the administration of the corresponding ministries. Meanwhile, the private-sector stakeholders typically consist of investors, insurers and engineering/construction companies acting as sponsors. These stakeholders are brought together under a legal entity or organisational framework known as the special purpose vehicle (SPV) (Bettignies and Ross, 2010). Concerted emphasis has been placed on the means by which the private and public sectors can forge partnerships to share risk and benefit (Bing et al., 2005; Brinkerhoff and Brinkerhoff, 2011; Schepper et al., 2014; Grimsey and Lewis, 2002, 2002; Hodge and Greve, 2017). To date, however, the relationship among the private stakeholders, which refers to the second P in the PPP is yet to be thoroughly discussed.

Based on the nature of infrastructure assets, the features of the PPP and the positions of different stakeholders, the relationships among the private stakeholders are analysed through the lens of contract in the scenario of the BRI. By following the analysis of the administrative institution framework at levels 1, 2 and 3 in Chapter Four, this chapter analyses the interactions among the private stakeholders of the BRI infrastructure PPP

at levels 1, 2 and 3 in the NIE framework (Williamson, 1998). The profiling of private sector stakeholders' roles and their functions in the context of the BRI infrastructure PPP is provided in Section 4.2. After the identification of the key private stakeholders and their functionality, the stakeholder framework consisting of the internal relations and contracts between the private stakeholders is summarised in Section 4.3. On the basis of a game theory-based approach, the private stakeholder relationship is discussed with consideration of risk allocation and payoff distribution in Section 4.4. The relationships are impacted by the features of the specific BRI context, infrastructure asset, and the nature of PPP, and reflected by the contractual ability and enforceability of PPP.

The chapter aims to develop a richer understanding of the dynamics and strategies of the private stakeholders of infrastructure provision in the specific BRI background. The findings will contribute to a better aggregate conceptualisation and theory building and generate more meaningful practical guidance. It can be used by the private sector players to select the strategic options under any set of contractual terms and to assist in the choice of a realistic set of contractual terms, as well as allow the potential participants from the public sector to adopt a more comprehensive angle in the governance of BRI infrastructure provision in the form of PPP.

4.2 Identification of private stakeholders in the BRI infrastructure projects

Private involvement in infrastructure development has been re-emerging in developed economies and has also been practised in many developing economies. China has been one of the international players in the developing economies for around 20 years and has increased its investment in emerging economies along the Belt and Road. Based on

the extensive case studies of the BRI infrastructure PPP projects, the stakeholder types are summarised. Broadly speaking, under the PPP contractual agreement initiated by the government, there are different types of stakeholders involved in the PPPs. For example, the special purpose vehicle (SPV) will be established to raise finance through a combination of equity provided by the project company's shareholders and debt provided by banks, or through bonds or other financial instruments and to implement the project construction, operation, and other relevant activities. SPVs manage the design and construction contracts and are in charge of operations and maintenance.

The financing structure represents the combination of equity and debt and the contractual relationships between equity holders and lenders. The initial equity investors, who initiate the PPP model, are typically referred to as project sponsors. Typical equity investors may be developers, engineering/construction companies and private equity funds. The lenders in PPP projects in countries normally include commercial banks, multilateral and bilateral development banks, and specialised development funds. The guarantees provided by the insurance companies are usually the prerequisite agreements for the banks to grant loans. The contractors, suppliers, and operators will be responsible for the construction, operation, and maintenance of performance contracts (Table 5).

Table 5 Generic groups of stakeholders

Stakeholders	Forms of involvement
Government	Authorisation/Support/Warranty/Capital input
Shareholders/Enterprises	Capital input/Expertise input/Guarantee
SPV (special purpose vehicle or project company)	Responsible for implementing the project financing, project construction, operation, and other relevant activities along the life-cycle of the project
Equity investor/Lender	Capital input
Insurance Company	Providing insurance to mitigate the project risk and compensate the project loss
Contractor/Builder	Designing and providing construction expertise and capacity
Operator	Operating and maintaining the infrastructure
Supplier	Supplying the construction material and other necessities

4.2.1 Shareholders, SPVs, contractors, operators, and suppliers

In most BRI infrastructure PPP projects, SOEs are equity investors in most cases, in addition to also being the project sponsors. The main function of the SOEs is to directly or indirectly participate in the implementation of the contract and provide credit guarantee and engineering capacity for the SPV after obtaining the government permits or approvals required for the project. For example, in Colombo Port City of Sri Lanka, China Harbour Co. Ltd., as the main investor of the project, holds the majority of shares of the SPV. Generally, the roles of contractors, operators, and suppliers are also assumed by SOEs and their subsidiary companies. In the Kamchay Hydropower case, China Hydropower International, as the Engineer, Procure, Construct (EPC) general contractor of the project, signed a series of contracts for the project with the SPV set up by China Hydropower itself. In the international engineering market, China is the world's largest country deeply involved in overseas engineering contract construction. The China Communications Construction Group successfully bid for a dredging project when competing with other international counterparts by providing downstream real estate development service. The local land owner established a joint venture company together with the China Communications Construction Group since it brings added

value to the project (Lina Yan, 2016). Another case conducted by the China Minmetals Corporation demonstrates the company's integrated role as a contractor and supplier. In the construction of the Hejing Steel Plant in Vietnam, the China Minmetals Corporation was responsible for the plant design and construction, while it leveraged its strength and resources in the mining industry and equipment manufacturing to provide the iron ore and smelting equipment for this plant. This contract is by far the largest steel construction project undertaken by China overseas, with a total contract value of about 2.4 billion USD (China Economy, 2017). From these two cases, the Chinese infrastructure enterprises have shown a transformation trend indicating that the business is extended to a life-cycle management in the 'glocal' process, thus improving the competitiveness in the global market and achieving the shift from the industrial chain to the value chain with the more integrated roles as a contractor, developer, operator and supplier.

4.2.2 Lenders and insurers

Lenders:

The current funding sources closely linked with the 'Belt and Road' can be summarised into the following five classes: multilateral financial institutions, developmental and policy financial institutions, commercial banks, specialised investment funds, and emerging multilateral development financial institutions. The following is the general introduction of the major lenders in the BRI infrastructure, especially from China's perspective.

Multilateral financial institutions

The credit facilities provided by the World Bank and the Asian Development Bank are important to the BRI infrastructure project finance. The World Bank Group includes five member institutions: The International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA) and the International Centre for Settlement of Investment Disputes (ICSID). The IBRD and IDA are the main investors, mainly in the form of concessional loans to the government in developing countries and public-private agencies guaranteed by the government. In the fiscal year 2016, the IBRD and IDA together provided loans totalling 45.9 billion USD (World Bank, 2017) and part of them have been invested along the Belt and Road. In terms of industry distribution, the World Bank provided loans support in the areas of energy and mining, health and other social services, industry and trade, transport, water supply and sanitation and flood control. These areas are closely related to the target fields of the BRI. The Asian Development Bank is an Asian regional development organisation dedicated to reducing poverty in Asia and the Pacific by providing loans, grants, research and technical assistance to its member countries and investing in private companies. ADB, comprising 67 members, 48 of whom are from the Asia Pacific region and therefore highly aligned with the Belt and Road Initiative regions. In 2016, its investment was mainly used to support energy (24%), agriculture and natural resources (5.6%), transport (34.9%), and urban infrastructure and services (9.6%) (Asian Development Bank, 2017).

1) Policy-oriented financial institutions

The current major policy banks in the BRI are the China Development Bank (CDB) and the Export-Import Bank of China (EXIM), which mainly provide financing and financial advisory services through bank credit, syndicated loans, preferential buyers' loans, foreign aid loans, export credit insurance and state industrial funds. Since 2013, the CDB has signed more than 140 agreements with state partners along the 'Belt and Road' and has implemented bilateral cooperation programs with Kazakhstan, Laos, Cambodia, Mongolia, Pakistan and other states. At the end of 2016, the CDB has issued more than 160 billion USD in loans along the 'One Belt and One Road', with a balance of more than 110 billion USD, accounting for more than 30% of its international business balance (China Development Bank, 2017). The state reserve foreign exchange program along the 'Belt and Road' exceeded the 350 billion USD financing needs by 500 billion and set up special loans for various fields including energy, minerals, equipment manufacturing, transportation, aviation, finance, chemical engineering and high-tech industries. The projects involved include the New Europe Sino-Russia Crude Oil Pipeline, the Central Asia Natural Gas Pipeline, the Capacity Cooperation and Development of Industrial Parks between China and Indonesia, Laos and Kazakhstan, the Astana Light Rail Project, the Indonesia Yaman Speed Rail Project, and the UK HPC Nuclear Power Project (China Development Bank, 2017). Since 2014, the Exim Bank of China has provided loans for more than 1,200 contracted projects along the 'One Belt and One Road', with most of the projects being concentrated in the road, railways, airports, water transport, and other transport areas (Xinhua, 2017b).

2) Commercial banks

As market-oriented indirect financing financial institutions, commercial banks play an important role in financing the ‘Belt and Road’. Chinese commercial banks have formulated a number of credit policies and measures to provide financial support for the Belt and Road through diversified financial instruments, such as syndicated loans, industrial funds, loans for contracted projects abroad, and reciprocal loans. Their infrastructure investment has covered roads, railways, ports, power plants and communications. By the end of 2016, the Bank of China had granted loans for 420 mega overseas infrastructure projects, the Industrial and Commercial Bank of China had reserved 412 projects in the investment pool, and the China Construction Bank had stocked over 180 ‘going global’ infrastructure projects with a credit scale of US \$ 90 billion. By the end of 2016, the Bank of Communications has provided about 40 billion USD for 37 key projects in the form of internal foreign loans, overseas syndicate loans, and bilateral loans (Bank of Communication, 2017). The major commercial banks investing in the BRI infrastructure mentioned above are state-owned and referred to as the ‘Big Four’. The other commercial banks include the Agricultural Bank of China, the Bank of Communications, and the Postal Savings Bank of China (CMSC Securities, 2017).

3) Specialised investment funds

The specialised investment funds are initiated and funded by policy banks, commercial financial institutions and foreign exchange reserves. They are mainly invested in regions, such as the Association of Southeast Asian Nations (ASEAN), Africa and Eurasia. The Silk Road Fund, the China-ASEAN Investment Cooperation Fund, the China-Africa Development Fund and the China Investment Co., Ltd. (Chinese sovereign wealth fund) are the representative direct funds. For example, the Belt and

Road oriented Silk Road Fund was established in 2014, whose nature is a medium and long-term development fund, similar to the medium and long-term private equity investment fund. The size of the Silk Road Fund is 40 billion US dollars, invested by the foreign exchange reserves (through Buttonwood Investment Platform Co., Ltd.), China Investment Co., Ltd. and the China Development Bank Capital and the Bank of China. The main investment types of the Silk Road Fund are equity investments, bond investments and entrusted asset management with a relatively long-term horizon. The Silk Road Fund has signed 15 projects in the field of infrastructure and relevant financial products with a total investment amount of 6 billion USD. The investment covers Russia, Mongolia, Central Asia, South Asia, South-East Asia, North-West Asia, North Africa, and Europe along the ‘Belt and Road’ (Qi Jin, 2017).

4) New multilateral development financial institutions

New multilateral development financial institutions investing in the ‘Belt and Road’ include the Asia Infrastructure Investment Bank and the New Development Bank. The AIIB was officially established in 2016. The AIIB, which covers 57 member countries, is a multilateral development financial institution that aims to meet the investment needs of infrastructure in Asia. The statutory capital of the AIIB is 100 billion USD, while China contributes 50% from the Chinese foreign exchange reserves. The other founding members jointly raise the remaining capital. The AIIB is an intergovernmental financial development institution operating under the model and principle of a multilateral development bank. It is by far the largest and highest-profile government multilateral cooperation fund in China. By 2017, the AIIB had 70 signatories and had provided a total of 1.73 billion USD loans to support nine infrastructure projects in

seven countries (Pakistan, Bangladesh, Tajikistan, Indonesia, Myanmar, Azerbaijan and Oman) (AIIB, 2017).

In total, the external funding including the outstanding loans and equity investment had reached 292 billion USD by the end of 2016, with approximately 51% thereof being derived from the ‘Big Four’ Chinese state-owned commercial banks. The policy banks, such as the National Development Bank and the Export-Import Bank of China provided 46% of the funding, whereas the Silk Road Fund, the Asian Infrastructure Investment Bank, and the New Development Bank together contributed the remaining 3% of the funding (Fig. 11). The funding source distribution implies that the investment in the BRI infrastructure is still dominated by the financial institutions with a strong political background. It should be recognised that a more diverse funding source constituted by state-backed capital as well as privately owned capital is crucial for a more sustainable funding structure.

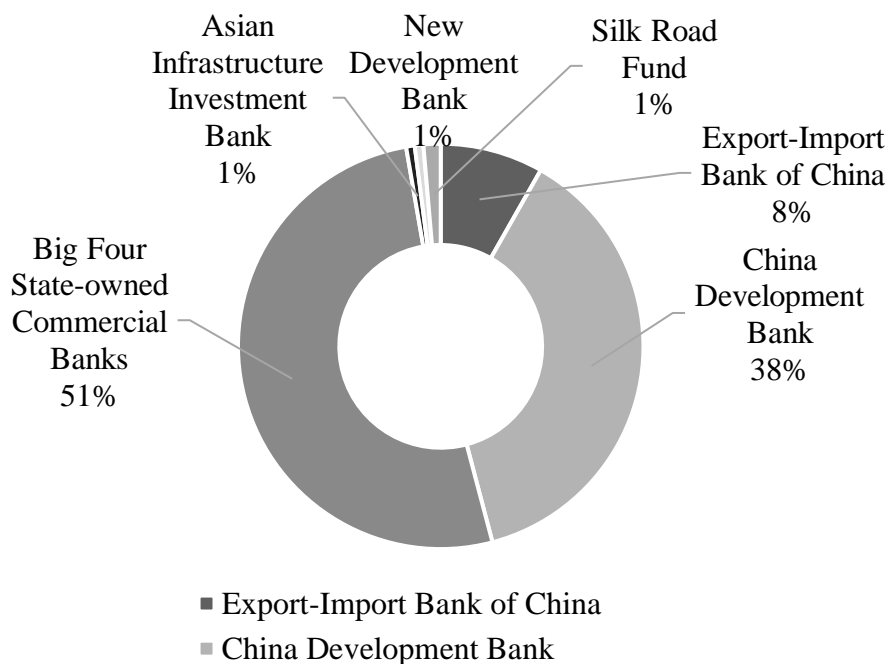


Figure 11 BRI Infrastructure funding source distribution

Source: Financial Times, Oxford Economics, data collected by the author

Insurers:

At present, Sinosure (China Export Credit Insurance Corporation) and the PICC (People's Insurance Company of China) are the main insurance providers for Chinese cross-border infrastructure projects. Their long-term underwriting insurance options include export buyer credit insurance, export seller credit insurance, export extension contract refinancing insurance, finance leasing insurance, and overseas investment insurance. The most common insurance adopted in Chinese cross-border infrastructure PPP projects is the export buyer credit insurance. Taking Sinosure as an example, it provides export credit insurance and overseas investment insurance to related enterprises. Since 2013, Sinosure has supported more than 440 billion USD of exports and investments in countries along the 'Belt and Road', including the Central Asia Natural Gas Pipeline Project, Jordan's Attarat Oil Shale Power Project, Pakistan's Sahiwal Coal-fired 1097 steel plants, the 3.5 million tons steel plant project in Malaysia, and the Sanhe Hydropower Project in Cambodia. The issued insurance covers a total area of 1,097 projects, such as transportation, petroleum equipment, power engineering, housing construction, and communications equipment (Xinhua, 2017c).

Whether the projects are qualified for the requirements of insurance companies, such as Sinosure and the PICC (People's Insurance Company of China) are the prerequisite condition for the banks to provide the loan. In most Chinese overseas infrastructure PPP projects, Sinosure requires that a minimum of 70% of the funding is issued by the Chinese side. This requirement is also known as the regulation of Chinese elements. For example, in the Bangladesh Shahjibazar power project, the insurance for political and commercial risks is covered by Sinosure (up to 95%). Given that the requirement of Sinosure is that at least 70% of the financing should be provided by the Chinese side,

HSBC, therefore, chose to partner with the Industrial and the ICBC and CEXIM for this transaction for compliance reasons.

The China Reinsurance (Group) Corporation is a major player in Chinese overseas infrastructure investments. The China Reinsurance (Group) Corporation (hereinafter ‘China Re’) was co-founded by the Ministry of Finance of the People’s Republic of China. China Re is now Asia’s largest and the world’s eighth largest reinsurer in terms of reinsurance premium income. As China’s sole state-owned reinsurance group, it has always been the main channel of reinsurance for Chinese infrastructure projects. Apart from providing reinsurance for infrastructure projects overseas, China Re also acts as a long-term investor in domestic PPP infrastructure projects in China. In the Beijing Metro line 16 project, the asset management firm under China Re acts as the equity investor. However, the asset management firm under China Re adopted the principal-agent model by outsourcing the management to Beijing Investment Limited (Sino Re, 2015).

4.3 Conceptualisation of the PPP stakeholder framework in the BRI infrastructure projects

Drawn upon the identification and functionality description of the major private sector stakeholders and the existing BRI infrastructure PPP projects, the interrelations between them can be conceptualised into a stakeholder framework at the project level by the author (Fig.12). Such framework consists of direct and indirect links among all the stakeholders of the PPP project: from governments to corporates, banks, funds and insurance companies. At its core, the SPV is at the centre of this whole network consisting of the public and private sectors in a PPP project. Grimsey and Lewis (2007) also define SPVs as organisations that can be established as distinct legal entities to

bring together the other companies involved in the PPPs for the purpose of managing the project while sharing risks and rewards.

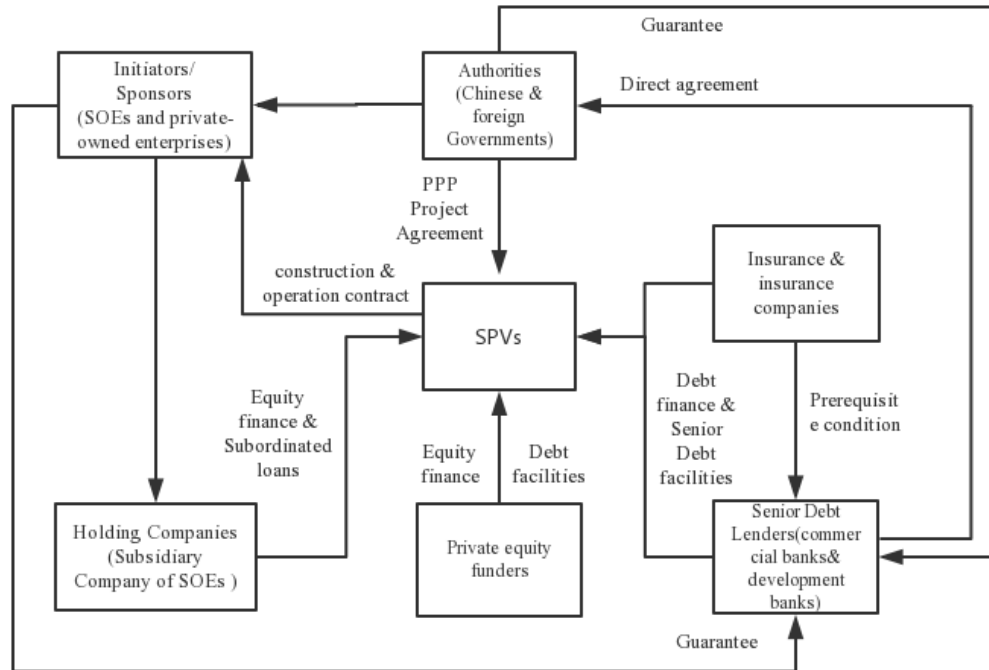


Figure 12 Typical stakeholder structure of BRI infrastructure PPP project

Source: The author

In most Chinese BRI infrastructure PPP projects, the SOE and private-owned enterprises (POE) sponsors will not implement the projects as direct participants. In actual practice, the SOEs will jointly establish the SPVs with the POEs through the holding companies, which are usually the overseas subsidiary companies affiliated with the SOEs. The link between the sponsors and the SPVs is represented by the construction and operation contracts since the SPVs themselves lack engineering and management capacity. Therefore, both construction and operation are outsourced back to the SOE and POE sponsors. Investing in the overseas infrastructure project indicates that more significant information asymmetry derived from social, political, and cultural

diversity. Hence, the main reason why the sponsors are not involved in the direct investment is risk isolation from the parent companies. The holding company is also the knot linking the investment activities between the sponsors and the SPVs. Through holding companies, the sponsors provide equity investment for the SPVs, as well as subordinated loans when the loans granted by the senior debt lenders are insufficient.

Apart from the investment provided by the sponsors, the international, multilateral, and national development banks, as well as the commercial banks, will provide the senior debt to BRI infrastructure PPP projects with the sovereign guarantee from the government authorities and credit guarantee from the parent SOEs and POEs. Another prerequisite condition of senior debt facility for the BRI infrastructure is the insurance and reinsurance for controlling the loan risks. Apart from the credit guarantee and the insurance guarantee, the direct agreement is another contractual tool to control the risks that senior lenders may be confronted with. If an event of default is outstanding during the term of the contract, the senior lenders may step in via the direct agreement to procure an insolvency official in relation to the SPVs' assets or appoint an eligible person assuming the SPVs' obligation under the construction. Since the high capital intensity of infrastructure assets, one commercial bank will establish the bank consortium together with other commercial banks and development banks to diversify the risks and release the capital constraint.

On the other hand, investment funds such as the Silk Road Fund and China-ASEAN Investment Cooperation Fund mainly play the roles of equity investors. It is also noted that these specialised funds have adopted the 'Equity + Debt' model in infrastructure project finance, which mainly provides equity investment but also offer loan as a

complementary financing source. By now, the Silk Road Fund equity investment has accounted for 72% of its total investment, amounting to over 80 billion USD (Qi Jin, 2017). While, for projects with large capital demands, in addition to the equity investment, the Silk Road Fund also cooperates with financial institutions, such as commercial and development banks, to provide syndicate loans. This approach aims to control the risk of the fund itself.

PPPs can be conceptualised as a collaboration framework, encompassing an array of actors, such as suppliers, consumers, regulators, and competitors (South, Levitt and Dewulf, 2015). By conceptualising the BRI infrastructure PPP stakeholder structure, it is observed that the asset features of the infrastructure and the diversity of social and economic development both influence the private stakeholder relationships. The long-term horizon, capital intensity, opaqueness/translucence and heterogeneity determine the composition of the stakeholders and their relations. Conversely, the position of the stakeholders and their approach in this cooperative and relational structure are impacted by the socio-economic perspective. It is also noted that among the stakeholders, the enterprise sponsors would select an indirect pathway to participate in the PPPs to balance the risks and return, for example, setting up overseas holding companies to indirectly invest in the SPVs. This indirect method leads to the umbrella contract form to isolate the debt recourse and protect the sponsor from bankruptcy risks.

4.4 The private stakeholder relationship in the BRI infrastructure PPP projects

The governance of the private stakeholder relationship can be directly related to the socio-economic, institutional and legal framework underpinning the governance jurisdiction of stakeholders and assets. It has been noted that the corporate governance systems vary from nation to nation with a clear divide between the Anglo-American

‘open’ system, and the ‘closed’ systems found in other western economies. Closed governance regimes involve corporations having concentrated ownership with controlling owners, while corporations in an open regime have their ownership dispersed with a clear separation in the relationship between shareholders and managers (Clark and Wójcik, 2007). According to the framework conceptualised for the stakeholder structure of BRI infrastructure PPP projects, the SOE sponsors are the major shareholders, controlling the shares of the SPVs indirectly, by contrast, normally POE sponsors only control a much smaller portion of the shares of the SPVs. Therefore, both the ‘closed’ and ‘open’ governance systems co-exist in the BRI infrastructure PPP projects. Such a unique framework needs to be considered by institutions looking to become involved in the BRI infrastructure development as a result of the partnership, which represents the complex reflection of ownership and managerial rights in the multinational BRI context.

4.4.1 The private stakeholder relationship

If market transactions were costless, all that matters (questions of equity apart) is that the rights of the various parties should be well-defined and the results of legal actions easy to forecast. But as we have seen, the situation is quite different when market transactions are so costly as to make it difficult to change the arrangement of rights established by the law.

R. H. Coase (1960)

For any initial allocation in the Coase Theorem, this would predict that the stakeholders will attempt to achieve Pareto optimality through bargaining. The bargaining can be

regarded as the negotiation for the design of contracts and the renegotiation after the execution of contracts. However, given that the transaction cost in the infrastructure is not able to be neglected and the ultimate aim of the negotiation and renegotiation in the PPP is to achieve a fairer risk sharing and payoff distribution, the Pareto optimality may not be sufficient to present the optimal solution for the entire infrastructure provision in the form of PPP.

In order to justify the solutions that may improve the total performance of the risk sharing and payoff distribution, the concepts of Pareto optimality and Pareto improvement ought to be distinguished. Pareto optimality is a state of allocation of resources from which it is impossible to reallocate so as to make any one individual or preference criterion better off without making at least one individual or preference criterion worse off. Whereas under the rubric of neoclassical economic theory, a Pareto improvement occurs when a change in allocation harms no one and helps at least one stakeholder, given an initial allocation of goods for a set of stakeholders. It also suggests that Pareto improvements will keep enhancing the value of the entire partnership until it achieves a Pareto equilibrium, where no more Pareto improvements can be made (Pardalos et al., 2008).

Under the PPP stakeholder framework of the BRI infrastructure PPP, the private stakeholders' decision-making demonstrates the direction towards the Pareto improvement in the cooperative game. Thus, the allocation of the risk and payoff can be better conducted throughout the whole process, including financing, insuring, construction and operation. Once the Pareto improvement points out the direction of the cooperative game, then the question remains as to what strategies will be adopted.

The common strategies adopted by the private stakeholders in the BRI infrastructure PPP provision will be described in the following sections. The contract governance and ownership angles will be applied to analyse the reasons behind this choice.

In contract theory, the optimal contract is one form of the contracts, the complete contract. However, in reality, the contract is inevitably incomplete due to the *ex-ante* contract lacking the full spectrum capacity of defining remedies for all unforeseeable contingencies and outcomes in the long term. Moreover, drafting a complete contract is costly. From the ownership perspective, when it is expensive to list all specific rights over assets in the contract, the optimal solution may be to let one party purchase all residual rights (Grossman and Hart, 1986). As the major shareholder, the SOE sponsors have residual control rights, which may influence the payoff distribution. Although concerns may arise, the dominant role of SOEs and state capital behind the stakeholder structure can still be regarded as a means of reducing the transaction cost and increasing the capacity for risk and contingencies management.

The neoclassical contract system has its limits, thus failing to provide a more comprehensive, dynamic and flexible perspective (Macneil, 1977). Flyvbjerg et al. (2003) argue that PPPs often come draped in politics of mistrust. According to these authors, society fears that political inequality in access to decision-making processes may lead to an unequal distribution of risks, burdens and benefits. Less mistrust was perceived in cases with a lower potential for external conflict. The relationship governance, therefore, may complement the reasoning from another angle.

Relational governance emphasises the role of trust relationships in achieving mutually beneficial outcomes. Relational governance mechanisms based upon social processes, such as trust relations, can safeguard, albeit informally, against exchange hazards and facilitate the enforcement of obligations as well as provide flexibility and dynamic adjustment (Zheng et al., 2008). Similarly, unforeseeable contingencies may be accommodated by a well-constructed relation to problem-solving, which facilitates adaptations—particularly within a long-term contract (Zand, 1972). Kumaraswamy et al. (2008) developed an integrated conceptual framework and initiated the concept of relational contractual for sustainable PPPs, and proposed that relationally integrating larger PPP teams can help generate more successful joint risk management, sustainable relationships and a long-term positive payoff.

The relationship can be further explained and summarised from a more comprehensive stance with the inclusion of the Coase Theorem, ownership, and contract governance. The most common theoretical logic to explain this phenomenon is based on Transaction Cost Economics (TCE). Assuming opportunism and bounded rationality (Williamson, 1993), the TCE asserts that firms attempt to minimise transaction costs by ‘assigning transactions’ to governance structures (Williamson, 1985). Therefore, organisations will only internalise activities where higher costs might arise from outsourcing and collaboration with external partners. Moreover, it is noted in the TCE that stakeholders have to safeguard against the hazard of opportunism by forming legal contracts, specifying what is acceptable and what is not, with threats of law enforcement or non-legal retribution (Williamson, 1983). Ideally, an optimal contract should entail the lowest transaction costs by containing all the ‘to avoid’ opportunistic behaviours and

reduce transactional ambiguity through clear specification in the contractual relationship (Caldwell and Howard, 2010).

So far, most of the research focuses on the relationship between the public and private stakeholders, for example, the selection of the private players in the bidding process in the game theory framework (Cruz and Simaan, 2000; Durieu, Haller, Querou and Solal, 2008; Ouenniche, Boukouras and Rajabi, 2016; Xu, 2000). However, the internal relationships have not been discussed, particularly in the context of the BRI. Since the private sector stakeholders are those who deliver the infrastructure goods, it is necessary to understand their relationships as well. In this section, the emphasis is placed on the analysis of private sector relations and their reflection and impact on the contracts. As an experienced practitioner comments on PPP practices:

PPP is not a one-off transaction. The private stakeholders must employ a long-term perspective to realise the sustainable risk allocation and payoff distribution with other private stakeholders and the public sector stakeholders, which highly emphasises the spirit of contract.

Interview, No. 6, (2016)

In the previous sections, the key stakeholders in the BRI infrastructure PPP projects were identified and an integrated conceptual stakeholder framework was developed with the discussion of the role of these stakeholders and their relations. Therefore, building upon these fundamentals, the stakeholder relationships and their impact on the contractual ability and contract enforceability of the PPP projects in the specific BRI

context will be assessed on the basis of two dimensions: risk preference and payoff expectation.

4.4.2 The basic assumptions in the formulation of the game theory for private relationships

Game theory and the specific conditions of BRI infrastructure PPP provision

A game includes a number of players N , a set of strategies for each player, and a payoff that describes the outcome of each ‘play’ of the game with reference to the amount that each player wins or loses. A strategy for each player can be very complicated because it is a plan, determined at the start of the game, which describes what a player will do in every possible situation. There are two types of games: non-cooperative games and cooperative games (Nash, 1953, 1951). The two basic conditions for the existence of cooperative games are: (1) For the coalition, the overall payoff is greater than the sum of the payoff of each of its members when they operate alone; (2) Within the coalition, there should be an allocation rule with a Pareto improvement nature, that is, each member can obtain more payoff than if they did not join the coalition (Cooter, 1998; Moulin, 2014).

Therefore, one important difference between the cooperative game and the non-cooperative game lies in that the former emphasises the information exchange within the alliance of players and the existence of the binding executable and enforceable contract (Heide and Miner, 1992; Luo, 2002). It is in stark contrast to the features in the non-cooperative game, reflected by the independent decision-making of each player and non-obligation to abide the common agreement. The exchange of information serves as the primary premise and basic condition for establishing cooperation and enables players to cope with the information asymmetry and share common interests to

form alliances for the same purpose. However, whether or not the coalition gains and allocates the payoff and shares the risks requires a contract guarantee. Therefore, when people are discussing the cooperative game, they often pay more attention to the contract of enforcement, which is the essential characteristic of the cooperative game. In addition, a cooperative game involves two players whose interests are neither opposing nor completely coincident (Barron, 2013). Most of the relationships between entities are neither totally strictly conflicting nor strictly cooperative, suggesting that the games are between players whose interests are neither opposite nor fully coherent. These games can be described as non-zero-sum games. Non-zero-sum games' solutions constitute the equilibrium in the cooperative game.

Games are also categorised by whether players move sequentially and whether or not the information is complete. In terms of the moving sequence of the players, there are two basic types of games: static games and dynamic games. Complicated by the information owned by players, the games can be further categorised into static games of complete information, dynamic games of complete information, static games with incomplete information, and dynamic games of incomplete information (Vries and Yehoue, 2013). In the static game, the players act more or less simultaneously and are unaware of each other's decisions before making their own decisions. In contrast, a game is dynamic if the players will select the strategies after observing the outcome of the actions done by previous players.

PPPs can be interpreted as a game due to a set of interactions involving players with complex features, particular strategies, behaviour, interest, and so forth. These characteristics are closely related to pay-off and risk sharing. Thus, it is important to

analyse all potential risks and pay-offs associated with the realisation of the partnership and their distribution between parties. Considering PPPs as a game, we must take into account the nature of cooperative games, infrastructure assets, and imperfect and incomplete information in the context of the BRI. The cooperation in the BRI infrastructure provision means that all the stakeholders in the game are going in the same direction in order to maximise the overall return of infrastructure development and minimise the risks even the competition exists, from the initial construction phase to the operation phase until the end of the partnership.

The domains and scenarios of the game-theoretic analysis

Building upon the analysis in the previous sections, two structural dimensions serve the stakeholder relations analysis in the PPPs. These two structural dimensions are (1) Risk preference, and (2) Expectation of payoff. Risk allocation in PPP projects is fundamentally different from that in traditional projects. A number of standard risk allocation matrices have been produced to guide appropriate risk allocation in PPP projects, most of which agree on the general allocation of risks between different stakeholders (Grimsey and Lewis, 2007b, 2002; Ng and Loosemore, 2007). As the contractual arrangement contains contract types, contract award methods, and risk allocation, the equitable risk allocation between the stakeholders determines both contractual ability and enforceability (Carbonara et al., 2014; Gordon, 1994).

In BRI infrastructure PPP, the sponsors' payoff will not only come from the returns on equity and debt investments in the concessionaire, but also from the payment of the construction and operation contracts since the sponsors would often act as the major

contractors for construction and operation. An important characteristic of the operation contract returns is that the returns are possible only when the project is completed and the sponsors continue with the operation, whereas the construction returns can be achieved once the construction work is finished as required in the contract. This difference between the construction contract returns and operation contract returns plays an important role in the governance of BRI PPP, as we shall discuss later. The payoff structure of the BRI infrastructure PPP investment is better explained by the PPP stakeholder framework illustrated in Figure 12, which indicates that the returns of the PPP investment include equity returns, construction contract returns, and operation contract returns. From the sponsors' perspective, the payoff from a PPP investment represents the overall returns from the profit pool. Moreover, how the payoff distribution mechanism is structured is determined by the interactions between the different stakeholders.

The game scenarios unfold along the process of the BRI infrastructure PPP. Given the features of PPP, a cooperative game approach will be used for modelling and analysing the dynamic relationships between players based on contractual ability and enforceability. As illustrated in the conceptualised PPP stakeholder structure, the SPV is the key knot of the network representing the ownership of sponsors. In what follows, the relationships within the private sector will be discussed by analysing the dynamics between the SPV and each key private-sector stakeholder in terms of risk preference and payoff expectation, respectively.

General risk and payoff matrix of PPP projects

In a PPP scenario, taking x to represent the payoffs of the SPV, and y to represent that of the other private stakeholders, the following payoff and risk matrix can be formulated (Fig. 13), where m and n indicate the possible choices or strategies that each project party can make. In the general matrix, (x_{ij}, y_{ij}) represents the payoffs/risk of both SPV and other private sector stakeholders if the SPV chooses strategy i while another private sector stakeholder selects strategy j .

i, j	0	1	2	...	n
0	(x_{00}, y_{00})	(x_{01}, y_{01})	(x_{02}, y_{02})	...	(x_{0n}, y_{0n})
1	(x_{10}, y_{10})	(x_{11}, y_{11})	(x_{12}, y_{12})	...	(x_{1n}, y_{1n})
2	(x_{20}, y_{20})	(x_{21}, y_{21})	(x_{22}, y_{22})	...	(x_{2n}, y_{2n})
\vdots	\vdots	\vdots	\vdots	\ddots	\vdots
m	(x_{m0}, y_{m0})	(x_{m1}, y_{m1})	(x_{m2}, y_{m2})	...	(x_{mn}, y_{mn})

Figure 13 The theoretical game matrix for the SPV and other private stakeholders

The concept of equilibrium offers a tangible way to analyse the outcome of a game. An equilibrium describes a stable status, where all players are satisfied with their chosen strategies, in the sense that deviating to another strategy cannot make them better off. The specific definition of equilibrium is referred to as the solution concept in the literature. Whereas in the non-cooperative setting, Nash equilibrium is the most notable and widely adopted solution concept, Pareto optimality is more appropriate here for the PPP scenario. The key is the players are essentially cooperative, so a unilateral change would be considered infeasible if it makes an individual player better off but at the expense of making other players worse off. In contrast, a beneficial change that preserves every other player's payoff is acceptable, and this is called a Pareto improvement.

Coalition Formation Game

While the edgewise interaction between players in Figure 13 are captured by the bi-matrix games as described above, the interaction concerning all the players can be modelled as a coalition formation game. The framework has been used to analyse strategic scenarios where alliance-formation and contact are viable means for enhancing competence (Maschler et al., 2013). Specific to the PPP scenario, let the types of players (e.g., SPVs, private equity funders, private shareholders) be in a collection Θ . For each type $\theta \in \Theta$, let there be an associated set S_θ that contains the candidate players of type θ . Now the players in the union set $\cup_{\theta \in \Theta} S_\theta$ are playing a coalitional formation game. Their goal is to forge a group with a full set of roles as in Figure 12. The payoff $U(S)$ for a coalition S can be defined as follows:

$$U(S) = \begin{cases} u - \sum_{s,s' \in S} c(s,s'), & \text{if } S \text{ is a full set} \\ 0, & \text{otherwise} \end{cases}$$

where u denotes the gain from the project, and $c(s,s')$ denotes the cost incurred from cooperation between two players s and s' , which is determined by the edgewise games. Namely, a full set of roles allows the group to accomplish the project and gain a reward u . Otherwise, the gain is zero. In addition, $c(s,s') = -\infty$ if the s and s' are unable to cooperate (e.g., no contractual ability). The outcome of a coalitional game is a partition of players into groups and a distribution of gains among each individual player.

4.4.3 SPVs and their relationships with the key private stakeholders in the BRI infrastructure PPP projects

SPVs and the lenders

The initial purpose of establishing the SPV is to conduct the PPP project. Therefore, all the financing activities will surround the SPV. In the form of debt finance, the SPV is regarded as a borrower, the sponsor of the project providing the guarantee for contractual ability and enforceability. The loss borne by the sponsor is limited to the amount of project equity investment through the limited recourse project financing, which is also the most frequently used financing mode for the infrastructure project. Under this context, the relationship between the lender and the SPV will be discussed, considering the constraints of risk and payoff under different scenarios in the game theory framework.

Table 6 Lender and SPV game matrix considering the project risk preference

Lender and SPV game matrix		SPV	
		Low risk	High risk
Lender	Low risk	A	B
	High risk	C	D

There are four scenarios in the lender and SPV game matrix with risk preference constraints. In the BRI infrastructure PPP development process, the lenders mainly consist of the China Development Bank, the Export-Import Bank of China, and the state-owned commercial banks in the bank consortium led by these two policy-oriented banks. Since the asset and credit guarantee of the sponsor constitute the compulsory prerequisite conditions for the loans, the default of the senior debt contract is mainly due to the political risks and force majeure risks. The contractual ability and

enforceability are high when the risk is low for both the SPVs and the lenders. However, the likelihood of this scenario is low in most BRI infrastructure cases. In practice, the political risk and force majeure risk in the local countries are relatively high due to the political uncertainties and fast-changing international relations. The Chinese overseas infrastructure development serves the national political ‘going out’ strategy. Therefore, the contractual ability is relatively high even when the risk is significant, which will fit in scenario D.

However, applying for the senior debt facility from the development bank and bank consortium remains problematic for POE sponsors since the credit rating of POEs is at a disadvantage compared with the SOEs, even though the SOEs are also regarded as private participants or social capital by the central government. The relationships between the SOEs, government and banks reflect another reason. Although the SOEs in China has undergone an ownership reform, transferred from being wholly state-owned to mixed ownership (owned by the state and the private shareholders), the nexus between the banks, the state and the SOEs is still very tight. SOEs are the preferred clients with higher credit ratings since part of the ownership is under the management of the SASAC. Therefore, most of the POEs will jointly initiate and sponsor the overseas infrastructure project with the SOEs to obtain the loan from the banks hence increasing the contractual ability and enforceability of the project debt financing contract. It is also often necessary for the host government to provide the investors with certain guarantees that relieve some of the risk shouldered by the private parties to attract investment. This approach adopted by the POEs can be regarded as a form of Pareto improvement. For instance, a minimum revenue guarantee supplied by the government can attenuate the market risk borne by the investor.

Table 7 Lender and SPV game matrix considering the project payoff expectation

Lender and SPV game matrix		SPV	
		Low payoff	High payoff
Lender	Low payoff	A	B
	High payoff	C	D

Similarly, the scenarios with the payoff expectation constraint also demonstrate some unique features. As noted, the major lenders in the Chinese overseas infrastructure projects are the ‘Big Four’ state-owned commercial banks, the development financial institutions, such as the CDB and the EXIM Bank of China, and the specialised funds, such as the Silk Road Fund. These financial institutions exhibit better performance in mitigating the information asymmetry, given their closer cooperation with the public authorities and SOEs, which will increase the completeness of the information obtained. Second, the positioning of these financial institutions, particularly of the policy banks, is not limited to the lenders. They also participate together with the government authorities in the adjustment of economic activity. Hence, their behaviour pattern in loan management can better control the pro-cyclical problem in the marketised economy. Conversely, due to the debt period mismatch, information asymmetry, and focus incompatibility, the other types of commercial debt financing providers are reluctant to grant loans for the BRI infrastructure PPP projects. Third, the commercial financial institutions are primarily involved in the bank consortium led by development financial institutions to seek a more reliable guarantee of the payoff in the form of debt repayment and interest.

Theoretically, scenario D has the highest contractual ability and enforceability. However, in actual BRI cases, this is rare to see, given that the nature of the infrastructure is constituted by public goods. Most of the cases fall into scenarios A, B,

and C based on the variation of the interest rate. Usually, the interest rate of the loan provided by the CDB and the EXIM Bank of China is slightly higher than the benchmark lending interest rate base set by the People's Bank of China (PBOC, the Central Bank of China), but it is still preferential compared with the loan provided by the commercial banks. However, the trend has reached a turning point in that the commercial banks have now outweighed the policy banks in financing the infrastructure. As the policy banks mainly raise their capital from issuing bonds, the cost of capital is around 4~5% a year. On the other hand, the capital pool of commercial banks is filled by a significant amount of household and individual savings. The cost of the capital is the benchmark saving interest rate set by the PBOC, which is around 1.35% a year. Given that the cost of debt financing is generated from the outstanding interest, the SPV will inevitably choose the lenders who can provide the loan with a lower interest rate.

There are several feasible strategies that can release the conflicts of interest in the SPV-lender relations to increase the contractual ability and enforceability. It is observed from the BRI infrastructure PPP cases that to ensure the enforceability of PPP projects, SPVs are often required to submit construction and operation guarantees in order to obtain the loan. Meanwhile, SPVs will pledge the proceeds of the project operation period to the lenders, or the SPVs can mortgage the land use right to the lenders when the SPVs obtain the project land use right during the operation period. It is also often necessary for the government of the host country to provide sovereign guarantees in order to encourage the involvement of the lenders due to the large scale of investments to demand and long tenure of the projects (Liu et al., 2014). In addition, the lenders will provide a grace period to allow the SPVs to start to repay the debt even a few years

after construction completion. These guarantees can be regarded as the measures of Pareto improvement.

The capital for the debt repayment and the return for the SPVs come from the cash flow generated by providing the infrastructure goods or services for the local users in the project operation phase. The exchange rate between the investor’s country and the country where the projects are located becomes the main uncertainty for debt repayment. In the countries along the Belt and Road, the exchange rate fluctuations phenomenon is quite common, which will also significantly impact the project profitability, such as the increase in raw material prices, labour prices, and even construction costs and operating maintenance costs. Therefore, the choice of settlement currency with a relatively stable inflation rate, the negotiation with the senior debt lenders, and the design of payment mechanisms based on the inflation rate are important during contract establishment.

SPVs and the shareholders

Table 8 Shareholder and SPV game matrix considering the project risk preference

Shareholder and SPV game matrix		SPV	
		Low risk	High risk
Shareholder	Low risk	A	B
	High risk	C	D

Another prevalent source of financing is equity. In the BRI infrastructure PPP cases, the SOEs directly own the subsidiary companies of SOEs. The subsidiary companies of SOEs act as the holding companies, which directly invest in the equity of the SPVs. Compared with SOEs, which have a higher risk tolerance capacity, private enterprise stakeholders are more risk averse. Therefore, they tend to cooperate with SOEs or join

the PPP project after the construction phase to avoid construction risks. Another type of shareholder is the infrastructure equity funds, normally state-backed, such as the Silk Road Fund and China-African Fund. These funds receive capital from public sources, such as the foreign reserve and national development fund. They tend to be risk-averse by bearing not only investment responsibility but also undertaking political duties. Hence, the contractual ability and enforceability with risk constraints are determined by the risk preference of the three major types of shareholders, namely state-backed shareholders, fully private-owned shareholders, and equity fund investors. As noted, by setting up the indirect investment and management framework through the holding companies, the SOE and POE shareholders are protected from bankruptcy and legal disputes by the limited recourse in relation to the SPVs. Whilst the infrastructure equity funds will adopt an ‘equity+debt’ approach to allocate the capital into equity, which is riskier, as well as debt, which is less risky. In general, the shareholders are aware of the risks in the BRI infrastructure PPP investment and are relatively risk averse. Therefore, the most common scenario in the BRI infrastructure investment is scenario B. By adopting the indirect approach, the risks of the project are controlled better towards the direction of the Pareto optimisation, and the contractual ability and enforceability depend on the relations and the risk preference balance of the SOE, POE, and equity fund shareholders.

Table 9 Shareholder and SPV game matrix considering the project payoff expectation

Shareholder and SPV game matrix		SPV	
		Low payoff	High payoff
Shareholder	Low payoff	A	B
	High payoff	C	D

The payoff for SPVs can be achieved via government payment, user payment, and viability gap subsidies. The milestones of receiving the payoff include the completion of the construction phase and the key operation time knots. The construction and operation work is often outsourced via the construction and operation contracts to the subsidiary companies of SOEs. To achieve maximum payoff, the SOEs will maximise the profit through the construction process, which will reduce the profit of the SPVs and SPVs' non-SOE shareholders, for example, the POE and equity fund shareholders. The conflicts of interest drive the POE shareholders to more strategic approaches. For example, in the Malaysian Kuantan industry park project, the POEs refrained from becoming involved in the construction phase but joined afterward in order to provide operation, maintenance, and other relevant services, assuming the roles of operators and logistics service providers so as to avoid the conflicts of interest. From the perspective of the equity funds, to obtain fair payoff, they opt to invest in the holding companies rather than directly in the SPVs. Since the holding companies are the SPVs' direct shareholders, the equity investors can receive the payoff of the project proportionally, including the return on construction and operation return.

Given that the shareholders have direct and indirect control right over the SPVs, and the construction and operation work is normally outsourced to the engineering and service companies owned by the SOE and POE shareholders of the SPVs, the negotiation power regarding the payoff subsequently belongs to the shareholders. Therefore, in the payoff distribution, scenario A and scenario C are the inevitable results of the stakeholder relations. The equity funds chosen for investment in the subsidiary company of the SOEs can also be interpreted as a type of Pareto improvement from their perspective.

SPVs and the insurers

Table 10 Insurer and SPV game matrix considering the project risk preference

Insurance company/Reinsurance and the SPV game matrix		SPV	
		Low risk	High risk
Insurance/reinsurance company	Low risk	A	B
	High risk	C	D

In recent years, Sinosure has become a prerequisite for financing large-scale overseas infrastructure projects in China. As the global infrastructure investment landscape changes, expanding insurance coverage can effectively enhance the credibility and bankability of the projects. From what has been observed, there is a substantial increase in risk evasion demand, particularly in the case of regulatory risk, currency devaluation risk, and sovereign government risk. Along the Belt and Road, most countries are emerging economies, and thus the market maturity, culture, legal system, and regulatory system are very diverse. Some countries even lack political stability and a functional government.

The infrastructure project risks under the Belt and Road context are relatively high for both SPVs and insurance companies. In the context of the BRI infrastructure development, Chinese insurance, and reinsurance companies, including Sinosure, PICC, and SinoRe, usually have high requirements in relation to the guarantee of state sovereignty in project evaluation and approval, leading to high entry barriers for SPVs. However, excessively relying on the guarantee of state sovereignty will also expose the insurance institutions to higher risks, given the existing political uncertainties. With the transaction volume of cross-border investment rising in recent years, the insurance institution will assume an alarming amount of compensation if the enterprises claim the

insurance. Either over-reliance on sovereign guarantees or an over-charge insurance fee reflects the conservative underwriting willingness of the insurers towards the SPVs, which are exposed to high risks. This phenomenon can be reflected in scenario B.

Information asymmetry derived from the nature of infrastructure assets and the geographic distance is also part of the risk source. To mitigate the risks, Chinese insurance companies have started entering the global markets. At present, some Chinese insurance companies have established partnerships with local institutions, and the insurance brokers who cooperate with the Chinese are using their global or regional networks to provide insurance and risk management expertise for Chinese enterprises and their ‘glocal’ strategy. This type of cooperation can also be regarded as a principal-agent model. Taking the PICC as an example, it has a series of *ex-ante*, concurrent and *ex-post* approaches globally. In the *ex-ante* measures, the PICC will hire consulting firms from mature markets, such as the Munich Reinsurance Group and the American International Group, to assess the risks for countries along the Belt and Road.

Table 11 Insurer and SPV game matrix considering the project payoff expectation

Insurance company/Reinsurance and SPV game matrix		SPV	
		Low payoff	High payoff
Insurance /Reinsurance company	Low payoff	A	B
	High payoff	C	D

The BRI is expected to trigger new demand for construction activities and trade liberalisation, which in turn will present opportunities for Chinese and international insurers. The Belt and Road construction projects that may be forthcoming in the period August 2016 to 2030 could generate approximately USD 27 billion in premiums, of which USD 16 billion could be allocated to Chinese insurers. The primary

beneficiaries of these projects will be engineering, property and marine insurers (Swiss Reinsurance Company Ltd, 2016). In the dimension of payoff, the joint insurance and reinsurance schemes can reduce the risk exposures and increase their profitability as a whole. When the risks are high, the insurance company will buy proportional reinsurance or sign the quota share treaty, surplus treaty and excess of loss treaty etc., with the reinsurance company to hedge the risks. Meanwhile, a portion of the insurance companies' payoff will be redirected to reinsurance companies. In that case, the scenario will fall under categories A or C depending on the level of risks.

SPVs and the contractors/operators/suppliers

Table 12 Contractor/operator/supplier and the SPV game matrix considering the project risk preference

Contractor/operator/supplier and SPV game matrix		SPV	
		Low risk	High risk
Contractor/operator/supplier	Low risk	A	B
	High risk	C	D

As observed, in the BRI infrastructure PPP projects led by China, the contractors, operators and suppliers are normally the subsidiary engineering and service companies of the SOE and POE sponsors. It should be recognised that the risks in the different phases of project implementation are changing dynamically. The construction period is the most risk acute phase throughout the project cycle, but the operating risks and supply risks are also quite significant (Ng and Loosemore, 2007). The SPVs will outsource the project construction/operation to the contractors and operators through the general-separate contracts so that part of the risks is transferred. However, given the relationships embedded between the SPVs and the contractors, operators, and suppliers

through the ownerships noted previously, the risk remains at the level of the same network. Hence, the risk exposure of both sides falls under scenario D. To rebalance the risks within the network, a series of agreements are introduced to the contract system in the overseas PPP project. The contracts include the completion guarantee, performance guarantee, advance payment guarantee, retention money guarantee and defect liability guarantee. The core principle of these agreements is to transfer some of the construction, operation and supply risks to the contractor/operator/supplier, thus relieving the risks of the shareholders behind the SPV, which fits scenario C.

Table 13 Contractor/operator/supplier and SPV game matrix considering the project payoff expectation

Contractor/ operator/supplier and SPV game matrix		SPV	
		Low payoff	High payoff
Contractor/ operator/supplier	Low payoff	A	B
	High payoff	C	D

The game between the contractor, operator and supplier and the SPV in the payoff dimension shows commonalities with the game of shareholders and SPVs. As stated, the payoff for SPVs can be achieved by means of construction payments and user payments, in which the construction work is often outsourced via the construction contract to the subsidiary companies of the sponsor. The construction phase is regarded as the most lucrative phase. Thus, the engineering subsidiary companies of the SOE sponsor are normally the preferred bidders. Therefore, the SOEs will maximise the profit through the construction phase as well as through the supply chain and operation, which reduces the profit of the SPV. This phenomenon falls under scenario C. The fundamental factor is how profits can be fairly distributed to each party, especially based on the cooperate management and shareholding structure design. To summarise,

the contractual ability and enforceability for the construction, operation and supply contract rely on how the SPV and their subsidiary companies allocate the risks and how the payoff is distributed between them.

4.5 Synthesis of results

PPPs have a permeable boundary, which allows the entrance and exit of different actors during the PPPs' life cycle. Due to the complex, long-term, and dynamic features of cross-border infrastructure PPP projects, various stakeholders enter the partnerships at varied stages and different depths. Following the analysis regarding the governance framework and the relationships between the public stakeholders (administrative institutions) in Chapter Three, this chapter first identifies private sector stakeholders and conceptualises the private stakeholder framework in BRI infrastructure PPP projects. This framework lays the boundaries of the partnerships, clarifies the key stakeholders, and highlights the knot function of the SPVs. Then, the analysis of this chapter moves to the analysis of the relationships among the key private stakeholders and the SPVs from a game theory stance.

Although the proposed model does not provide the approaches to quantifying the game parameters, this study still illustrates the features of the game strategies and the relationship among key private stakeholders from a descriptive stance, specifically in the BRI infrastructure PPP. The focus is the selection of a strategy that can reduce transaction costs and enhance the overall efficiency and performance of the PPP from the perspective of contractual ability and contract enforceability. The possible scenarios are explained, in which the strategies adopted by private stakeholders are regarded as the approaches to achieve the maximisation of the overall payoff and fair allocation of the risks, or in the terminology of game theory, the Pareto improvement.

After the Pareto improvement points out the direction of the cooperative game strategies, the strategies in the possible scenarios are discussed from the perspectives of contract governance and ownership. Since the formal contract is inevitably incomplete for the BRI infrastructure provision in the form of PPP, the dominant role of SOE sponsors and state capital can be regarded as a measure to attenuate the cost and increase the capacity for risk and contingencies management internally through the informal contract. The informal contract reflects these relational governance mechanisms and is complementary to the formal contract. It is based upon social processes in the sense that trust relations and internally linked ownership can safeguard, albeit informally, against exchange hazards and facilitate the enforcement of obligations as well as provide flexibility and dynamic adjustment.

The game theory model is specialised to describe the relationship among private stakeholders in the infrastructure PPP provision. The model is based on classical game theory and applicable to the cooperative PPP game in both the jurisdiction of the mature market as well as the BRI. In addition, it should be emphasised that the differences between the BRI and mature market strategy selection lie in the ownership of the stakeholders. From the angle of relational governance, the internal and inclusive relationships between the SOEs and the other state-backed parties in the BRI infrastructure PPP provision are reinforced because of the shared state background and residual rights from the major ownership. The private stakeholders in the mature market have a more diverse ownership composition. Thus the strategy selection trends towards a more competitive direction.

There are also problems remaining in the BRI private stakeholder cooperation. For example, the administration term of SOEs leadership conflicts with the life-cycle of infrastructure development and stakeholder management. The PPP duration project is usually more than ten years, while the administration term of SOEs leadership is a five-year period. The long-term *ex-ante* planning required by infrastructure will normally not be able to generate revenue during the first five years. SOEs' leaderships are therefore less motivated to plan infrastructure projects from a sustainable and long-term perspective.

Having illustrated how the features of the infrastructure assets, the roles of key stakeholders, and the specific context of the BRI infrastructure PPP provision determine the relationships of the stakeholders and impact the contractual ability and enforceability in this chapter, the subsequent research will explore the BRI infrastructure PPP through the lens of capital structure. The analysis angles include the asset class categorisation, the capital source and structure, the determinant factors, and the decision-making approach for the shareholding structure and debt level, respectively.

CHAPTER FIVE: CAPITAL STRUCTURE OF BRI INFRASTRUCTURE PPP PROJECTS

Chapter Five constitutes of two parts. Part I focuses on asset classification, exploring the financing features and determinant factors based on the current BRI PPP cases. Part II then moves to the discussion of the decision-making for the equity structure and debt level according to the findings from Part I.

5.1 Part I—Asset Classification, Financing Features and Determinant Factors for Capital Structure Design

5.1.1 Introduction

Following the analysis of the public administrative framework at level 2 in Chapter Three and the private stakeholder relations at level 3 and 4 in Chapter Four, this chapter analyses the capital structure selection of the BRI infrastructure PPP projects at level 4 of the NIE framework (1998). The key to the success of project financing is to achieve a satisfactory and effective distribution of project profits and risk-sharing among the key stakeholders, therefore, the capital structure plays essential functions in the project financing process.

Most of the current research on the capital structure of PPP projects mainly focuses on conducting financial analysis to verify the capital structure. For example, the equity/debt ratio is decided based on the discounted cash flow method (DCF), the net present value (NPV), and the internal rate of return (IRR). Apart from the financial analysis, Vaaler et al. (2008) proposed a multi-level theoretical framework for understanding the factors shaping the credit risk and capital structures through the

assessment of 238 projects in the Asian infrastructure market from 1995 to 2004. These factors include the macroeconomic factors at the country level, principal-agent theory-related factors, transaction cost theory-related factors, and others. The specific hypotheses linking these factors to the project capital structure are drawn upon the perspectives of the institutional theory (North, 1990), macroeconomy (Cantor and Packer, 1996), agency (Jensen and Meckling, 1976) and transaction cost (Williamson, 1988). However, very little research has investigated a comprehensive structure that combines the objectives of different stakeholders. As observed from the previous chapters, the current BRI infrastructure PPP project finance led by Chinese stakeholders demonstrates specific features, among which reference may be made to the high requirement of SOE sponsors' guarantee and lack of diverse funding sources given that a significant capital source is derived from Chinese policy banks and SOE sponsors. These features require further research on the stakeholder-capital structure nexus in order to facilitate the BRI infrastructure project PPP finance and incentivise more diverse stakeholders to participate.

In terms of project financing, there are four major structures that require a thorough and comprehensive plan, namely, investment structure, financing structure, funding structure, and credit guarantee structure. These four structures provide the basis for the analysis of project financing, especially the capital structure analysis. The investment structure refers to the ownership structure of the project asset. It stands for the degree of control by the investors and is regarded as the foundation of project financing. The critical consideration of the investment structure design is constituted by the compatibility of the sponsors' expertise and investment capacity. The financing structure refers to the agreed financing models aligning the objectives of different

stakeholders. The funding structure stands for the sources, proportional relationship, scale, duration and cost of the equity capital, debt capital and other types of funding sources between equity and debt funding. The credit guarantee structure determines the safety of project financing and the repayment capacity of the project. The profitability, related parties' direct or indirect guarantees and the insurance provided by the insurance companies are critical for the design of the credit guarantee structure.

From the perspective of the BRI infrastructure PPP sponsors, it is beforehand that the sponsors should assess their investment and expertise capacity, investigate the asset features, and identify the critical determinant factors to design the capital structure accordingly. Effective project financing aims to realise a more positive return overall and optimise the alignment of the objectives of different stakeholders with the achievement of financial closure as the prerequisite condition.

In Part I, this study first categorises the BRI infrastructure PPP projects into different asset classes and then profiles the typical sponsors in the corresponding asset classes in Section 5.1.2 and typical stakeholder compositions in Section 5.1.3. After the asset class categorisation and the generalisation of the empirical capital structure of the BRI infrastructure PPP projects, this chapter subsequently focuses on exploring the determinant factors for the design of the capital structure, as well as the financing behaviour pattern and the features of capital sources in Section 5.1.4.

5.1.2 BRI asset class specification and categorisation

There are different ways of defining infrastructure assets from different perspectives. O'Neill (2017) proposed a typical industry classification method for infrastructure

assets based on their investment profiles. The infrastructure assets are also classified into two different categories: core-plus assets and merchant assets. Core assets may be defined as assets with monopoly features given natural supply conditions (such as water supply) or regulation (such as an urban metro). Core-plus assets are typically supplied under monopoly conditions, but where demand changes with the economic cycle, for instance, the energy industry. Merchant assets represent infrastructure investments, which are not just subject to economic cycles but also to compete for revenues, including seaports and airports in a relatively unregulated market.

Infrastructure is also classified into economic infrastructure and social infrastructure based on their functionality and whether they are directly/indirectly related to the production processes and final consumption in the economy. Economic infrastructure includes toll transport infrastructure (e.g., toll roads, bridges, railways, ports and tunnels), energy (e.g., gas and electricity), water and communications. On the contrary, the economic gain of social infrastructure is less tangible, yet more related to the community welfare, which comprises hospitals, schools, prisons and public housing (Sharma, 2012; Torrance, 2006). However, there is limited research that classifies the infrastructure based on its capital features and expertise demand. The capital feature represents the amount of capital demand and composition of different capital sources, while the expertise stands for the construction and engineering capacity as well as the maintenance and operation.

Table 14 summarises the information of 16 BRI infrastructure PPP projects which have achieved financial closure. The projects selected in this thesis cover all the BRI infrastructure PPP projects in the project pool of the Ministry of Finance, the China

International Contractor Association and other disclosed information sources. Based on the investment scale, project type and the PPP mode of these cases, the characteristics of the project assets can be extracted. Meanwhile, the in-depth investigation of the project financing scheme, which achieves the financial closure, can facilitate the comprehensive understanding of the effect of the contracting ability and provide the implication of the enforceability of the BRI infrastructure provision in the form of the PPP.

According to the summary of the listed cases, the major project types are energy, transport, and urban/industrial park construction. Furthermore, the BRI infrastructure PPP projects can be categorised into two asset classes based on the assessment of project investment and the involvement of stakeholders. Project type and asset characteristics affect and reflect the preconditions of the selection of the compatible stakeholders as well as the design of the capital structure. On the one hand, the public sector should consider choosing private entities based on the asset characteristics of different projects. On the other hand, the private sector also needs to consider whether its investment capacity and expertise can meet the demand for infrastructure assets.

Table 14 further analyses the information from the perspectives of asset characteristics, from which we can gain a more unobstructed perspective of the BRI asset class and asset features. The first asset class can be defined as the fixed-asset investment, construction and operation-oriented asset, including the energy, industrial park complex and transport infrastructures in the form of joint venture, DBFOT, BOOT, BOT and BOO. The concept of the fixed asset in this study refers to that of a long-term tangible piece of property that a firm owns and uses in its operations to generate income. The

energy, transport and construction infrastructure projects adopting the DBFOT, BOOT, BOT and BOO models require significant capital input for design and construction. Prior to the completion of the construction phase, the cost can only be partially covered by government subsidies and a fixed construction payment. Thus, the capital demand in the initial phase is significant.

The second class can be defined as the engineering expertise and equipment input-oriented asset, including the EPC energy and transport projects. These projects require a higher engineering and management expertise input aside from capital input. Based on the profiling of the key stakeholders in Chapter Four, the EPC + O&M contractors are also the shareholders of the SPV. However, it is not generally necessary to be a shareholder in order to act as a contractor although some governments may require this in some projects. An EPC + OM contract consists of two individual subcontracts, the EPC contract and the operation and management contract. The EPC contract carries out the design of the project, equipment, and material procurement, while the construction of the prescribed facility is within a stipulated term, which is usually shorter than the contract term of the BOT, BOOT and BOO models. The EPC service is often procured by the government, and the contractor is paid with a certain amount of the contract value upfront. After the completion of the construction, the contractor will be paid according to the availability of the project. Thus, the initial financial burden on the contractors is released and the certainty of the return is ensured by the contract. The OM contract requires the operator to operate the publicly owned infrastructure asset for a specific period of time. The operator is paid according to the performance of the management and operation. Hence, the OM subcontract does not require intensive capital input at the initial phase.

Table 14 Summary of BRI infrastructure PPP project types

Project No.	Project name	Project type	Investment amount (USD)	PPP mode
1	Port Kyaukpyu Industrial Park, Myanmar	Construction	7.2 billion	DFBOT
2	Thar Engro Coal Power Project (Thar-II), Pakistan	Energy	1.95 billion	Joint venture
3	Karot Hydropower Project, Pakistan	Energy	1.64 billion	BOOT
4	Shahjibazar Power Plant, Bangladesh	Energy	338 million	EPC + Joint Venture
5	Palembang 150MW Coal-based Power Plant, Indonesia	Energy	98.43 million	BOOT
6	Kamchay Hydroelectric Project, Cambodia	Energy	280 million	BOT
7	Jawa-7 IPP Power Project	Energy	1.88 billion	EPC + Joint Venture
8	Payra Fire Power Plant, Bangladesh	Energy	2.48 billion	BOO
9	Port Qasim Coal-fired Power Plant, Pakistan	Energy	2.09 billion	BOO
10	Emeisai Downstream Power Plant, Cambodia	Energy	578 million	BOT
11	Cacho Wind Power Plant, Pakistan	Energy	130 million	EPC+OM
12	Ethio-Djibouti Railways	Transport	4 billion	EPC+OM
13	China Cosco-Port of Piraeus, Greece	Transport	660 million	Joint Venture
14	Jamaica H2K North-South Highway Project	Transport	734 million	BOT
15	Mar2 Highway, Colombia	Transport	656 million	BOT
16	Colombo Port City, Sri Lanka	Urban construction complex	1.396 billion	BOOT

Table 15 BRI infrastructure PPP project asset class and features

Project type	PPP model	Amount	Case No.	Asset feature
Energy	BOO/BOT/BOOT	6	3,5,6,8,9,10	Fixed-asset investment and operation-oriented asset
Energy	EPC + Joint Venture/OM	4	2,4,7,11	Engineering expertise and equipment input-oriented asset
Transport	BOT	2	14,15	Fixed-asset investment and operation-oriented asset
Transport	EPC + OM	2	12,13	Engineering expertise and equipment input-oriented asset
Construction	DFBOT/BOOT	2	1,16	Fixed-asset investment and operation-oriented asset

5.1.3 The sponsor profile of the BRI infrastructure PPP projects

According to the analysis above, it can be concluded that different BRI infrastructure projects come with specific asset features. Moreover, the composition of the project sponsors needs to consider its compatibility with these asset features. In the following analysis, the sponsor compositions will be assessed in order to provide a more detailed rationale. It can be seen from Table 16 that a successful project initiation is closely relevant to the composition of the sponsors. The composition is determined by the equity capital investment capacity, construction engineering capacity, management and operation expertise, the technology development and equipment manufacturing ability. The stakeholder composition of each asset class is discussed further as follows.

Table 16 The sponsor composition of BRI infrastructure PPP projects

Project No.	Project name	Sponsor composition	PPP mode
1	Port Kyaukpyu Industrial Park, Myanmar	financial institution, contractor, operator, and governments	DBFOT
2	Thar Engro Coal Power Project (Thar-II), Pakistan	contractor, operator, and governments	Joint venture
3	Karot Hydropower Project, Pakistan	contractor, operator, and governments	BOOT
4	Shahjibazar Power Plant, Bangladesh	contractor, equipment provider and governments	EPC + Joint Venture
5	Palembang 150MW Coal-based Power Plant, Indonesia	contractor, operator, and governments	BOOT
6	Kamchay Hydroelectric Project, Cambodia	contractor, operator, and governments	BOT
7	Jawa-7 IPP Power Project	contractor, technology and equipment provider, operator, and governments	EPC + Joint Venture
8	Payra Fire Power Plant, Bangladesh	contractor, operator, and governments	BOO
9	Port Qasim Coal-fired Power Plant, Pakistan	contractor, operator, and governments	BOO
10	Emeisai Downstream Power Plant, Cambodia	contractor, technology and equipment provider, operator, and governments	BOT
11	Sascha Wind Power Plant, Pakistan	contractor, technology and equipment provider, operator, and governments	EPC+OM
12	Ethio-Djibouti Railways	contractor, technology and equipment provider, operator, and governments	EPC+OM
13	China Cosco-Port of Piraeus, Greece	financial institution and operator	Joint Venture
14	Jamaica H2K North-South Highway Project	contractor, operator, and governments	BOT
15	Mar2 Highway, Colombia	contractor, operator, and governments	BOT
16	Colombo Port City, Sri Lanka	contractor, operator, developer, and governments	BOOT

1. Sponsor composition of the fixed-asset investment and operation-oriented asset

The Port Kyaukpyu Industrial Park Project in Myanmar is implemented in the DBFOT model and initiated by the Myanmar government and China International Trust Investment Corporation (CITIC) in collaboration with China Merchants Port Holdings Co., Ltd., China Harbour Engineering Co., Ltd., TEDA Investment Holding Co., Ltd., Yunnan Construction Co., Ltd., CHIA TAI Group and local enterprises. In this partnership, each stakeholder has a specific function. The CITIC leads the lender and equity investor for the whole port-industrial park complex, China Harbour Engineering Co., Ltd. is in charge of the port design and construction, and China Merchants Port Holdings Co., Ltd. is responsible for port maintenance and operation. As for the industrial park, TEDA Investment Holding Co., Ltd. and CHIA TAI Group act as operators, given the industrial park operation experience of TEDA, and the local resources, relations, and reputation of the CHIA TAI Group. Yunnan Construction Co., Ltd. is responsible for the construction given its construction engineering expertise. Compared with the traditional EPC model, this DBFOT combines and leverages the capacity of the sponsors to facilitate project commencement as well as reduce the transactional cost along the project life cycle.

2. Sponsor composition of the engineering expertise and equipment input

Ethio-Djibouti Railway is a new standard gauge international railway that serves as the backbone of the new Ethiopian National Railway Network. All construction and

operations of this PPP project will be jointly undertaken by the China Railway No. 2 Group and China Civil Engineering Construction Corp (CCECC) according to the EPC + OM contracts. The operation and maintenance contracts also include the training provided by the Chinese operators for local employers to prepare the project transfer for the local government. In the EPC phase, China Railway No. 2 Group and CCECC are responsible for the railway construction in the turn-key approach, given their engineering expertise. Meanwhile, the subsidiary company of the state-owned China North Industries Corp carries out the duty to design, manufacture and supply the locomotive vehicle. After the completion of the turn-key agreement, the consortium consists of the China Railway and the CCECC are awarded the OM contract to deliver the operation experiences to the local parties. Based on the observation of these two cases, the relevance of the BRI infrastructure asset and sponsor profile at the initial project phase can be summarised. For projects with high fixed-asset investment and operation demand, sponsors with substantial capital investment capacity and operational expertise are more compatible with the need. For projects with high engineering expertise and equipment input, experienced contractors and specialised equipment suppliers are preferred.

5.1.4 The capital structure of the current BRI infrastructure PPP projects

The right and obligation, as well as the allocation of returns and risks, are the manifestations of the sponsor composition, which also determines the implementation of the project finance. In the initial project phase, with the exception of the EPC projects,

the contractor-operator consortia are usually the leading sponsors, who proportionally have the most significant investment in fixed assets and hold the majority of the SPV shares. Hence, they have absolute ownership to guarantee the construction and operation payoff. Given that the initial phase (including project preparation and construction) is the riskiest phase throughout the life-cycle of the infrastructure project, the contractors also bear the most significant risks before the completion of the construction project. Section 5.1.2 demonstrates the asset class, asset feature, and the compatible composition of the project sponsor, providing the basis for further analysis regarding the capital structure design.

5.1.4.1 The equity-debt analysis of the BRI infrastructure PPP projects

Table 17 provides the debt-equity ratio and the debt information of the BRI infrastructure PPP cases. It is observed that the equity ratio ranges from 15% to 30%, while correspondingly, and the debt ratio of the total investment ranges from 70% to 85%. For projects with large fixed-asset investment demand, such as the BOOT and BOT projects, the equity/debt ratio is higher, considering that the sponsors have a higher degree of involvement in the project cycle. In comparison, for the engineering expertise and equipment supply-oriented BRI infrastructure assets, the equity/debt ratio is lower, considering that the EPC+ OM contracts require less shareholding responsibility from the contractors and the operators. The shareholding structure of the EPC+ OM Sascha wind power plant in Pakistan is distinguished from the other BOOT

and BOT projects due to 100% of its equity capital being derived from the Pakistan Sascha Energy Company rather than Chinese contractors or operators.

The equity-debt ratio also reflects the financing ability of the project sponsors as well as the solvency of the projects. The sponsors with robust financing capabilities (e.g., parent company guarantee, sovereign guarantee and credit rating, etc.) can obtain more low-cost debt capital investments. Meanwhile, the profitability and solvency of the projects are the underlying conditions for obtaining debt funds. Therefore, the projects with a relatively stable cash flow have more advantages over those with a potentially fluctuating cash flow. Energy projects can usually receive the cash flow from a stable tariff fee based on the electricity purchase agreement. Thus, their equity-debt ratio is lower compared with the transport projects which are exposed to an unstable traffic flow and a non-guaranteed toll income.

Compared with the mature infrastructure project financing market, the current BRI infrastructure PPP project financing capital sources are still very limited. A significant portion of the equity capital is usually provided by the Chinese SOE sponsors, while a smaller portion of the equity capital is provided by the local government or enterprises. Moreover, the debt capital of these projects is mainly derived from the Chinese policy banks. Conversely, mature financial markets can provide the capital from insurance funds, pension funds, sovereign funds and other long-term funds in order to reduce the

financial pressure on the original shareholders, widen the exit channels and assist the realisation of the project equity value.

Table 17 The capital structure of the BRI infrastructure PPP projects

Project Name	PPP mode	Equity-debt ratio	Debt source	Shareholder
Karot Hydropower Project, Pakistan	BOOT	20%:80%	EXIM Bank, CDB, IFC, SRF	China Three Gorges South Asia Investment Co., Ltd. >50%
Jawa-7 IPP Power Project	EPC + Joint Venture	30%:70%	CDB	Shenhua Group 70%+ PLN 30%
Payra Fire Power Plant, Bangladesh	BOO	20%:80%	EXIM Bank	China National Machinery Import and Export Group 50% + Bangladesh Northwest Power Production Co., Ltd. 50%
Port Qasim Coal-fired Power Plant, Pakistan	BOO	25%:75%	EXIM Bank	China Power Construction Overseas Company 51%+ Qatar AL Mirqab Capital 49%
Sascha Wind Power Plant, Pakistan	EPC+O M	15%:85%	ICBC	Pakistan Sascha Energy Company 100%
Ethio-Djibouti Railways	EPC+O M	Part 1: 15%:85% Part 2: 30%:70%	EXIM Bank	N.A.
Jamaica H2K North-South Highway Project	BOT	30%:70%	CDB	China Communications Construction Co., Ltd. 100%

5.1.4.2 The determinant factors for the selection of the optimal capital structure

The capital structure of the BRI infrastructure PPP project represents the focus of the stakeholders, which determines the project's profitability, financial risks and bankability. The general observation of the current BRI infrastructure PPP projects demonstrates the typical features of the BRI PPP project through a systematic perspective, including the asset class, the composition of the shareholders and the typical capital structure. This section will examine the determinant factors associated with capital structure selection and the characteristics of sponsors' financing behaviours. Furthermore, it lays the foundation for the discussion addressing the equity and debt structure decision-making in Part II of Chapter Five.

The existing research has highlighted the importance of the asset-liability ratio, equity-debt ratio and the scale of debt for the optimisation of the PPP infrastructure capital structure (Moszoro, 2008; Sharma, 2012; Zhang, 2005). According to the review of the capital structure theories by Harris and Raviv (1991), there are four major theoretical perspectives on capital structure, underpinning the capital structure design in four ways:

- 1) ameliorating differences in interest among various stakeholder groups;
- 2) conveying information to capital markets or mitigating adverse selection effects;
- 3) influencing the nature of products or competition in the industrial sector/market;
- 4) influencing the outcome of corporate governance.

By combining these theoretical views of capital structure with the features of PPP in the context of the BRI, such as the involvement of the policy banks and dominant role of the SOEs, a set of specific questions is designed for the questionnaire.

The experts selected as the questionnaire survey recipients have in-depth practical experience in the actual BRI PPP projects, particularly those who are familiar with project finance and cooperate governance. A total of 147 experts were identified as the questionnaire recipients, and a total of 58 experts responded to the survey effectively. 6 out of a total of 58 questionnaires submitted are omitted from the pool due to their bias. All respondents belong to the key stakeholder groups, representing a broad and complete spectrum of the PPP infrastructure experts. Moreover, 76.9% of the respondents had at least three years of industrial experience or above and senior positions. Their experience covers the field of transport, energy, and urban construction (Table.18). This hands-on practical experience and the close relevance of the institutions which the respondents belong to uphold the validity of this study. The effective recovery rate of the questionnaires is 35.3%, which complies with the general academic study standards (Baruch, 1999) and outstands the ordinary responsive rate in the study in the field of engineering management as well as what has been achieved by an earlier survey dealing with PPP infrastructure research (Ke, 2010; Li et al., 2005). The final data received are considered sufficient for the descriptive analysis, including the ranking of the determinant factors for the design of the capital structure, capital source and financing behaviour.

Table 18 Background information of the respondents

The institution of the survey respondents							
Category	Bank	Investment Fund	Government Department	Engineering Construction Enterprise	Operation Enterprise	Supply Enterprise	Consulting/legal firm
Percentage (%)	26.2	14.3	4.8	35.7	7.1	2.4	9.5
Types of BRI PPP projects that the survey respondents have participated in							
Category	Transport			Energy		Urban Construction	Telecommunication and Others
Percentage (%)	78.6			47.6		38.1	19
Degree of responsibility of the survey respondents							
Category	Investment and Finance	Design, Engineering and Construction	Operation and Management	Equipment Procurement	Legal and Consultancy	Other	
Percentage (%)	54.8	19.1	21.4	11.9	21.4	9.5	
Experience of the survey respondents							
Category	0-3(≤) years	3-5(≤) years	5-10(≤) years	More than 10 years			
Percentage (%)	23.1	31.2	23.9	21.8			

Based on the questionnaire survey data, the different degrees of importance of the determinants for the capital structure are ranked in Table 19. The ‘importance index’ in the table represents the weighted average value of the factors relevant to the design of the capital structure. It is noted that the determinant factors cover the considerations from the perspectives of debt repayment capacity, project profitability, stakeholder interest and management strategy. In this ranking, the top three factors are the ‘External institutional and economic environment’, ‘Corporate financial risk resulted from excessive debt’, and the ‘Capital cost of debt finance’.

The importance of the institutional and economic environment has been stated in Chapter Three. A facilitating institutional environment can increase investor confidence in infrastructure project finance. In order to mitigate the financial risk led by excessive debt, the level of debt requires thorough consideration to ensure the financial safety of the project. Furthermore, the debt level is not only related to financial safety but also influences the levels of profitability. The higher the debt level and interest rate, the higher the cost of debt repayment, with the levels of profitability being thus influenced.

In the factor class of the stakeholder interest, increasing the proportion of equity finance to improve the debt coverage ratio assessment by the financial institutions ranks as the third important factor for the capital structure, whereas the remaining factors in the

same class are regarded as less critical. It is due to the lenders, mostly the banks, preferring a higher equity level to minimise their risks as the debt is senior to the equity in the repayment and profit distribution process. Another critical reason lenders require a higher equity level is that this will ensure a greater ‘ownership’ of the project by equity holders and consequently an increased incentive and commitment on their behalf to ensure the contracting ability, contract enforceability, and performance of projects.

The ‘Feasibility of debt financing’, ‘Guarantee of the ownership and executive right of the existing shareholders’, ‘Increasing the proportion of equity finance to improve debt coverage assessment by the financial institutions’, ‘Negative impact of an excessive debt level on the credit rating’ and ‘Financial flexibility for subsequent debt financing’ represent the consideration of the use of financial instruments in order to obtain the debt finance from the perspectives of the management strategy, debt repayment capacity as well as the macroeconomic and market condition. The credit rating is regarded as one of the most prioritised factors in the assessment of loan granting. Therefore, the SOEs with a higher credit ranking are more preferred by the lenders. However, the concerns remain as the management efficiency, and transparency of the SOEs is controversial. It is common that most of the BRI infrastructure PPP projects demand refinancing prior to the completion of the construction and operation processes. Thus, the feasibility of the subsequent debt financing is also critical for the capital structure design.

Table 19 The impact factors for the capital structure of the BRI infrastructure PPP projects

Rank	Influential factor	Factor class	Average rate
1	Institutional and economic environment	Macroeconomic condition	3.64
2	Corporate financial risk resulted from excessive debt	Debt repayment capacity	3.55
3	The capital cost of debt finance	Profitability	3.45
4	Feasibility of debt financing	Macroeconomic condition	3.31
5	Guaranteeing the ownership and executive right of the existing shareholders	Management strategy	3.19
6	Increasing the proportion of equity finance to improve debt coverage assessment by the financial institutions	Stakeholder	3.19
7	The negative impact of excessive debt levels on the credit rating	Debt repayment capacity	3.00
8	Financial flexibility for subsequent debt financing	Management strategy	3.00
9	Feasibility of equity financing	Macroeconomic condition	2.88
10	Equity financing provided by the contractor/operator/supplier better leverages their expertise and reduces the principal-agent risk	Stakeholder	2.81
11	The capital cost of equity finance	Profitability	2.76
12	Control of debt level to relieve the project default concern of the public sector	Stakeholder	2.64
13	Increasing the proportion of equity to demonstrate the confidence of the project sponsors	Stakeholder	2.55
14	Limiting the debt level to ensure the return of the shareholders	Management strategy	2.50
15	Average debt level in the industry	Industrial standard	2.40
16	Controlling the capital cost to lower the price of public goods or service	Stakeholder	2.40
17	Controlling the return distribution to the lender by adjusting the debt level	Management strategy	2.38
18	Increasing the proportion of debt can improve the ROE	Profitability	2.12
19	Tax deduction effect of the interest	Profitability	1.98

Factors such as the ‘Average debt level in the industry’, ‘Controlling the total capital cost to lower the price of public goods or service’, ‘Controlling the return allocated to the lender by adjusting the debt level’, ‘Increasing the proportion of debt can improve the ROE’ and the ‘Tax deduction effect of the interest’ represent the factor classes of the industrial standard, stakeholder interest, management strategy and profitability, respectively. Their relatively low ranking indicates that the public affordability for the infrastructure goods, the positive effect of the loan and the income distribution between the lenders and the shareholders receive less attention in the decision-making process related to capital structure.

Given that institutional investors (banks and specialised investment funds) and corporates (contractors/operators/suppliers) are the primary decision-makers in the capital structure design, we compared their response with these 19 determinants in order to explore the difference of importance among these determinants for each stakeholder group. Table 20 demonstrates that the importance of the majority of the determinants is consistent for both institutional investors and infrastructure corporates, even though the institutional investors seem to pay more attention to all the determinants associated with the capital structure design. The ‘Institutional and economic environment’ is commonly regarded as the most important factor influencing the capital structure. Significant differences exist in five factors. The ‘Capital cost of debt finance’, ‘Guaranteeing the ownership and executive right of the existing shareholders’, ‘Capital cost of equity finance’, ‘Control of debt level to relieve the

project default concern of the public sector’, ‘Average debt level in the industry’, and ‘Tax deduction effect of the interest’ factors are regarded as crucial by institutional investors.

Table 20 Importance of the capital structure determinants

Factor Rank	Mean		t-Test	
	Institutional investor	Corporate	Difference	p-value
1	3.50	3.50	0.000	1
2	3.64	3.20	0.443	0.3249
3	4.07	3.00	1.071**	0.0486
4	3.79	3.15	0.636	0.2354
5	3.64	2.50	1.143*	0.0825
6	3.29	3.00	0.286	0.6685
7	3.00	2.45	0.550	0.4405
8	3.21	2.75	0.464	0.4087
9	3.36	2.85	0.507	0.3314
10	3.07	2.45	0.621	0.2866
11	3.29	2.25	1.036*	0.0999
12	3.14	2.25	0.893*	0.0952
13	3.00	2.15	0.850	0.2367
14	2.64	2.05	0.593	0.284
15	3.00	2.05	0.95*	0.0572
16	2.57	2.30	0.271	0.6607
17	2.79	2.15	0.636	0.2829
18	2.50	1.95	0.550	0.3875
19	3.07	1.50	1.571***	0.012

Note: *, ** and *** denote statistically significant at the 10%, 5% and 1% levels, respectively.

These significant differences indicate that the cost of capital, especially the debt capital, is a more important indicator among the institutional investors looking to assess the capital structure of the BRI PPP project. The ‘Guaranteeing the ownership and executive right of the

existing shareholders' factor is considered less important by the infrastructure corporates considering that the mainstream profit model of the infrastructure corporates heavily relies on the fixed income from construction, operation and supply contracts. Meanwhile, the demand for exit might lead to a relatively more dynamic ownership structure and change of executive power. The low importance of increasing the corporate ROE can verify this finding as well. From the perspective of the institutional investors, a stable ownership structure and effective executive right is an indicator that will positively ensure the safety and return of the investment. The average debt level in the industry serves as the benchmark to assist the investment decision of the institutional investors. Thus, it is regarded as more important. The significant difference regarding the 'Tax deduction effect of the interest' factor implies that the value of the tax shield lacks sufficient consideration among infrastructure corporates. It should be noted that the interest expenses are considered to be tax deductible, so tax shields enable infrastructure corporates to benefit from the tax planning.

5.1.4.3 The project financing behaviour of the BRI infrastructure PPP projects

Based on the survey response, the frequency of the use of various financing methods and capital sources is discussed in the initial phase (including preparation and construction) and in the operation/management phase, respectively. The frequency of the use of different financing instruments in the initial phase can be seen in Table 21. The frequency index and rank are provided according to the portion and weighted average of the responses 'sometimes', 'often' and 'always'. From Table 21, it is

observed that the most frequently used financing method is the preferential and long-term loan provided by Chinese policy banks, such as the EXIM Bank of China and the National Development Bank. The Chinese policy banks provide the concessionary loan, including the concessional government loan and preferential buyer's credits. Its advantage comes from a relatively lower interest rate (2%~3%) compared with the interest rate (4%~5%) of the standard long-term loan. Another advantage of the concessionary loan is that the long payback period, which is usually from 15 to 20 years, is divided into a grace period and a repayment period (Minsheng Security, 2017). In the grace period, the borrower only needs to pay the interest, and the debt repayments are made once every six months during the repayment period. Meanwhile, the debt is granted based on the buyer's credit, or the sovereign debt guaranteed by the foreign government. Therefore, it is the liability off the balance sheet of the Chinese sponsors that is thus favoured by the SOE sponsors.

On the other side of the financing behaviour, the use of the loan provided by the multilateral development banks ranks at the bottom, even though they can provide more preferential loans with lower or without interest. This phenomenon implies that the insufficient involvement of the multilateral development banks in the BRI infrastructure PPP project initiated by the Chinese sponsors. On the contrary, the use of the loans provided by the foreign commercial banks outweighs the use of the loans offered by the Chinese commercial banks, indicating the advantage of coping with information

asymmetry when foreign commercial banks act as local financial intermediaries. What is worth mentioning is the use of short-term loan ranks as the fourth most frequently used financing method. Although it seems to contradict the long-term nature of the infrastructure capital demand, it reveals the demand for the short-term subordinate capital facility and emergency loans in the BRI infrastructure PPP project.

Apart from the debt financing approach, the direct equity investment from the sponsors is also the most frequently used method, which is consistent with the most common PPP project pattern at present. Other financing methods such as the issuance of corporate bonds, specialised funds and mezzanine financing are less common in the BRI infrastructure PPP market. With the growth of the cross-border financial market, these financial instruments will be more commonly applied to project financing. The obstacles remain in the feasibility of the issue of the corporate bond, especially the Chinese SOE infrastructure enterprises in the global market given the concerns over ownership, governance as well as transparency.

In comparison with the usage frequency of various financing instruments and funding sources in the initial project phase, the use of financing methods in the operation/management phase is also discussed to unveil the phase-wise differences of the financing behaviour. The choice of the different financing methods in operation phase following the initial construction phase can be seen in Table 22. The frequency difference of financing methods between the initial and the operation phase is presented in Table 23.

Table 21 Frequency index and rank of different financing methods in the project initiation phas

Rank	Financing Method	Never	Rare	Sometimes	Often	Always	Frequency Index
1	Concessionary loan granted by the Chinese policy banks	7%	2%	17%	45%	29%	4.13
2	Long-term loan	5%	7%	24%	40%	24%	4.00
3	Direct equity investment from project sponsors	2%	17%	31%	24%	26%	3.94
4	The loan provided by the foreign commercial banks	10%	7%	43%	24%	17%	3.77
5	The loan provided by the Chinese commercial banks	17%	13%	43%	13%	13%	3.69
6	Short-term loan	24%	21%	33%	17%	5%	3.48
7	Issuing bond	17%	43%	29%	10%	2%	3.35
8	Specialised funds	7%	36%	40%	14%	2%	3.33
9	Mezzanine financing	29%	38%	26%	7%	0%	3.21
10	Financial leasing	21%	43%	29%	7%	0%	3.20
11	The loan provided by the multilateral development banks	12%	21%	38%	24%	5%	2.33

Table 22 Frequency index and rank of different financing methods in the project operation phase

Rank	Financing Method	Never	Rare	Sometimes	Often	Always	Frequency Index
1	Long-term loan	0%	17%	39%	22%	22%	3.88
2	Short-term loan	26%	31%	10%	31%	2%	3.83
3	Concessionary loan granted by the Chinese policy banks	0%	14%	31%	38%	17%	3.83
4	Direct equity investment from project sponsors	2%	19%	43%	21%	14%	3.64
5	The loan provided by the Chinese commercial banks	12%	12%	43%	21%	12%	3.59
6	Financial leasing	24%	36%	21%	14%	5%	3.59
7	The loan provided by the foreign commercial banks	14%	33%	31%	14%	7%	3.55
8	The loan provided by the multilateral development banks	14%	24%	33%	24%	5%	3.54
9	The additional investment made by original shareholders	7%	12%	43%	33%	5%	3.53
10	Issuing bond	10%	36%	26%	29%	0%	3.52
11	Capital increase and share expansion by new shareholders	14%	7%	45%	33%	0%	3.42
12	Share transfer	10%	19%	43%	35%	0%	3.40
13	Specialised funds	12%	36%	38%	14%	0%	3.27
14	Mezzanine financing	26%	36%	12%	24%	14%	1.16

Table 23 The frequency difference of financing methods between the initial and the operation phase

Test name	Frequency mean			
	Initial phase	Operation phase	Difference	P-value
Concessionary loan granted by the Chinese policy banks	3.738	3.286	0.452*	0.068
Long-term loan	3.524	3.048	0.476**	0.033
Direct equity investment from project sponsors	3.190	2.857	0.333	0.193
The loan provided by the Chinese commercial banks	3.071	2.738	0.333*	0.090
The loan provided by the multilateral development banks	2.333	2.190	0.143	0.000
The loan provided by the foreign commercial banks	1.976	1.857	0.119	0.554
Short-term loan	1.905	1.643	0.262	0.288
Specialised funds	1.905	1.714	0.190	0.435
Issuing bond	1.357	1.929	-0.571**	0.029
Financial leasing	1.143	1.452	-0.310	0.217
Mezzanine financing	1.071	1.286	-0.214	0.246

Note: * and ** denote statistically significant at the 10% and 5% levels, respectively.

In the project operation/management phase, it is noted that the use of long and short-term loans becomes the most frequently used financing instrument. The reason behind this is that this type of loan is used to supplement operational liquidity either over a short or long period, where most of the fixed-asset investment has already been made in the initial construction phase of the project. Given that the project will enter a more stable and less risky condition in the operation/management phase, the share transfer, capital input increase, and share expansion by shareholders and any additional investments made by the original shareholders also emerge as the common financing method. The primary purpose of the share transfer is to achieve the exit plan and cash out on the project when there is a need to bring in new shareholders in order to improve the project performance or when the profit has reached the target. The function of the capital input increase and the share expansion by shareholders, along with the additional

investment made by the original shareholders, serve the capital demand of operational costs and the project expansion or update.

Compared with the initial construction phase, the use of concessionary loans granted by Chinese policy banks becomes less frequent, given that its main function is to increase the credibility of the project from the government's perspective during the initial phase. The long-term loan is less used since the operation phase is expected to generate stable cash flow, and thus, the need for a long-term loan is reduced. The same reason can also apply to explain the reduced frequency of the use of loans provided by Chinese commercial banks. In contrast, the issue of bonds is more commonly utilised as a financing method in the operation phase. Placed on the operation stage, bonds have a lower risk, thereby, a lower interest rate. The purpose of the bond issuance at the operation phase may be the release of the initial investors' capital. Conversely, the bond issuance in the initial phase is less frequent given that the investment gap can also be bridged by other alternatives which not only provide a credit enhancement function but also lower costs, such as the concessionary loan granted by the Chinese policy banks, multilateral financial institutions and the direct equity investment of the project sponsors.

5.1.4.4 Capital sources

The capital source is a critical aspect of the capital structure, given that it influences the inflow channel of the investment. The selection of the capital source and the frequency of use and rank is shown in Table 24. The statistical results show that the capital pool of Chinese policy banks is still the most common capital source. The company's equity funds rank as the second important capital source. The private equity funds, insurance

funds, trust funds and QFII funds are less frequently used. In comparison, the sources of the infrastructure not only include policy banks, commercial banks and government funds, but also private equity funds, insurance funds, QFII funds, sovereign wealth funds as well as pension funds in mature markets (Clark et al., 2012). The more diverse capital source channels can construct a relatively more complete financing system to support the direct investment of different financial institutions. The less diverse capital sources reveal the concerns of the investors in the investment of the BRI infrastructure PPP projects, such as the immaturity of the financial market, the instability of the political and economic environment, and the insufficiency of the guarantee regarding the profitability and investment safety. The participation of international commercial banks in the current BRI infrastructure PPP financing is at the low level, according to the survey result. However, its positive implications involve the future potential of a more active involvement.

Table 24 The frequency index and rank of capital sources

Rank	Capital Source	Never	Rare	Sometimes	Often	Always	Frequency Index
1	Chinese policy banks	0%	7%	19%	50%	24%	4.05
2	The equity fund of the sponsors	2%	31%	31%	17%	19%	3.82
3	Chinese commercial banks	2%	5%	31%	52%	10%	3.77
4	Multilateral development banks	4%	39%	22%	22%	13%	3.69
5	Chinese government budget funds	10%	17%	36%	31%	7%	3.61
6	Trust funds	22%	52%	26%	0%	0%	3.38
7	Private equity funds	21%	38%	29%	10%	2%	3.35
8	Foreign commercial banks	17%	29%	38%	14%	2%	3.35
9	QFII funds	43%	21%	43%	17%	0%	3.28
10	Insurance companies	33%	24%	33%	7%	2%	3.28

5.2 Part II— Decision-making for Project Equity Structure and Debt Level

5.2.1 Introduction

Part I of Chapter Five provides a detailed analysis of the compatibility of the BRI infrastructure PPP asset features with the sponsor's capability and composition, the determinants of the capital structure, and the financing behaviour pattern. It is observed from the case studies that the initial sponsors, as well as major equity investors of the BRI infrastructure PPP SPVs are the SOEs. These SOEs also play the roles of contractors, operators, and specialised equipment suppliers. The financial institutions provide the capital to finance the BRI infrastructure PPP projects through concessionary loans and long-term loans provided by the Chinese policy banks via the SPVs.

The problems of the current BRI infrastructure PPP project finance are the SOEs' limited capacity towards equity investment and the conflicts of interest between the key stakeholders when they assume different roles as principals and agents. These problems are stated by Hart (2003) in his research regarding the incomplete contracts and their application to the PPP. According to Hart's theoretical findings, the trade-off between PPP and conventional public provision depends on whether it is more cost-effective and easier to write the unbundling/bundling contracts considering the conflict of interests between the principals and agents. The principal and agent in Hart's model refer to the public sector and the private sector, respectively. In addressing the problems of the capital structure design in the PPP project finance sphere, his findings can be extended further to investigate the partnership between the sponsors (acting as the major initial shareholders) and the financial institutions (mainly acting as the lenders).

In Part II of Chapter Five, the necessity and impact of the involvement of financial institutions as shareholders are studied based on the VNM (von Neumann-Morgenstern) utility theorem (Ross, 1973) and the expected return function of the principal-agent theory in Section 5.2.2. After the analysis concerning the shareholding structure, the second pillar of the capital structure of the BRI infrastructure PPP project, debt level, is scrutinised in Section 5.2.3, considering the key performance indicators from the perspectives of the sponsors, shareholders and lenders, respectively. The Kamchay Hydropower Plant Project is examined in order to provide practical evidence to the theoretical findings of both shareholding structure and debt level design.

Overall, combined with the findings from Part I, this chapter expects to provide a framework for the decision-making of the capital structure design for the BRI infrastructure PPP projects based on the asset classification, sponsor capacity profiling and match, determinant factors identification, and the structure design for equity and debt financing.

5.2.2 Decision-making of the project equity structure

The equity capital composition can be reflected by the shareholding structure of the SPVs, and the shareholding structure reflects the composition and position of the equity investors as well as their relations. The different shareholding structures of the SPVs determine the differential corporate governance structure and furthermore define the impacts exerted on the development, construction, and operation of the infrastructure projects carried out by the SPVs.

In the development of BRI infrastructure PPP projects, the current mainstream role of financial institutions is to act as capital providers. The capital is invested in the project mainly in debt via the SPVs, such as the concessionary loan and long-term loans provided by the Chinese policy banks. There are many advantages to the loan provided by Chinese policy banks, such as the low-interest rate and extended maturity. However, the complexity of the BRI environment increases the risk of the emergence of non-performing assets and even breach of financial contract.

According to the previous analysis, the current BRI infrastructure PPP projects can be categorised into two major types of assets: the fixed-asset investment and operation-oriented asset and the engineering expertise and equipment input-oriented asset. Each asset type demonstrates the demand for competent sponsors, and the features shared by both assets and the corresponding sponsors should be compatible. In the BRI infrastructure PPP projects, the major shareholders of the SPVs are either professional contractors with abundant engineering and construction experience, or specialised export merchants who can provide critical equipment or critical engineering technologies for the projects. The downside risk is that the limited financing capacity and expertise of the contractors, operators and suppliers might constrain the diversification and price discovery of the equity investment. In addition, the tolerance of financial risk is limited as well (Faruqi and Smith, 1997; Schaufelberger and Wipadapisut, 2003; Zhang, 2005).

The questionnaire survey also indicates a significant difference in the importance among the determinants related to the equity structure evaluated by institutional investors and infrastructure corporates. For example, to ‘guarantee the ownership and

executive right of the existing shareholders' and 'the capital cost of equity finance' are regarded as significantly more critical by the institutional investors rather than by the infrastructure corporates. The manner in which this discrepancy could be integrated via the shareholding structure design is critical for meeting the requirements of the financial agreement. The mathematical model will be applied to the analysis of the shareholding structure under the principal-agent model in order to examine the optimal shareholding structure in each asset type from the perspective of different stakeholders.

Because the agent's choice affects the possible realisation of alternative outcomes, the contracts are designed by the principal, in order to induce the agent to implement an action that is in the principal's best interest. In the principal-agent model, the situation where a principal delegates a task to a single agent through a contract is discussed in the extension in light of the incentive of participation of the agent. The application of the principal-agent model covers a broad range of issues like the interlinking of agrarian contracts, the design of incentive schemes according to the aggregate performances, and finally the choice of integration of firms and its incentives (Laffont and Martimort, 2002).

In addition, the multidimensional tasks are ubiquitous, for example, the financial institutions can provide debt as well as equity financing to the borrowers, in the meantime, they can also deliver the alternative financing tools such as the asset-based securitisation to liquidise the asset. Therefore, a multitask linear principal-agent model is proposed to assure that an increase in an agent's compensation in any of the tasks will cause certain reallocation of effort away from other tasks. The specialised model considers both the fixed payment and the performance that influence the value of a

productive asset in the contract (Holmstrom and Milgrom, 1991). In the decision theory, the Von Neumann-Morgenstern (VNM) utility theorem shows that, under certain axioms of rational behaviour, a decision-maker faced with the risky (probabilistic) outcomes of different choices will behave as if one is maximising the expected value of some function defined over the potential outcomes at some specified point in the future. This function is known as the von Neumann-Morgenstern (VNM) utility function (Ross, 1973).

In view of the main analytical focus of this work, the axiomatic models are developed by constitute a synthesis of the principal-agent theory and VNM utility theory. The linear multitask principal-agent model is further specialised according to the current phenomenon of the BRI PPP projects given the contractors/operators/suppliers are the most common and sole shareholders in the current BRI infrastructure PPP cases. When the contractors/operators/suppliers are the principals, the necessity and impact of the introduction of financial institutions as shareholders will be studied based on the VNM utility and the expected return function of the principal-agent theory in this section. To simplify the model, the number of research subjects can be limited to two, namely the collective contractors/operators/suppliers as the principal and the financial institution as the agent.

(1) Scenario one: the financial institution is not involved as the shareholder

Initially, the assumption is that the contractor/operator/supplier consists of a single shareholder group of the SPVs, and there is a principal-agent relationship between the contractors/operators/suppliers and the financial institutions due to the financing

demand from external sources. Apart from the return generated from the construction contracts, which is assumed to be the fixed income, the rest of the project yield (Ei) of the initial phase is as follows:

$$Ei = \varphi\alpha \quad (5.1)$$

Where α = the effort input level of the financial institutions and φ = the yield index ($\varphi > 0$), indicating the relations between the effort input of the financial institutions and the subsequent influence on the project return. Assuming that the principal is risk-neutral and the agent is risk-averse in accordance with the principal-agent theory, the contract value of the financial service awarded by the SPVs for the financial institution can be represented as follows:

$$R_f(E) = \rho + \omega Ei \quad (5.2)$$

Where ρ = fixed income as the agent, ω = the incentive index. The incentive is usually in the form of the dividend of the abnormal project return. The expected return of the SPVs is represented as follows:

$$R_{spv}(E) = E[Ei - R_f(E)] = \varphi\alpha - \rho - \omega Ei = \varphi\alpha - \rho - \omega\varphi\alpha \quad (5.3)$$

Given the fact that the financial intuitions are more risk-averse, the VNM utility index is introduced to complement the analysis of the expected return. The VNM utility index is represented as $\mu = -\alpha^{-\lambda i}$, where λ stands for the risk-averse level, and i stands for the average return for financial institutions in the PPP infrastructure market. Meanwhile, the effort input cost index b ($b > 0$) is also introduced into the function to better modify the impact of the effort input. Considering the cost of financial institutions as:

$$C_f = \frac{b\alpha^2}{2} \quad (5.4)$$

The expected return of the financial institution can be represented as follows, where $\frac{\lambda\omega^2}{2}$ stands for the risk cost of the financial institutions:

$$R_f(E) = \rho + \omega\varphi\alpha - \frac{b\alpha^2}{2} - \frac{\lambda\omega^2}{2} \quad (5.5)$$

When the incentive index ω approaches zero, the financial institutions tend to resist any forms of risks. If the financial institutions are trying to maximise their expected return by increasing their effort input α , the maximised return can be calculated by the first-order derivative approach generalised by Sinclair-Desgagne (1994).

$$dR_f(\alpha) = \omega\varphi - b\alpha \quad (5.6)$$

When $dR_f = 0$, the maximised return is achieved when α approaches $\frac{\omega\varphi}{b}$. The expected return function of the financial institutions can thus be described as follows, where the average return of the financial service is defined as i :

$$\text{Max}[R_f(E)] = \rho + \omega\varphi\alpha - \frac{b\alpha^2}{2} - \frac{\lambda\omega^2}{2} = \rho + \frac{\omega^2\varphi^2}{2b} - \frac{\lambda\omega^2}{2} \geq i \quad (5.7)$$

It can be observed that the maximised return of financial institutions is based on the fixed contract income of the financial service, the incentive level, effort input level and the risk-averse level. If the financial institutions are awarded better incentives and become less risk-averse, they will contribute more effort and expertise into the project to obtain a higher return. However, the SPVs also aim to maximise their return. Therefore, the incentive the financial institutions can obtain is constrained by the corporate principals, namely the shareholders of the SPVs. When the expected return of the financial institution reaches the limit considering the interests of the SPVs' shareholders, the incentive index can be calculated by the first order approach and represented as follows:

$$\omega = \frac{\varphi^2}{\varphi^2 + b\lambda} \quad (5.8)$$

Therefore, with this incentive index approved by the SPVs, the effort input level of the financial institutions can be represented as follows:

$$\alpha = \frac{\varphi^3}{b(\varphi^2 + b\lambda)} \quad (5.9)$$

Under this condition, the return of the SPVs can be represented as follows:

$$\text{Max } R_{spv}(E) = \frac{b\lambda\varphi^4 + \varphi^6}{2b(\varphi^2 + \lambda b)^2} - i \quad (5.10)$$

(2) Scenario two: the financial institution is involved as shareholder

In the scenario where the financial institutions jointly sponsor the projects as equity investors, they are playing dual roles, as principals as well as agents. Therefore, their expected return consists of two sources, including the fixed income of the financial service contract and the dividend of the SPV share. The expected return of the financial institutions is therefore represented as follows:

$$\begin{aligned} R_f(E) &= \rho + \omega\varphi\alpha - \frac{b\alpha^2}{2} - \frac{\lambda\omega^2}{2} + k(\varphi\alpha - \rho - \omega E i) \quad (5.11) \\ &= \rho + \omega\varphi\alpha - \frac{b\alpha^2}{2} - \frac{\lambda\omega^2}{2} + k(\varphi\alpha - \rho - \omega\varphi\alpha) \end{aligned}$$

Where k ($0 < k < 1$) stands for the share portion held by the financial institutions. In this scenario, the expected return of the contractors/operators/suppliers can be described by the following function:

$$R_{cos}(E) = (1 - k)(\varphi\alpha - \rho - \omega\varphi\alpha) \quad (5.12)$$

Assuming that the financial institution aims to achieve the maximal return, the effort input can then be obtained when the first order value of $\frac{\Delta R_f(E)}{\Delta \alpha}$ approaches zero. The input value of α at this point can be represented as below:

$$\alpha = \frac{\varphi}{b}(\omega + k - \omega k) \quad (5.13)$$

For comparison purposes, the incentive index of the abnormal project income is assumed to remain $\omega = \frac{\varphi^2}{\varphi^2 - \lambda b}$ as when the financial institutions are only playing the role of agents. Then, the optimal effort input to achieve the best return is when:

$$\alpha = \frac{\varphi}{b} \left[\frac{(1-k)\varphi^2}{\varphi^2 + \lambda b} + k \right] \quad (5.14)$$

Subsequently, the expected return of the SPV can be represented as:

$$R_{spv}(E) = \frac{2b^2\lambda^2\varphi^2k + b\lambda\varphi^4 + \varphi^6}{2b(\varphi^2 + \lambda b)^2} - i \quad (5.15)$$

The expected return of the contractors/operators/suppliers can be represented as:

$$R_{cos}(E) = (1 - k) \frac{2b^2\lambda^2\varphi^2k + b\lambda\varphi^4 + k\varphi^6}{2b(\varphi^2 + \lambda b)^2} - (1 - k)i \quad (5.16)$$

The expected return of the financial institutions can be represented as:

$$R_f(E) = \frac{b^2\lambda^2\varphi^2k^2 + b\lambda\varphi^4 + k\varphi^6}{2b(\varphi^2 + \lambda b)^2} + (1 - k)i \quad (5.17)$$

(3) The comparison between the two scenarios

When we compare the effort input of financial institutions in these two different scenarios, the difference in the effort input of the financial institutions can be represented as follows:

$$\Delta\alpha = \frac{k\varphi\lambda}{\varphi^2 + \lambda b} \geq 0 \quad (5.18)$$

It is observed that when the financial institutions act as both shareholders as well as financial service providers, their effort input level is higher than when they solely act as financial service agents. In these two scenarios, the difference of the SPV return can be represented as follows:

$$\Delta E_{spv} = \frac{b\lambda^2\varphi^2}{(\varphi^2 + \lambda b)^2} \geq 0 \quad (5.19)$$

From which it is noted that the overall return for the SPV is more positive when financial institutions are involved in their capacity as shareholders. Meanwhile, the

return difference for the contractors/operators/suppliers can be represented as follows. It is favourable to involve financial institutions as shareholders in order to increase the overall project return.

$$\Delta E_{cos} = (1 - k) \frac{bk\lambda^2\varphi^2}{(\varphi^2 + \lambda b)^2} \geq 0 \quad (5.20)$$

The remaining question is the distribution of the equity. Thus, the value of k requires further discussion. When the return of the contractor/operators/suppliers is optimised when the financial institutions are involved as the shareholders, then the return of the initial shareholders is represented as the maximised value of formula 6.16. Based on the first-order approach, the return of the original contractor/operator/supplier shareholders considering the share proportion of the financial institution can be represented as follows:

$$k' = \frac{dR_{cos}}{dk} = \frac{1}{2} + \frac{i(\varphi^2 + b\lambda)^2 - b\lambda\varphi^4 - \varphi^6}{4kb^2\lambda^2\varphi^2} \quad (5.21)$$

When $0 < k < k'$, the return for the original contractor/operator/supplier shareholders will increase in line with the share proportion of the financial institution. k' is the turning point of the return. When $k > k'$, the return allocated to the original shareholder will start to decrease (Figure 14). The optimised share portion k' taken by the financial intuitions is determined by the effort input cost, effort yield index and the risk-averse level in each case.

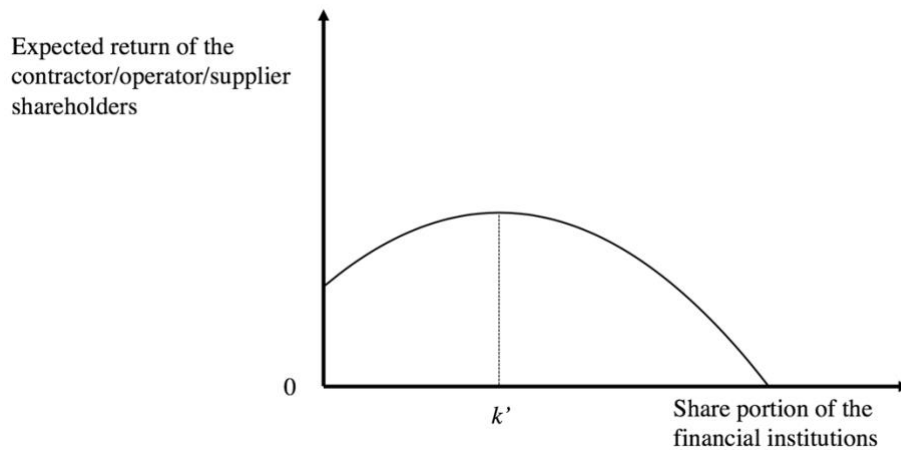


Figure 14 The correlation between the share portion of the financial institutions and the return of original corporate shareholders

Source: The author

5.2.3 Decision-making of the project debt level

Following the discussion of the shareholding structure design for the initial phase, this section examines another core pillar of capital structure, namely the debt level, based on the literature, theoretical deduction, and the empirical case.

5.2.3.1 The features of the debt level and the empirical debt scope

Debt is the most important source of finance for infrastructure projects because it is the most extensive form of available financing. Debt accounts for between 70% and 90% of project financing (including mezzanine capital and subsidies where applicable (Weber et al., 2016). Debt can be obtained from multiple sources, including commercial lenders, institutional investors, export credit agencies, bilateral or multilateral financial organisations, bondholders and sometimes the host country government (World Bank, 2018). There are two significant features notified through the previous analysis and literature.

Firstly, there is a remarkable consistency of the debt level for the project in the same asset class. According to the findings of Section 5.3 in Part I, the equity ratio of the BRI infrastructure PPP projects ranges from 15% to 30%, and the debt ratio of the total investment ranges from 70% to 85%, correspondingly. The result of the questionnaire survey is also consistent with the observation based on the cases. For the projects with more considerable fixed-asset investment demand, such as the DBFO projects, the equity/debt ratio is higher given that the sponsors are usually more concerned about the capital cost in the long term as equity capital from the shareholders is cheaper than the loan. Therefore, leveraging less debt for the capital-intensive fixed-asset investment projects can reduce the debt repayment pressure, especially when the project financial risks are relatively higher. For the engineering expertise and equipment supply-oriented BRI infrastructure assets, the equity/debt ratio is lower due to a more stable cash flow guaranteed by the EPC+ OM contracts.

Second, there is a strong correlation between the projected return, risks and debt level. The projected return, risks and loan repayment ability reflect the project profitability and affect the debt level of the PPP projects. An empirical scope of debt for different project types and risk levels is proposed in Table 25. The projects with stable cash flow and lower risks can leverage a higher debt level as opposed to those confronted with a non-secured project return and higher risks.

Table 25 The empirical debt level of the infrastructure projects

Project type	Risk level	Upper limit of debt level
Energy infrastructure projects in the form of EPC with a secured electricity sale contract	Low	85%
Transport infrastructure, e.g., toll road	Low ~ medium	80%
Natural resource infrastructure, e.g., mining	Medium	70%
Energy infrastructure projects without a secured electricity sale contract or hedge arrangement	Significant	50%

Source: Yescombe (2013)

5.2.3.2 The preference of key stakeholders and the crucial indices of debt level

Different stakeholders of the PPP project have their interests and goals. The government mainly focuses on social benefits, such as social welfare and the value for money of the project, as well as the control of systematic risks and relieving the public financial deficit. The lenders are concerned about the loan repayment ability of the project and the capital gain from the project. The sponsors of the project seek a maximised return of the project construction, operation and dividend. The alignment of the objectives of the key stakeholders is crucial in the selection of an appropriate debt level. In what follows, the analysis will incorporate project valuation from the sponsors' (shareholders) and lenders' (financial institutions) perspectives, respectively. This analysis aims to develop a heuristic formula including the key performance indicators representing the prioritised objectives of the sponsor and lender.

The critical indicators for the optimisation of project value from the perspective of the project sponsors

According to the findings in Part I, the definition as well as the standard formulas in financial analysis, the key performance indicators in the project valuation from the perspective of the sponsor include:

1. FCF (free cash flow), representing an assessment of the amount of cash a company generates after accounting for all capital expenditures, such as buildings or property, plant and equipment. The excess cash is used to expand production, develop new products, pay dividends and reduce debt. Furthermore, it also represents the maximised cash return distributed to the equity investors, namely the sponsors in the PPP project.

The formula of the FCF is as follows, where P represents the price of the public goods or service, D represents the demand amount of the public goods or service, C_c represents the construction cost, C_{om} represents the operational cost and t represents the t th year in the project lifecycle:

$$FCF_t = P_t D_t - C_{ct} - C_{omt} \quad (5.23)$$

Therefore, the value of the SPV can be represented as below, where t_{PPP} indicates the time length of the construction and the concession period in the PPP contract.

$$V_{SPV} = \sum_{t=n}^{t_{PPP}} \frac{FCF_t}{(1+WACC_t)^{t-n+1}} = \sum_{t=n}^{t_{PPP}} \frac{P_t Q_t - C_{ct} - C_{omt}}{(1+WACC_t)^{t-n+1}} \quad (5.24)$$

2. In the valuation of the SPV, there is another key performance indicator, the weighted average cost of capital (WACC). It reflects the cost of equity capital and loan, and can be represented as follows:

$$WACC = W_e R_e + W_d R_i \quad (5.25)$$

Where W_e represents the proportion of the equity capital, and W_d represents the proportion of the debt capital. R_e represents the cost of the equity capital, and R_d represents the interest rate on the debt.

3. The operation risks of the PPP infrastructure project are also important factors for the debt level. Apart from claiming the fixed return in the construction phase or through supplying the equipment, most of the BRI infrastructure PPP projects have adopted the BOT or BOOT modes, which incorporate the consideration of returns in the operation phase. The operation risk usually represents the degree of the operating leverage (DOL), where C_v represents the unit variable cost, C_F represents the fixed cost, t represents the t th year in the PPP contract and V_{SPV} refers to the appraisal of the project company.

$$DOL = \frac{D_t(V_{SPV_t} - C_{vt})}{D_t(V_{SPV_t} - C_{vt}) - C_{Ft}} \quad (5.26)$$

4. The financial risks are normally represented by the degree of financial leverage (DFL), which measures the sensitivity of a company's operating income due to changes in its debt capital structure and interest. The higher the DFL, the higher the financial risk derived from the debt. Thus, it also reflects the impact of debt level on the value and returns on equity. The DFL formula is as follows, where $EBIT$ represents the earnings before interest and taxes, and I represents the interest of debt:

$$DFL = \frac{EBIT_t}{EBIT_t - I_t} \quad (5.27)$$

5. The profitability of the project is also the key performance indicator for the sponsor, which consists of the profit margin, return on assets (ROA) and return on equity (ROE). In the PPP infrastructure project, it is relevant to the fixed income of the construction and equipment supply, as well as the cash flow and the internal rate of return (IRR). Overall, we can conceptualise the profitability through the perspective of the total project cash flow as follows:

$$P_{spv} = \sum_{t=1}^{T_{PPP}} (C_i - C_o)(1 + IRR) \quad (5.28)$$

Where C_i represents the cash input from the equity fund on the balance sheet, and C_o represents the cash outflow. When the WACC equals to IRR, the P_{spv} equals to zero.

The key indicators for the optimisation of project value from the perspective of project lenders

As stated in Chapter Four, most of the debt capital of the BRI infrastructure PPP project is financed by national or multilateral development financial institutions. In addition, commercial banks also play a role in providing loans. With the growth of financial markets, pension funds, sovereign wealth funds, insurance funds, and even private equity infrastructure funds are also gradually entering the market. The features of the project finance, such as the limited recourse, construction completion guarantees, cash flow repayments, etc., determine its differences from the commercial loan. It is observed that the lenders are still the prominent capital providers for the BRI infrastructure PPP projects. Thus, the following analysis will be conducted from the perspective of the lenders.

According to the findings of the questionnaire survey, there are three dimensions pertaining to the objective of the lenders: (1) whether the cash flow can cover the annual

debt repayment and the remaining loan period; (2) the capital gain from the loan interests and the capital cost; (3) the safety of the capital, which usually reflects the requirement of the credit guarantee to hedge the default risk. In particular, from the perspective of risk management, it is regarded as the necessary condition for most of the BRI PPP project. The key performance indicators are discussed under each dimension as below.

The debt service coverage ratio (DSCR) is used to measure whether the annual cash flow before the debt service (CFS) is enough to pay the instalments due. It is represented as follows, where $OMCF_t$ represents the operation/management cash flow in the t th year of the PPP contract, K_t represents the principal loan repayment in the t th year of the PPP contract, and I_t represents the interest of the debt in the t th year of the PPP contract.

$$DSCR = \frac{OMCF_t}{K_t + I_t} \quad (5.29)$$

Given the long-term nature of the PPP infrastructure, it necessitates the consideration of debt maturity in the contract term. The loan life coverage ratio (LLCR) is similar to the debt service coverage ratio (DSCR). The DSCR captures a single point in time, whereas the LLCR addresses the entire span of the loan. The LLCR is used to estimate the ability of the borrowing company to repay an outstanding loan after a certain point in time. Project financing agreements invariably contain covenants that stipulate LLCR levels. It is calculated by dividing the net present value (NPV) of the cash flow available for outstanding debt repayment. It is illustrated as follows:

$$LLCR = \frac{\sum_{t=n}^t \frac{PPP OMCF_t}{(1+r)^t}}{\sum_{t=n}^t \frac{PPP K_t}{(1+r_d)^t}} \quad (5.30)$$

Where K_t is the principal repayment amount of the outstanding loan in a specific year of the PPP contract, r_d is the interest rate on the debt, r is the discount rate. Depending on the risk profile of the project, sometimes a debt service reserve account is required by the lender. In such a case, the numerator of the LLCR would include the reserve account balance.

With reference to the second dimension of the lender's interest, the profitability can be described as the debt capital gain deducted by the capital cost. The formula is shown as follows:

$$P_{lender} = \sum_{t=n}^{t_{PPP}} \frac{K_t + I_t}{(1 + WMCF_t)^{t-n+1}} - \sum_{t=n}^{t_{PPP}} \frac{B_t}{(1 + WMCF_t)^{t-n+1}} \quad (5.31)$$

Where the I_t is the outstanding interest in the t th year of the PPP contract, B_t is the balance of the loan in the t th year of the PPP contract. $WMCF_t$ is the weighted marginal cost of debt capital in the t th year of the PPP contract. It is closely related to the interbank offered rate, the minimum capital adequacy ratio and the risk-weighted rate of the asset. Thus, the $WMCF_t$ not only reflects the cost of the debt capital but also the consideration of capital safety.

The existing research on project finance has summarised the empirical scope of the DSCR and LLCR in Table 26 according to the importance of these two factors and their subsequent impact on the profitability of the project (Gatti, 2012; Sheng, 2013). From the perspective of the lenders, the requirement for the DSCR and LLCR should be no less than one given that it is the baseline for ensuring the debt repayment. Given the fact that the DSCR captures a single point in time, whereas the LLCR addresses the

entire span of the loan, the LLCR ratio requirement is higher in order to better guarantee the long-term debt repayment ability.

Table 26 The average DSCR and LLCR in various sectors

Project sector	Average DSCR	Average LLCR
Energy		
Merchant plants (e.g., plants with no offtake agreement)	2.0 x -2.25 x	2.25x–2.75x
With tolling agreement	1.5 x -1.7 x	1.5x–1.8x
In cases involving regulated business	1.3 x -1.5 x	1.3x–1.5x
Transportation		
Telecom	1.2 x -1.5 x	N.A.
Water	1.2 x -1.3 x	1.30x–1.40x
Waste to energy	1.35 x -1.4 x	1.80x–1.90x
Private F	1.35 x -1.4 x	1.45x–1.50x

Source: Gatti (2012); Sheng (2013)

Guarantee structure

Aside from the fundamental financial requirements, the guarantee structure is adopted as a complementary mechanism for the incomplete PPP contract structure, particularly for the debt contract. The guarantees share some commonalities and demonstrate differences in usage. Credit guarantees cover all or part of a financial obligation (usually a loan or bond) and are triggered irrespective of the cause of the political or commercial defaults. While risk guarantees cover all or part of a financial obligation, they are called only when the government or government-owned entity fails to meet specific obligations under the project agreements to which it is a party (Norton Rose Fulbright, 2016). Apart from the sovereign-backed guarantee and the guarantee provided by the multilateral development banks (MDBs), the asset guarantee is also required by the banks in case of debt repayment default risks. Given that most of the countries along the Belt and Road constitute emerging markets where the risks are relatively higher due

to the instability of the sovereignty, the asset guarantee is, therefore, a critical factor worth considering in the process of debt level decision-making.

5.2.3.3 Empirical case study for the capital structure design

An existing BRI infrastructure PPP case is unveiled as below in order to extend the critical factors from both the project sponsors' and lenders' perspective to the debt level decision making. In addition, this empirical case study not only supports the consideration of the debt financing indices but also provides the practical evidence to support the compatibility of asset class and the sponsors, the determinant factors in capital structure design and guarantee structure application.

Project overview

The Kamchay Hydropower BOT Project is a hydropower project initiated/developed by the Ministry of Industry, the Mines and Energy (MIME), and the National Electric Power Company of Cambodia. China Hydropower Construction Group International Engineering Co., Ltd. has officially signed the BOT contracts with the Ministry of Industry, Mines and Energy of Cambodia after winning the bid. At present, the project entered the formal commercial operation phase. It is also one of the very first BRI infrastructure PPP projects that have completed the construction phase.

Sponsor profile

The SPV Company -- Kamchay Project Company is a wholly owned company of Sino Hydro International Co., Ltd., the overseas subsidiary company of China Hydropower Construction International Engineering Co., Ltd. Sino Hydropower International owns

the control and management rights of the project. As the actual borrower, it can avoid the obstacles related to legal regulation and transnational offshore management.

Financing arrangement

The Kamchay Hydropower BOT Project adopts the internationally acknowledged BOT corporate structure. The total equity investment amounted to 80.05 million USD. The equity investment accounts for 28% of the total investment, and the bank provided 200 million USD, accounting for 72% of the total investment.

Borrower: Kamchay Project Company (SPV)

Loan maturity: Based on the project construction and investment recovery period

Interest rate: 6 months LIBOR + MARGIN (approx. 6%), using different interest rates prior and after construction completion, four years construction phase and 40 years operation phase

Repayment period: After the project construction is completed, the loan starts to be repaid every six months

Tax and electricity tariff: The first nine years of the operation phase are free of tax payments, while afterwards, there is annual profit tax rate of 9%. The electricity is priced at 8.35 cents USD/kWh in the first nine years, 8.696 cents USD/kWh from year 10 to 15, and 7.72 cents USD/kWh for the remaining 25 years.

Guarantee structure

Completion guarantee: Prior to the completion of the project, the parent company's parent company (Sinohydro) is obliged to provide the guarantee for repaying the loan;

The other guarantee arrangements include project assets pledged during the operation period; the pledge of the project custodian account; the pledge of the electricity offtake agreement; the pledge of the concession agreement; repayment guarantee provided by the Cambodian government; the pledge of the share of the borrower; overseas investment insurance, etc.

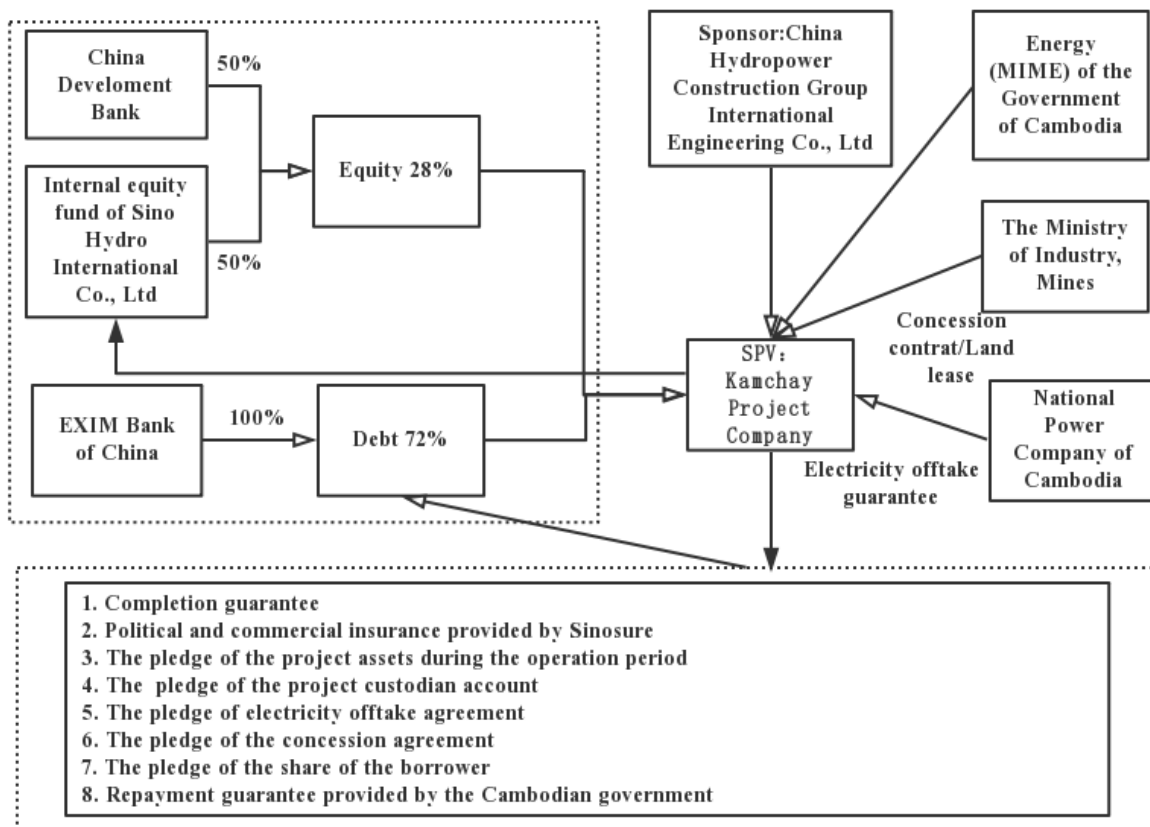


Figure 15 The project structure and capital structure of the Kamchay BOT Project

Source: The author

Financial performance of the Kamchay BOT project

It is observed that with 14% of equity investment from the initial sponsors, this project has incited about 300 million USD investment in total. The on-grid electricity tariff is 8 cents USD with the government ‘Take or Pay’ guarantee. According to the ‘Take or Pay’ contract, 100% of the generated electricity will be purchased. The total investment annual profit rate is 5.67%, the internal rate of return of the total financial reaches 9.55%, and the internal rate of return of the equity investment is 11.08%. The financial performance is illustrated in Table 27.

Table 27 Performance of the key financial analysis indicators

Item	Indicator (USD)	Item (after tax)	Indicator (% or USD)
Total investment	280.55 million	Annual investment profit rate	5.67%
On-grid tariff	Approx.0.084/kWh	Annual rate of return on capital	23.28%
Sales income for electricity	Approx. 1.60 billion	The internal rate of return of the total financial investment	9.55%
Cost of electricity generation	684.71 million	Net present value of the total financial investment	36.52 million
Revenue tax	165.96 million	The internal rate of return on the equity investment	11.08%
Interest tax	13.2 million	Net present value of the equity investment	11.21 million
Dividend tax	95.50 million	Payback period (construction phase excluded)	12.3 years
Total revenue of the electricity generation	910.52 million	Debt repayment period	11 years
		Debt asset ratio	72%

Source: China Power (2016)

Based on the analysis of the design of equity shareholding and debt structure, the key determinant factors for improving the performance of the BRI infrastructure PPP project are recognised. In the Kamchay hydropower project, as one of the major shareholders, the CDB contributes 50% of capital to the SPV equity investment.

Moreover, compared with commercial banks, the CDB is more risk-tolerant, given it is a state-backed policy bank. The improvement of the project return compared with those without the financial institutions as shareholders can be demonstrated by the positive performance of the IRR.

According to this case study, the price and quantity of the public goods, the cost of the construction and operation/management, the weighted average cost of the capital, the cash flow, IRR, debt interest rate, and debt coverage ratio are the determinant factors for the investment return of the SPVs and the lenders. The consideration of these critical factors is reflected by three core agreements in the Kamchay project. The first agreement is the Implementation Agreement (IA), in which the government authorities provide the payment guarantee. The second agreement is the Power Purchase Agreement (PPA), in which the electricity offtake concession is awarded. The payment currency selection is set as 80% in USD and 20% in the local currency, and the electricity tariff is paid on a monthly basis. What is worth mentioning is that the 20% payment made in the local currency is used for the local expenditure in the process of power plant management and operation to mitigate the exchange rate fluctuation risk. In the meantime, 80% of the payment is made in USD to facilitate the debt repayment to the EXIM Bank of China. The third agreement is the leasing agreement, which authorises the right of land and road use to the SPV (Zhang and Zhou, 2016). These three agreements provide the contractual basis for the stable cash flow generated from the project income, the electricity offtake, low-cost capital, debt repayment capacity, and the positive IRR.

5.3 Synthesis of results

The study of the capital structure of the current BRI infrastructure PPP projects takes into account the features of infrastructure assets, stakeholder composition, financial arrangement, as well as the difference of the investors' preferences along the project life-cycle. The key findings of this chapter can be summarised as follows.

The BRI infrastructure PPP projects can be categorised into two types, (1) fixed-asset investment and operation-oriented asset and (2) engineering expertise and equipment input-oriented asset. For these projects with a high fixed-asset investment and operation capacity demand, the sponsors with a substantial capital investment capacity and operational expertise are more compatible with the need. For these projects with high engineering expertise and equipment input, experienced contractors and specialised equipment suppliers can better meet the demand.

These two types of assets are delivered in different contract forms. The fixed-asset investment and the operation-oriented asset is often provided in the DBFOT or BOT contracts. The engineering expertise and equipment input-oriented asset is usually delivered in the EPC plus OM contracts, which require less equity capital input from the project sponsors. The success of the project is closely relevant to the composition of the sponsors, reflecting the combination of the equity financing ability, construction engineering capacity, management, and operation expertise. Therefore, the asset class feature and the compatibility of the sponsors' profile with the asset demand is the first dimension for the capital structure design.

An importance index of the determinants for the design of the capital structure is proposed, with the top five determinant factors covering the perspectives of project profitability, stakeholder interest, debt repayment capacity, management strategy, and macroeconomic and market condition. The comparison reveals the commonalities and differences in the decision-making process for the capital structure design from the perspectives of different investors. The utilisation frequency of different financing methods shows that their selection should consider the phase-wise project features. In the initial construction phase, the concessionary loan from the Chinese policy banks not only provides low-interest debt capital but also serves the enhancement of the credit for obtaining further investment. Other capital sources such as the direct equity investment from the sponsors can also ensure long-term engagement and active management. On the other hand, the more liquid financing methods such as the subordinated loan and the mezzanine finance can complement the short-term capital demand. In the operation phase, the frequency of the usage of the long-term loan from the policy banks and commercial banks decreases given that the project is potentially able to generate cash flow and repay the debt for the construction.

In the decision-making of the equity structure, it is observed from the case studies that the most common and major sponsors are still the engineering Chinese SOEs, who play the roles of contractors/operators/suppliers as well as the equity investors and major shareholders in the projects. The financial institutions are regarded as the agents providing the financial service. However, it will lead to the potential agent costs. The necessity and impact of the introduction of financial institutions as shareholders is studied based on the VNM utility and expected return function of the principal-agent theory in this section. The results illustrate the benefits of bringing the financial

institutions as shareholders together with the engineering SOEs, such as the reduction of the principal-agent cost, the increase of competence and risk tolerance. The arrangement of the shareholding structure and its payoff effect extends the rationale of the incentive effect of the residual rights generated from the ownership.

In the decision-making of the debt level, there is a remarkable consistency of the debt level for the project in the same asset class. For the projects with a more substantial fixed-asset investment demand, such as the DBFO, BOO and BOT projects, the equity/debt ratio is higher as the sponsors are usually more concerned about the capital cost in the long term. For the engineering expertise and equipment supply-oriented BRI infrastructure assets, the equity/debt ratio is lower due to the cash flow guaranteed by the EPC+ OM contracts.

Overall, considering the findings of the BRI infrastructure PPP project capital structure, this chapter aims to provide a framework for the design of the capital structure that better aligns the diverse interests and objectives of investors. The procedures in the framework include (1) Asset classification; (2) Assessment of the stakeholder composition; (3) PPP mode selection; (3) Capital structure scope definition; (4) Adjustment of the equity structure to align the interest of shareholders; (5) Debt level selection to meet the requirement of the lenders; (6) Guarantee structure design to assist the debt level arrangement.

Given the current mainstream practice and development stage of the infrastructure investment markets along the Belt and Road, this framework expects to facilitate the PPP infrastructure project investment, as well as motivate the involvement of potential

stakeholders with more diverse expertise and backgrounds. The potential change of shareholding structure, such as the exit of the initial sponsors, the entry of new equity investors, as well as the application of refinancing in the project operation phase require further study in order to serve the more comprehensive design of capital structure for the BRI infrastructure projects.

CHAPTER SIX: RISK MANAGEMENT FRAMEWORK OF BRI INFRASTRUCTURE PPP PROJECTS

6.1 Introduction

When infrastructure crosses borders in the context of the BRI, the benefits from increased connectivity are magnified, as well as the risks (World Bank, 2019). Risk, in general, is interpreted as the probability of a specific event or class of events occurring over a specified time horizon and exerting a negative influence. Uncertainty, by contrast, is understood as the situation where the probability of the event is unknown (Keynes, 1921; Knight, 1921). Uncertainty also affects the degree of contractual incompleteness that characterises the most complex projects (Iossa and Martimort, 2012). However, the degree of uncertainty is not intrinsically unknowable. Thus, the malleable and uncertain event can be transformed into risk (Clark, 2019). In the specific context of infrastructure provision in the form of PPP, risk stands for the uncertain factors that might exert a negative impact on time cost, capital expenditure, scale and performance (Ke, 2010).

The management of risk is the underpinning requirement of the contract negotiation in addition to the design capital structure. Risk identification, risk assessment and risk allocation are considered as three core components of risk management. The success of project management depends on the extent to which the risks involved can be identified, understood, measured and allocated to the appropriate parties (Tah and Carr, 2010). In addition, investigating the risk allocation preferences of the stakeholders prior to the contract negotiation is vital for driving the value creation as well as balance rewards in line (Delmon, 2017; Villani et al., 2017).

Many studies have been conducted in order to explore the risk management approaches for PPP projects in various regions, especially from the perspective of risk allocation. The preferred risk allocation in PPP projects in the UK was examined using a questionnaire survey, the findings of which indicate that the risk factors should be handled on a case-by-case basis (Li et al., 2005). The governance example of a toll way PPP project in the Indonesian market was analysed to provide the best local experience (Abednego and Ogunlana, 2006). The decision-making process of an Australian rail project was examined by Ng and Loosemore (Ng and Loosemore, 2007). Ke et al. (2010) identified the principal risk factors and the risk allocation preference between the public and private sectors in the Chinese PPP market. The risk allocation questionnaire survey initiated by Hwang et al. (2013) provided the risk allocation preference from the perspective of the contractors. A comparative analysis of the cross-country risk allocation was conducted in order to summarise the commonalities and differences regarding the PPP allocation of infrastructure projects (Chou and Pramudawardhani, 2015). However, there is still a significant research insufficiency pertaining to risk management, particularly the risk allocation of PPP infrastructure provision under the context of the BRI. In addition, the features of the infrastructure asset, PPP and BRI entail the complexity of designing a risk management scheme which can be compatible with the preferences of different stakeholders. In addition, it is necessary to balance the risks and returns of the public and private sectors in PPP projects (Grimsey and Lewis, 2002).

It is commonly accepted that the general principle is that each risk should be allocated to the party best able to manage it and for the lowest cost (Cooper et al., 2005). Notwithstanding that this criterion is commonly recognised and frequently applied, the controversial risk allocation is still frequently observed. Given the asymmetry of the

information and different bargaining power, it is often the case that the stakeholders with limited access to the information or lower bargaining power may bear more risks beyond their capacity and responsibility. These stakeholders are at a disadvantage in the sense that they may not be able to control the risk in the most efficient way or at the reasonably lowest cost (Medda, 2007). Thus, the risk management framework should be orchestrated *ex-ante* in order to optimise the total costs for both the public and private sectors, align the interests of key stakeholders, guarantee the contracting ability and contract enforceability, and, most importantly, improve the collective performance of the partnership.

This chapter discusses the risk identification and allocation among stakeholders at level 4 following the Williamson institutional framework (Williamson, 1998), in order to provide the context-based risk management framework to facilitate the BRI infrastructure PPP provision. In Section 6.2, the risks of the BRI infrastructure PPP projects are identified and categorised as the basis for a further analysis of this chapter. Subsequently, the stakeholders' preference differences, principles, and critical demands regarding the risk allocation are investigated in Section 6.3 to support the attempt to construct a risk management framework. A case study of an actual BRI energy infrastructure PPP project is presented in order to demonstrate the actual risk allocation and thus provide a more practical angle for the risk management framework. In Section 6.4, the risk management framework is proposed based on the analysis of risk identification and allocation. This framework aims to assist risk identification and allocation as well as align the interest of the stakeholders. The synthesis of results can be seen in Section 6.5.

6.2 Identification of principal risks of the BRI infrastructure PPP projects

Risk identification represents the first step and constitutes a very critical phase in project risk management (Zou et al., 2008). It refers to the systematic prediction, profiling and classification of risk factors that may potentially or objectively affect project performance. Some risk factors, such as cumulative material fatigue from minor stressors, poor maintenance, and new demands can cause physical collapse without warning (Ansar et al., 2016). Thus, risk identification is desired as early as possible (Li and Zou, 2012; Qiao et al., 2001). Most of the BRI infrastructure projects have the attributes of public goods, and the investment cycle is long, and the scale of investment is large, resulting in high risks and affecting the incentive of the private sector stakeholders. Unproductive infrastructure investment even leads to risks beyond PPP, such as the built-up of debt, monetary expansion, instability in the financial market, and economic fragility, which have already caused concerns in the Chinese market (Ansar et al., 2016). In addition, given the diverse background of the BRI and the infrastructure projects, the causes of risks are inevitably complex, and impact of risks varies from project to project. Therefore, prior to the analysis of risk allocation and management, the risk identification section serves as the general basis of the entire chapter and will answer the following questions: ‘What risks will the BRI infrastructure PPP provision be confronted with?’, ‘What are the causes of these risks?’ and ‘How do these risks affect project performance?’ In order to answer the first question, a straightforward and simple, yet valid method is the development of a risk checklist (Fang et al., 2004; Hwang et al., 2013). A comprehensive case study was conducted in order to collect actual data from 16 BRI infrastructure PPP projects (Table 28). By analysing the causes of failure on the basis of these cases, it can be concluded that there are 20 principal risks most common and impactful to the BRI infrastructure PPP projects.

Table 28 Summary of the risk from the existing BRI infrastructure PPP project

Project No.	Project Name	Risk Factor	Outcome
1	China Railway Construction Corporation (CRCC) high-speed railway project, Mexico	Government credit and transparency, corruption, instability of the government, contract breach by the government, inappropriate intervention by the government	The project is shelved indefinitely
2	China Railway Construction Corporation (CRCC) Makkah Mashaer railway project, Saudi Arabia	Religious conflict, disadvantaged geotechnical conditions, difference in technology standards, extreme weather	Completion delay, financial loss
3	China Overseas Engineering Group Co., Ltd. A2 motorway project, Poland	Conflict of negotiation and critical clause, construction cost overrun, constraints of labour, contract defect	Completion delay
4	Beijing Urban Construction Group Co., Ltd. public housing project, Thailand	Instability of the government, contract breach by the government	Project failure
5	China Railway Group Co., Ltd. Kunduz and Jalalabad motorway projects, Afghanistan	Terrorism attack	Completion Delay
6	Beijing Urban Construction Group Co., Ltd. Sana'a International Airport project, Yemen	Breach of payment contract by the local government, sovereign immunity, violation of bilateral investment agreements	The financial loss of the contractor, difficulty to use the arbitration channel to recover the loss
7	State Power Investment Corporation Myitsone hydropower station, Myanmar	Political opposition, instability of the government	The project is still shelved, no agreement has been reached so far

8	Sinohydro Co., Ltd. Kaduri hydropower station, Georgia	Inappropriate intervention by government, instability of the government, inability to pay, change of law, breach of contract by the government, terrorism	Completion delay
9	China National Petroleum Corp (CNPC) drilling project, Libya	Instability of the government, war	Termination of contract and financial loss
10	Sinohydro Co., Ltd. Vaga-Magee road upgrade project, Ethiopia	Disadvantaged geotechnical conditions, war	Financial loss
11	Shandong Electric Power Construction Co., Ltd. serial power plant projects, India	Taxation dispute	Financial loss
12	State Grid Cooperation of China Kirillon hydropower project, Cambodia	Operation cost overrun	Financial loss
13	China Harbour Engineering Co., Ltd. Colombo port city project, Sri Lanka	Breach of contract by the government, bilateral relation deterioration, government instability, environmental risk	Completion delay and financial loss
14	Dongfang Electric Corporation Longwan thermal power plant, Indonesia	Disadvantaged geotechnical conditions	Completion delay and financial loss
15	China Chengda Engineering Co., Ltd. Palembang power plant, Indonesia	Foreign currency exchange rate change, taxation dispute	Financial loss
16	China International Water and Electric Co., Ltd. Merowe Dam, Sudan	Environmental risk	Negative social impact of the project

(1) Government credit and transparency risk

In 2014, the Mexican government announced that it would invite tenders to participate in the construction of a high-speed railway project connecting the capital of Querétaro and Mexico City in the form of EPC + OM. The China Railway Construction Corporation (CRCC) consortium was announced as the only eligible bidder at that time. However, the Minister of Transport of Mexico declared the cancellation of the first-round bidding result and the delay of the second round of bidding according to the legitimacy and transparency issue of the project without transparent bilateral negotiation unilaterally. The Minister of Finance of Mexico announced later that due to the decline in international oil prices, Mexico's public budget for 2015 to 2016 would be significantly reduced, hence, the project has been set aside indefinitely (Feng et al., 2017).

(2) Corruption risk

This is also observed in the Mexico high-speed railway project. During the bidding phase, the members of the National Action Party, one of Mexico's opposition parties, claimed that 'a group closely associated with the current president will benefit from this transaction'. Constructora Teya, one of the Mexican enterprises in the PPP consortium, leased an aircraft to the then sitting president. Meanwhile, Constructora Teya was also accused of receiving a series of large-scale construction contracts from the government while the then sitting president served as the governor of Mexico (Feng et al., 2017).

(3) Government instability risk

In the Beijing Urban Construction International Co., Ltd. public housing project in Thailand, the contractor must pay the property guarantee up to 10% to 15% to the sponsor and project owner. However, shortly after the Beijing Urban Construction International Co., Ltd. transferred the guarantee to the Thai government, a military coup occurred in Thailand. The new government refused to recognise the contracts signed by the former government. The Beijing Urban Construction International Co., Ltd. went through numerous diplomatic channels to recover the performance guarantee. Fortunately, Beijing Urban Construction finally recovered the performance guarantee with the assistance of the diplomatic service. If it happened in countries with a worse economic status, the chance of recovering the loss would be much lower (CAIEC, 2017).

(4) Risk of inappropriate intervention by the government

Infrastructure projects typically exhibit economies of scale, possibly leading to natural monopolies. The inappropriate government intervention, policies and management may tend to be inefficient and subject to rent-seeking pressure. In part, the failure led by the government may in fact exceed the market failures (Winston, 2006). In the Sinohydro Co., Ltd. Kaduri hydropower station project in Georgia, the local government particularly required that the main construction work must be conducted by local contractors rather than the potential bidder with better engineering capacity. In addition, the local government postponed the project acceptance, power generation license and the confirmation of the electricity price. These inappropriate interventions ultimately led to a significant delay in project completion (Yang, 2007).

(5) Public opposition risk

Some of the countries along the Belt and Road are very diverse in terms of social and cultural standards; in part, the conflicts and oppositions derived from the differences will impact the realisation of the BRI PPP projects. For example, the Myitsone Hydropower Project in Myanmar was constructed by a joint venture between the China State Power Investment Corporation and the Ministry of Electricity of Myanmar in the form of BOT. However, the project became a target of public opposition in the democratisation of Myanmar, an event regarded as directly leading to the suspension of the project (China Dialogue, 2012).

(6) Payment risk

The payment risk is observed in the case of the Kaduri hydropower station project in Georgia. The agreed electricity price in the contract is 4.66 cents USD/kWh. However, the power grid company was unable to pay the agreed price. Eventually, only less than 30% of the electricity tariff was recovered at the price of 1.3 cents USD/kWh. Based on this recovery rate and electricity tariff, the power station can only receive less than 500,000 USD in electricity revenue per year. It can barely cover the operation and maintenance costs, which results in a significant financial loss for the project (Yang, 2007).

(7) Cost overrun risk

In the Cambodian Kirillon hydropower project financed by the State Grid Cooperation of China, a continuous financial loss is observed given the surplus operation cost. Eventually, the 100% equity and creditor's rights of the subsidiary investment company

of the State Grid Cooperation of China was listed for sale in order to mitigate the loss (Li, 2017).

(8) Religion risk

There is a section of the Saudi light rail project that was built in Mecca. Given that Mecca is closed to non-Muslim workers, the China Railway Construction Corporation had no alternative but to entrust labour service companies to recruit thousands of Muslim migrant workers. The religious customs, living and work habits of the Muslim workers have significantly increased the difficulty of project management since the Chinese consortium lack experience. Moreover, the lack of professional Muslim engineers in Saudi Arabia has directly contributed to the delay in project construction and the increase in the cost of labour expenditure, which in turn exacerbated the losses of the project.

(9) Sovereign immunity risk

In the BRI infrastructure PPP provision, the sovereign immunity risk is often the cause of the complete failure and unrecoverable loss of the project investment. In 2006, the Beijing Urban Construction Group won the bid for the new terminal building at Sana'a International Airport in Yemen. The owner is the Yemen Civil Aviation Weather Bureau. The project's bidding price is 115 million USD. However, the owners never processed the payment according to the contract and even deducted all the performance guarantees of the Chinese company, which totalled 30 million USD. In 2014, Beijing Urban Construction applied for arbitration to the international centre for settlement of investment disputes, accusing the respondent of the Republic of Yemen of violating the

1998 bilateral investment agreement signed between Yemen and China. Notwithstanding, it is barely possible to recover the loss since the result of arbitration is difficult to enforce on the Yemen government (CAIEC, 2017).

(10) Terrorism attack risk

In the China Railway Group Co., Ltd. Kunduz and Jalalabad motorway projects in Afghanistan, 11 of Chinese workers died, and 4 were injured as a result of a terrorist attack planned by the Taliban. It was deemed as a sign of protest for the collective western political nations because the project was financed by the World Bank and the European Union (People.cn, 2004). The attack led to additional costs on armed security and delays in completion.

(11) Bilateral relation deterioration risk

The China Harbour Engineering Co., Ltd. Colombo port city project in Sri Lanka was terminated by the then administration government due to the tension between China, India, and Sri Lanka. The project restarted after the alleviation of the geopolitical tension (China Dialogue, 2017).

(12) Labour constraint risk

Many countries, in particular developing countries, have set strict limits on the number of foreign workers in the contracting projects. However, it is often the case that only a limited number of skilled workers are available in the local market. Besides, the laws of some countries also explicitly set a ‘work permit’ system for foreign labour services. These institutional restrictions in the labour sector have created many obstacles for

construction and resulted in a substantial increase in labour costs. In the Poland A2 express highway project, the local labour law stipulates that overseas labour must be employed at local wage levels. The engineering equipment must be leased locally, and only qualified local workers are granted access, from which the skilled foreign workers are excluded. In addition, foreign workers from non-EU regions need to go through a different procedure for the visa, residence certificate and labour license application, etc. In this case, the labour constraint risk not only increases the cost but also affects the schedule (Caixin, 2011).

(13) Geotechnical condition risk

In the Sinohydro Co., Ltd. Vaga-Magee road upgrade project in Ethiopia, due to the poor construction geological conditions, particularly collapse and landslide, the project incurred additional expenditure for adjusting the construction plan even though the project was completed on time (Sinohydro Co., Ltd, 2012).

(14) Technology standard risk

The Mecca light rail project was conducted in the EPC and OM general contracting model. This kind of contract is also referred to as the ‘turnkey’ contract. In the project, the general contractor is solely responsible for the project from construction to operation. However, the Mecca light rail project was required by the project owner to adopt the US and the EU standards for the construction work, whereas the initial design was not consistent with the construction standards. It increased the difficulties of coordination and influenced the construction efficiency (Silk Road News, 2015).

(15) Taxation dispute risk

During the development of 6 power plant projects conducted by the Shandong Electric Power Construction Corporation in India, the total project contract amounted to approximately 6.5 billion USD, of which India's overseas contract amounted to approximately 4.8 billion USD. In 2013, the Indian tax authorities required that overseas and domestic contracts are merged into an EPC turnkey project, with a 1% deductible corporate income tax based on the total value of the supply contract and 10% of the service contract. Thus, it is conservatively estimated that the company has to bear an additional 38.24 million USD tax burden (Guizhou Provincial State Tax Bureau, 2017).

(16) Contract risk

In the international infrastructure engineering and construction industry, the Fédération Internationale Des Ingénieurs-Conseils (FIDIC) standard contract serves as the standardised contract template. If the contract terms are not well formulated, the contract defects will put the rights and investment return of the stakeholders at risk. In the aforementioned Poland A2 express highway case, reference may be made to the inefficiency of the contract review and the absence of the key clauses, resulting in contract disputes in the later construction process. For example, the clauses in the FIDIC contract concerning the disputes around arbitration were all deleted and replaced by 'all disputes are heard by Polish courts and cannot be arbitrated' (Zhu, 2018). This clause is against the fair right distribution in international commercial arbitration tribunals.

(17) Change of law

In the Kaduri power plant case, the Georgia government claimed that the tax law was in the amendment process. Thus, the tax incentive provided by the local government is yet to be fulfilled to this day, resulting in 1 million USD additional expenditure (Yang, 2007).

(18) Foreign currency exchange rate fluctuation

In the project involving the Palembang power plant in Indonesia, the electricity revenue was mainly collected in USD and in the local currency, the Rupee. However, after the completion of the project, the devaluation of the Rupee caused some financial loss to the project. Meanwhile, given that the debt financing was granted in RMB, the appreciation of the RMB is a non-negligible factor for the cost of interest and debt repayment during the operation phase. Overall, the fluctuation of the foreign exchange caused difficulties in hedging the fluctuation of the RMB, USD, and Rupee exchange rates (Zheng and Wang, 2007).

(19) Environmental risk

If the local government determines that an environmental pollution accident has severely affected the local ecological environment and the life quality of the residents, the project will be suspended, which will inevitably bring direct economic losses. In the China International Water and Electric Co., Ltd. Merowe Dam project in Sudan, the life quality of the resettled residents was brought into question. Meanwhile, the additional evaporation losses raised concerns about the water supply pressure (Dirar et al., 2015).

(20) Force majeure risk

A typical case is the Libyan Civil War. In February 2011, the Libyan Civil War broke out. At that time, there were 50 infrastructure projects contracted by 75 Chinese companies in Libya. The war led to a direct economic loss of 200 million USD (CAIEC, 2017).

Table 29 Summary of the principal risks identified in the existing failed BRI infrastructure PPP projects

Risk factor	Case No.															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Government credit and transparency risk	✓															
Corruption risk	✓															
Government instability risk	✓			✓			✓	✓	✓				✓			
Inappropriate government intervention	✓							✓								
Public opposition							✓									
Cost overrun			✓									✓				
Payment risk								✓								
Religion risk		✓														
Sovereign immunity risk						✓										
Terrorism attack risk					✓			✓								
Bilateral relation deterioration risk						✓							✓			
Labour constraint risk			✓													
Geotechnical condition risk		✓												✓		
Technology standard risk		✓														
Taxation dispute risk											✓				✓	
Contractual risk	✓	✓	✓		✓			✓					✓			
Change of law								✓								
Foreign currency exchange rate fluctuation															✓	✓
Environmental risk													✓			
Force majeure risk		✓							✓	✓						

After identifying the risks that have led to the failure of the existing BRI infrastructure PPP project, this section will proceed with the risk identification by exploring the risks deemed critical for consideration by the project sponsors. Since the major types of BRI infrastructure PPP are energy and transport infrastructures, the actual risk assessment forms of typical BRI PPP energy and transport projects are analysed as references in order to identify the principal factors to a further extent. In addition to the 20 risks, which have led to the project failure of the BRI infrastructure PPP project, another 17 risks are selected based on the actual risk assessment procedures, given that they are regarded as critical risk factors in energy and transport infrastructure projects. A total of 37 principal risks of the BRI infrastructure PPP project are identified. Although this analysis may not be very comprehensive due to the uniqueness of each individual BRI PPP case, it may be inferred that the principal risks are those with a high probability to emerge, thus leading to a severer, longer, and more identifiable impact on the projects. Table 30 provides the categorised checklist of these principal risks.

Table 30 Categorised checklist of the principal risks of BRI infrastructure PPP projects

Risk Categorisation	Risk Factor	Risk Definition
Political risk	1. Government credit and transparency risk	The risks related to the creditworthiness and transparency of the government.
	2. Government instability risk	The risks affecting the project completion and investment which stem from a change in government, legislative bodies, other foreign policymakers or military control.
	3. Risk of inappropriate intervention by the government	The inappropriate government intervention, policies and management may tend to be inefficient and subject to rent-seeking pressures.
	4. Expropriation and nationalisation	The government of the host country takes over the project run by the private enterprise or consortium without giving reasonable compensation.
	5. Corruption risk	The local government officials demand bribes or unjust rewards along the project lifecycle as well as hidden connected transactions or other collateral activities.
	6. Public opposition risk	Prejudice from the public due to different local living standards, values, cultures, social systems, etc.
	7. Political violence	Acts of war, civil war, insurrection/civil disturbance, terrorism, sabotage, or landowner and/or indigenous people's disturbance in the host country.
	8. Bilateral relation deterioration risk	Risk resulted from the deterioration of the political and diplomatic relations between countries.
	9. Risk of local government approval procedure	Delay or refusal of project approval and permit by local government.
Social and cultural risk	10. Religion risk	The potential conflicts resulted from religious customs and different behaviour patterns.

	11. Ethnic conflict risk	The conflict is between two or more contending ethnic groups, but the source of the conflict may be political, social, economic or religious.
Construction and operation risk	12. Unfair bidding	The bidding process lacks transparency or is designed to favour certain parties.
	13. Payment risk	The local user or the government are able or willing to pay for the infrastructure goods and service.
	14. Tariff risk	Improper tariff setting or adjustment leading to overcharge or insufficient income.
	15. Cost overrun risk	Construction or operation cost overrun resulting from improper measurement, ill-planned schedules or low operation efficiency along the project cycle.
	16. Labour constraint risk	The constraints of labour, such as the portion requirement of the local employees, the eligibility of local employees and the overseas working approval.
	17. Labour strike risk	The work stoppage caused by the mass refusal to work expressed by employees
	18. Production resource constraint risk	The lack of material for the construction or production activity of the project.
	19. Engineering capacity risk	The breakdown of devices or the lack of engineering capacity and expertise.
	20. Geotechnical condition risk	Construction barriers related to the geological condition in the project construction phase.
	21. Technology standard risk	The incompatibility or conflict with the local construction and operation standards.
	22. Corporate governance risk	The difference in shareholder background and management culture; balance interests of various segment divisions in the Group.
	23. Risk of residual assets	The improper maintenance or showdown of the infrastructure asset after the transfer at the end of the concession period.

	24. Taxation dispute risk	The local government's inconsistent application of the tax regulation to the project, which leads to the dispute concerning project return, transaction or arrangement.
Legal risk	25. Contract risk	It consists of the conflict of negotiation, the absence of a crucial clause and contract defect, non-recognition of concession by the government, breach of payment contract by the local government and change of contract party, etc. The government does not offer exclusive rights or fails to honour its commitment and builds another competitive project. The courts of one state cannot exercise jurisdiction over another state (including for this purpose its state-owned enterprises), nor can they adjudicate a dispute involving that state or enforce a judgment order or award against that state. The government breaches the contract and fails to fulfil future obligations. Inconsistency of the local government's regulations and laws, which influence the lawful rights, process and even the investment returns of the stakeholders.
	26. Exclusivity	
	27. Sovereign immunity risk	
	28. Government default	
	29. Change of law	
Economy and market risk	30. Foreign currency exchange rate fluctuation	The fluctuation in the currency exchange rate often results in additional costs for the payment or settlement of problems.
	31. Inflation risk	Unanticipated inflation rate due to the immaturity and instability of the local economic and banking systems.
	32. Interest risk	Unanticipated local interest rate due to the immaturity of the local banking system as well as the interest volatility in the international financial market.
	33. Currency convertibility risk	A situation in which government regulations prevent the free conversion of the home currency into a foreign one.
	34. Market demand change	Demand change due to the social, economic and competitive environment, except the exclusive right.

Environmental and climate risk	35. Environmental risk	Issues which exert an impact on the construction and operation of the infrastructure project given the insufficient attention to environmental issues.
	36. Risk of carbon emission	The issues related to the complex and lengthy procedure for carbon credits registration or the change in emission regulations.
Other	37. Force majeure	The circumstances that are out of the control of both foreign and local partners, such as extreme weather conditions, natural hazards, epidemic diseases and embargo, etc.

6.3 Risk preference and allocation

Allocating and sharing risk is one of the fundamental components of the PPP arrangement (Jin and Doloi, 2008). It has been recognised as one of the most important factors for project success (Mouraviev and Kakabadse, 2017; Osei-Kyei and Chan, 2015a; Zhang et al., 2016). Given the uncomprehensive and biased understanding of the nature of PPP, it is mistakenly believed that ‘the adoption of the PPP model is to transfer as many risks as possible to the private sector from the public sector’. Meanwhile, it is often deemed by the private sector stakeholders that taking more risks entails more rewards. Many project defaults and failures emerge due to an unreasonable risk allocation and irrational expectations (Ke et al., 2008). The concept of fair risk allocation should not only be applied to the infrastructure projects in mature markets, but it is also critical to the infrastructure PPP projects in BRI, given that they are exposed to higher uncertainties and more complex risks. The practical experiences drawn from the risk allocation of the infrastructure PPP projects globally and the theories refined from these experiences are able to lay the analytical basis for the infrastructure PPP projects in the context of the BRI.

The impact of risk allocation on the overall project cost can be justified by three effects, including the production cost effect, the transactional cost effect, and the risk-bearing cost effect (Oudot, 2005). The productive effect highlights the incentives for the risk owner to control risk and reduce the production cost. The transactional cost consists of the *ex-ante* and *ex-post* costs, which can be reduced by clear risk allocation criteria and agreements. The risk-bearing cost occurs when the risk materialises and the risk premium for compensation will increase the overall cost. If the public sector transfers

excessive risk to the private sector, then the private sector will claim a higher privilege quotation, which includes the risk premium. It also challenges the arrangement of risk premium as the compensation for the private sector when there is a high probability that risks will end up being borne by the end customers (Ng and Loosemore, 2007). In addition, if the risks exceed the tolerance capacity of the private sector, the efficiency of the project implementation will be influenced. For example, the excess transfer of risk to the private sector might discourage the private bidders to participate in the fair bidding process and foster opportunism (Zitron, 2006).

Thus, the principles of the risk allocation scheme can be summarised as follows. First, the risk should be borne by the party who has the best control of the risks. The concept of control is based on the comprehensive understanding and assessment of the risks to be assumed and the capacity to manage the occurrence of the risks (Loosemore and Cheung, 2015; Osei-Kyei and Chan, 2015b; Shrestha et al., 2018). Second, the compatibility between risk tolerance and the corresponding payoff should be carefully assessed (Chang, 2015; Iossa and Martimort, 2014). Third, the risk preference of different stakeholders should be taken into account (Chou and Pramudawardhani, 2015; Ke et al., 2010). In addition to these principles, it is worth mentioning that the attributes, origins and impacts of the risks play vital roles in the risk allocation design. However, inconsistencies may often be observed between risk allocation and risk control capacity, payoff and preference (Thomas et al., 2003).

6.3.1 Differentiated perception towards the allocation of the principal risks

Conducting a content analysis can assist in classifying textual material and reducing it to more relevant and manageable bits of data (Weber, 1990). This method is often

adopted in order to determine the major facets of a set of data, by simply counting the occurrence frequency or how many times an activity occurs, or a topic is depicted (Fellows and Anita, 2003). In this section, the risk allocation plans identified in the literature were first marked down and then categorised into the identified risk type and factors. By means of this approach, Table 31 has summarised the currently preferred risk allocation from different pieces of literature. The risks which are controversial in terms of allocation preferences are identified as the basis for the risk allocation analysis of the BRI infrastructure PPP projects. What needs to be emphasised is that the comparative analysis based on the existing literature might not be flawless, given the differences regarding the risk definition and description of the preferred allocation approaches.

From Table 31, it is observed that the consistency of the risk allocation preference only applies to some of the identified risk factors, including the ‘Government instability’, ‘Expropriation and nationalisation’, ‘Government approval procedure’, ‘Public opposition’, ‘Cost overrun’, ‘Labour constraint’, ‘Labour strike’ and ‘Force majeure’. Contrastingly, the preferred allocation for most of the risk factors is still controversial and lacks consensus. There is still a lack of research on risk allocation with regard to certain risk factors, such as the ‘Political violence risk’, ‘Religion risk’, ‘Ethnic conflict risk’ and ‘Carbon emission risk’. This observation reinforces the significance to discuss the principle and practice of the reasonable risk allocation in the BRI infrastructure PPP provision.

Risk preferred to be allocated to the public sector

The factors agreed to be solely allocated to the public sector as depicted in Table 31

are: 'Government instability', 'Expropriation and nationalisation' and 'Government default'. The features represented by these three risk factors are that they solely result from the unilateral decision-making of the government. The twelve risk factors to be mostly allocated or shared in part with the private sector are: 'Government credit and transparency', 'Inappropriate intervention by the government', 'Corruption', 'Public opposition', 'Bilateral relation deterioration', 'Unfair bidding', 'Taxation dispute', 'Contractual risk', 'Exclusivity', 'Change of law', 'Currency convertibility' and 'Foreign currency exchange rate fluctuation'. From the perspective of the risk factor categorisation, most of these risk factors fall into the categories of political risk, legal risk and economy and market risk. By taking one step further to analyse the risk factors, they are reflective of the influence of inappropriate governance, conflicts of civil issues, and the piece-meal issue of the policy-making.

Notwithstanding that the origins of the risk factors are from the side of the public sector, the private sector is not excluded from bearing the risks de facto. It is often the case that the private sector fails to adequately assess the project condition or employ the legal or financial tool to guarantee the risk compensation *ex-ante*. Given that the public sector is more capable of controlling, mitigating, and buffering the political and specific economy and market risks, the public sector should proactively take more risk, rather than leaving the private sector exposed to risks beyond its capacity.

Risk preferred to be allocated to the private sector

It is also observed that there are five risk factors to be solely allocated to the private sector, including the 'Cost overrun', 'Labour constraint', 'Labour strike', 'Engineering capacity' and 'Cooperate governance'. The risks are to be mostly allocated to the

private sector and in part shared with the public sector consisting of ‘Payment’, ‘Tariff’, ‘Production resource constraint’, ‘Geotechnical condition’, ‘Residual assets’, ‘Inflation’, ‘Interest’, ‘Market demand change’ and ‘Environment’. These risk factors fall into the categories of economy and market risk and construction and operation risk. The origins of these risk factors are not directly generated from the misbehaviour of the public sector and are out of the responsibility and beyond the control capacity of the public sector. Instead, they are more related to the insufficiency of the due diligence of the local market condition and the inadequate assessment of the project construction and operation criteria *ex-ante*.

Table 31 Comparison of the preferences for risk allocation based on the existing body of literature

Risk Category	Risk Factor	Li et al. (2005)	Wang and Tiong (2007)	Ng and Loosemore (2007)	Lam et al. (2007)	Ke et al. (2010)	Chou and Pramuda w-ardhani (2015)	Consistency
Political risk	1. Government credit and transparency risk	-	-	-	-	Public	Share	X
	2. Government instability risk	Public	-	-	Public	Public	Public	√
	3. Risk of inappropriate intervention by the government	-	Public	Public	-	Public	Share	X
	4. Expropriation and nationalisation	Public	Public	Private		Public	Public	√
	5. Corruption risk	-	-	-	Public	Public	Share	X
	6. Public opposition risk	Public	-	-	-	Share	Share	X
	7. Political violence	-	-	-	-	-	-	N.A.
	8. Bilateral relation deterioration risk	-	-	-	-	-	Share	N.A.
	9. Risk of local government approval procedure	-	-	Share	-	Public	Share	X
Social and cultural risk	10. Religious risk	-	-	-	-	-	-	N.A.
	11. Ethnic conflict risk	-	-	-	-	--		N.A.
Construction and operation risk	12. Unfair bidding	-	-	--		Public	Share	X
	13. Payment risk	Private	Private	-	-	Share	-	X
	14. Tariff risk	Private	Private	Private	-	Share	-	X
	15. Cost overrun risk	Private	-	Private	-	Private	Private	√
	16. Labour constraint risk	-	Private	-	Private	Private	Private	√
	17. Labour strike risk	-	Private	-	Private	Private	Private	√

	18. Production resource constraint risk	Private	Public	-	Private	Private	Private	X
	19. Engineering capacity risk	Private	Private	Private	-	-	Private	√
	20. Geotechnical condition risk	Private	Private	-	-	Private	Share	X
	21. Technology standard risk	Private	Private	-	-	Private	Private	√
	22. Cooperate governance risk	Private	Private	-	-	Private	Private	√
	23. Risk of residual assets	Private	-	Public	-	Private	Share	X
	24. Taxation dispute risk	-	-	-	-	Public	Share	X
Legal risk	25. Contractual risk	-	Share	-	Public	Share	Share	X
	26. Exclusivity	-	Share	-	-	Public	Share	X
	27. Sovereign immunity risk	-	-	-	-	Public	-	N.A.
	28. Government default	-	Public	Public	-	Public	-	√
	29. Change of law	Share	Share	Private	Share	Public	Share	X
Economy and market risk	30. Foreign currency exchange rate fluctuation	-	Public	-	-	Share	Share	X
	31. Inflation risk	Private	-	Share	-	Share	Share	X
	32. Interest risk	Private	Share	-	-	Share	Share	X
	33. Currency convertibility risk	-	Public	-	-	Share	Share	X
	34. Risk of market demand change		Private	Private		Share	Share	X
Environmental and climate risk	35. Environmental risk	Private	-	Private	-	Share	Share	X
	36. Risk of carbon emission	-	-	-	-	-		N.A.
Other	37. Force majeure	Share	-	Share	-	Share	Share	√

In addition to the allocation preferences of the public and private sectors regarding the specific risk factors, the key demand of the major stakeholders in the BRI infrastructure PPP projects also underpins the risk allocation scheme.

From the perspective of the public sector (mainly referring to the government authority of the host countries) along the Belt and Road, the key demand stipulates that (1) The project should be consistent with the states' political interest; (2) More positive value for money performance can be achieved compared with the traditional public sector procurement and operation route, known as the public sector comparator; (3) The project ownership can be transferred from the private investor back to the public sector when the investment return for the private capital is deemed reasonably sufficient; (4) The operation of the infrastructure serves the purpose of public service and goods; (5) The project can achieve financial closure, construction completion and successful operation without significant public input from the perspectives of capital, management or guarantee; (6) The government can grant the project to other private parties or intervene in project management when the original private stakeholders are unable to enforce the contract terms.

The key demand of the sponsor and equity investor can be assessed on the basis of the following aspects: (1) The market entrance permission or the increase of the market share; (2) The legality of the public procurement process; (3) The investment return from various channels, for example, the dividend of the share, the project payment from construction, operation, and product supply; (4) The risk transfer to other stakeholders in the PPP framework, such as the insurance company; (5) The protection of the ownership; (6) Achieving the benefit of off-balance sheet project financing.

The key demands of the lenders are more related to the bankability and legality of the project, including (1) The legality of the whole transaction; (2) Obtaining the fixed and stable debt repayment and interest from the SPV; (3) The right to step in and manage the infrastructure asset when the project triggers the upper limit of risk criteria; (4) Shareholders' dividend rights should be arranged after the outstanding loan is repaid or suspended when there is a default event; (5) Before the completion of the construction, the project revenue can only be used for debt repayment rather than invested in the project share; (6) The balanced arrangement of the capital structure; (7) The excessive risk should be covered by the insurance and even reinsurance company; (8) The overhaul fund should be established if it is necessary for the project in the long term.

The key demand of the contractor/operator/supplier focuses on the aspects of project-level performance, including (1) The project engineering feasibility; (2) The reliability of payment from the government or users; (3) The reasonable shareholding structure design; (4) The reasonable position in the partnership; (5) Clear technology standards for construction, operation and supply; (6) The guarantee from the sponsor and bank to protect the right and cover the cost in case of project failure.

6.3.2 Principles of risk allocation

Due to the idiosyncratic nature of the risks related to the diversity and complexity of the socio-economic condition, legal systems, government agency settings, institutional environment and project features in the countries in the context of the BRI, there is no unanimous risk allocation scheme applicable to the BRI infrastructure PPP project as a whole. Nonetheless, the differentiated risk allocation schemes often unanimously stem

from asymmetries in bargaining power. The bargaining power is determined by diverse factors, such as the political status, market competition, investment and engineering capacity, etc. Aside from assessing the preference and key demand of the stakeholders, the current principles pertaining to risk allocation are critical as well.

One of the principles fitting this specific context is the principle of imputation, which has been commonly used as the dispute-settlement method within the scope of the law. Its analytical angle can provide implications for the allocation of risk in theory and in practice. By following the principle of imputation, the origin of the risks and the attribution of the corresponding responsibilities are unfolded in this section. However, it should be noted that given the features of the BRI PPP itself, some PPP risk factors are not adequately defined yet in terms of the responsibility for the cause of risk.

Built upon the summary of the preferred risk allocation, it is found that the political risk is more, mostly or even solely preferred to be allocated to the public sector. The origins of these risk factors can provide a justified rationale for the application of the principle of imputation. For example, the corruption risk stems from the misbehaviour of public officials given that the lack of transparency or weak public institutions should be borne by the public sector. On the other hand, the risks recognised to be allocated more, mostly or solely to the private sectors fall under the category of construction and operation risks given that the private sector is predominantly involved in the execution of the construction and operation task. These risks constitute the adverse outcome of the insufficient capacity of the private sector. For example, the risk of technology standards resulted from the incompatibility of the technologies employed by the private sector with the requirement for the latter to be allocated to the private sector.

In addition, it is commonly agreed that the private sector should bear the cost overrun risk. However, the imputation of this risk still demonstrates different implications. The reasons leading to the cost overrun are diverse, such as the low efficiency of the public involvement, the incapability of the contractor or operator, the non-facilitating institutional environment, and other market-level drivers. The commonly preferred allocation plan positions the private sector as a comparatively disadvantaged party, given that the public sector could also be the party that causes the risk. In this case, the equilibrium of risk allocation can also be achieved by risk compensation in the form of a risk premium.

The controversial risk allocation is observed relatively often in the category of economy and market risk due to the fact the imputation is difficult to fairly assess in a context where multiple variables influence the market dynamically. Taking the fluctuation of the foreign exchange rate risk as an example, the volatility is caused not only by the macro-level fiscal policy of the central government or central banks but also generated from the international financial market. Therefore, its attribution is hard to define. Both public and private sectors are supposed to share it.

Another risk allocation principle is that the risks should be allocated to the party (public or private) who is better able to mitigate or manage them (Marques and Berg, 2011). This principle has been widely adopted as industry practice. It is defined that in the PPP, the private party bears significant risk and management responsibility and that the remuneration is linked to performance (World Bank, 2017). This principle consists of three types of considerations. First and foremost, the party who bears the risk should be the one that is best able to control the likelihood of risk occurrence. Second, the party

who bears the risk should be the one that is best able to control the impact of the risk on the project outcomes by assessing and anticipating a risk well and responding to it. Third, the party who bears the risk should be the one that can absorb the risk at the lowest cost if the likelihood and impact of risk cannot be controlled.

However, applying either of these principles alone cannot guarantee reasonable and effective risk allocation between the private and public stakeholders. The initial purpose of the application of the PPP to the provision of the BRI infrastructure is to leverage the private capital and expertise, thus compensating the deficit of public finance and managerial capacity. Thus, the public sector inclines to transfer most of the risks to the private sector, while the capacity limit of the private sector is overlooked.

For example, the rigid risk allocation is one of the driving factors leading to the failure of the A2 Poland express highway project. When the China Overseas Engineering Group Co., Ltd. consortium bid for the A2 project, the prices of raw materials, such as steel and asphalt, were among the lowest because the European debt crisis and the local economy was in a sluggish state. Following the recovery of the Polish economy by 2011, the prices of raw materials rebounded sharply. The price of sand rose from 8 PLN/ton to 20 PLN/ton, and the rental price for excavation equipment rose more than five times, which significantly increased the construction cost and exceeded the risk control capacity of the contracting consortium. However, the Public Procurement Law of Poland prohibits the adjustment of the contract bidding price, given that the Polish public authority deemed that the private consortium was able to manage the financial loss. In addition, during the contract negotiation phase, the contract defects were neglected. The critical terms regarding the claim for the adjustment of payment were

deleted from the FIDIC contract. The contracting consortium was thus confronted with excessive risks. Eventually, the unfair risk transfer turned the concession into a fixed price contract, and the rigidity inevitably eroded the possibility of project success and the incentive to encourage private sector involvement.

After the occurrence of risks, the project cost, progress and quality are likely to be affected, with the project even being suspended or terminated when the impact of the risks extends beyond the mitigating capacity of the stakeholders. Aside from the capacity to mitigate the impact of the risks, the incentive to proactively control the impact of the risk is another important indicator of risk allocation. For the 37 principal risks of the BRI infrastructure PPP provision listed above, the party who eventually and most frequently suffers from the impact of the risks is the private sector. Thus, the private sector is more motivated to create a fair risk allocation scheme. The dilemma for the PPP is that there is an insufficient incentive for the public authority to establish a fair risk allocation scheme with the private sector, in which the risks that neither party can control, such as force majeure, are not excluded.

6.3.3 The actual risk allocation scheme based on a real BRI infrastructure PPP project

Following the analysis of the risk preference and allocation principles, this section further explores the risk identification and allocation approach based on the specific and existing BRI infrastructure PPP case. Given that the majority of the BRI infrastructure PPP projects are in the energy and transport sectors, this section selects a BRI energy PPP project as the representative case for the following analysis.

This BRI PPP project is one of the first batches of energy projects in one of the key knot countries along the Belt and Road; hereinafter, the project will refer to Project F. It is sponsored by a Chinese energy SOE and the overseas subsidiary holding company of the SOE sponsor is the direct equity investor of the SPV project company. This parent SOE has vast experience in managing complex energy projects from construction to operation in the emerging markets. Currently, Project F has completed its construction phase and entered the operation phase. A total of 20 risk factors are identified for this specific case and consistent with the risk factors in the checklist.

In the risk matrix adopted by the energy BRI infrastructure PPP project, the risks are assessed on the basis of the aspects including probability, impact, impact term and risk level. In order to select the principal risks that have the most significant impact on the project, this study adopted an index calculation approach to analyse the weight of each risk factor based on the score probability, impact, risk significance level, risk impact period and insurability. In the calculation of the average weight of the risk factor, the risk probability is defined from 1 to 5. 5 stands for almost certain, 4 stands for highly probable, 3 stands for probable, 2 stands for lowly probable and 1 stands for almost impossible. The impact level is defined on a scale from 1 to 5. 5 stands for disastrous impact, 4 stands for severe impact, 3 stands for medium impact, 2 stands for minor impact and 1 stands for slight impact.

It is shown in Figure 16 that the risks with the most significant average weight of this project are the risk of delay in payment collection, taxation risk, tariff risk and project agreement risk. Conversely, the risks with a less weight are the environmental risk and the risk of carbon credit regulation. The government instability and terrorism attack,

risk of local government approval procedure and government default risk are albeit more impactful, the likelihood of their occurrence are much lower than the other risks given the tight relationship between China and the host country and its relatively stable administration at present. Nonetheless, it is important to recognise that most of the emerging economies along the Belt and Road are confronted with a relatively more unstable bilateral, political, military and institutional environment, therefore the assessment of political risks is indispensable.

The risks of political violence, terrorism and the conflicts between religious forces are shared between the SPV and the government of the host country and the uncertainty is perpetuated via the purchase of political risk insurance. Meanwhile, the government of the host country jointly bears the risk of outages/shutdown with the SPV rather than the SPV constituting the sole bearer of risk. There are two major driving factors behind the emergence of the outages/shutdown risk. The first factor represents the faulty and ageing of the transmission lines and the National Power Control Centre System. The second factor is attributed to the defect of the planning and coordination of the contractor/operator and the government authority in the energy sector. By following the principle of imputation, the government of the host country shares the risk with the SPV. This risk allocation scheme is also reflective of the principle that the risk should be borne by the party who can better manage the risk. In this case, the local government bears the risks given that the local government authority in the energy sector is more able to mitigate this risk by improving the quality of the grid and the performance of the coordination.

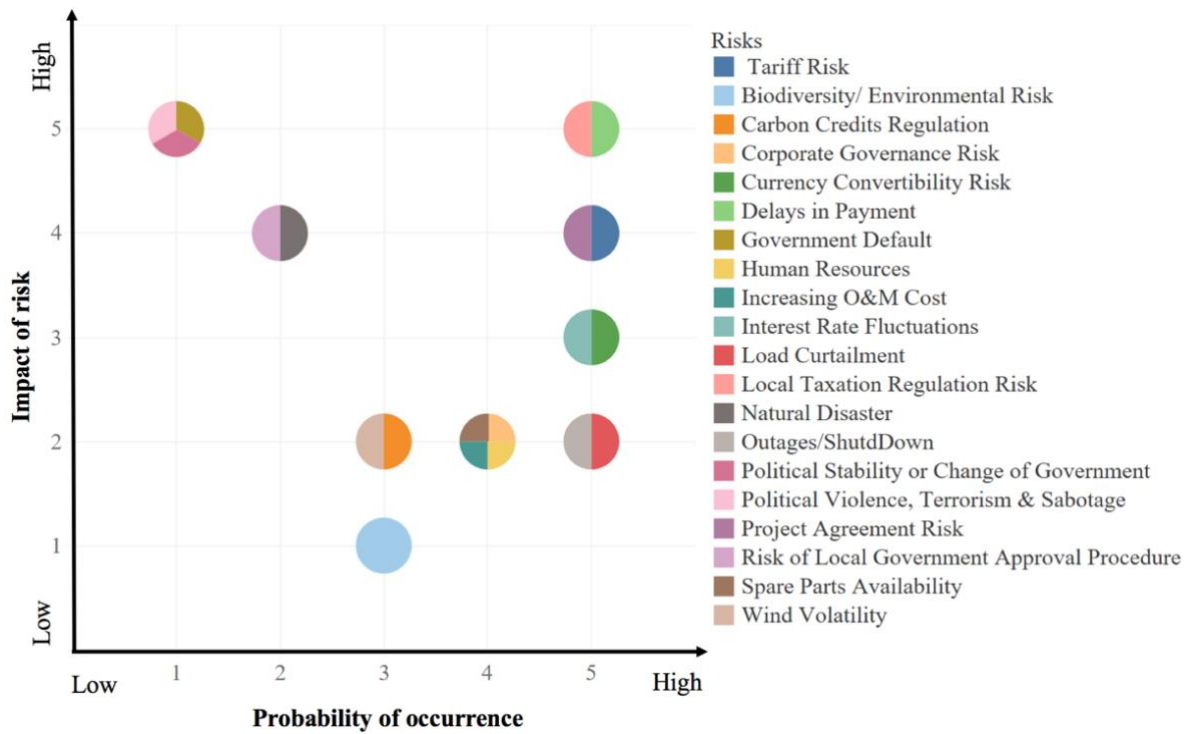


Figure 16 The risk matrix of the BRI PPP energy case study footnote to indicate the confidential sources

The rest of the risks, categorised into construction and operation risks, are mostly allocated to the SPV and the contractor, given that the origins of these risks are firmly related to the performance of these two stakeholders. The force majeure risk in this matrix is allocated to the SPV, which seems to increase the risk management pressure of the private sector. The transfer of the project risk to the insurance company is achieved via the purchase of natural hazard insurance. It is also observed that most of the risks are transferred to the SPV or to third entities through the SPV. In such a general PPP contract, the risks are eventually concentrated in the SPV and isolated from the other key stakeholders by the limited recourse mechanism.

Table 32 Risk matrix of the representative BRI PPP energy project

Category	Risks	Driving Factor	Risk Owner	Insurable
Political	Political stability or change of government	1) Opposing party activity 2) General elections 3) Diplomatic relations 4) Military coup	The government of the host country	Yes
Political	Political violence, terrorism and sabotage	1) Geopolitical armed attack 2) Interferences from tribes, communities and other anti-foreign forces 3) Attacks and hijacks by terrorists and extremists 4) Conflicts between religious forces	SPV, government of the host country	Yes
Political	Risk of local government approval procedure	1) Obsolete approval process and technologies being used 2) Deficiencies and loopholes in the system	The government of the host country	No
Construction and operation	Load curtailment	1) Excess generation of energy (strong fluctuation over time) in combination with insufficient network capacities (transmission/distribution congestion) 2) Insufficient regional demand (regional grid oversupply) 3) Correspondence issues	SPV	No
Construction and operation	Outages/shut down	1) Faulty and old transmission lines 2) Faults in the National Power Control Centre System	SPV, the government of the host country	No
Construction and operation	Increasing construction and operation cost	1) The cost forecast and repair reserves are not adequate 2) Shifting to outsourced instead of in-house models 3) Damages and repair cost of machinery and equipment	SPV	No

Construction and operation	Corporate governance risk	1) The difference in shareholder background and management culture 2) Unbalanced interests of various segment divisions in the group	SPV	No
Construction and operation	Human resources	1) The absence of an on-the-job skills development program, international training and workshops, professional certification roadmap etc. 2) Safety training and workshops	SPV	No
Construction and operation	Wind volatility	1) Low wind speeds 2) Very high wind speed	SPV	Covered as part of Cost-Plus Tariff Regime
Construction and operation	Delays in payment collection	1) Circular debt 2) Delays in the disbursement of subsidies 3) Delays in payment collection 4) Funds availability/shortage	SPV	No
Construction and operation	Local taxation regulation risk	1) Change in taxation regulations 2) Non-compliance of taxation regulations	The government of the host country, SPV	
Construction and operation	Spare parts availability risk	1) Unavailability of the parts in local market 2) Lengthy and tedious import		
Legal	Government default	1) Government's failure to make the payment within a 30-day timeframe for monthly and bonus energy generation	The government of the host country	No
Legal	Project agreement risk	1) Contrasting statements for the construction period	SPV	Partial
Construction and operation	Tariff risk	1) Government approvals for project timelines and milestones 2) Availability of grid	SPV	No

		3) Ambiguity in tariff determination concerning insurance policies		
Economy and market	Interest rate fluctuations	1) The variation in the rate will result in profit/loss on account of the interest rate variation	SPV, lenders	No
Economy and market	Currency convertibility risk	1) Covered through indexation on a quarterly basis but there is exposure on a monthly basis	SPV	No
Environment	Carbon credits regulation	1) Complex and lengthy procedure for carbon credits registration	SPV, government of the host country	No
Environment	Biodiversity/environmental (bird migration)	1) Bird migration to nearby lake causing bird fatalities 2) Noise effects 3) Shadow flickers	SPV	No
Force majeure	Natural disasters	1) Earthquakes, cyclones, lightning, heavy rain, sandstorms	SPV	Yes

6.4 The risk management framework of BRI infrastructure PPP projects

Overall, the application of PPP to the BRI infrastructure is based on the general principle that the public sector seeks to shift risk from the public sector to the private stakeholder and offer a profit incentive in return. In order to achieve the success of infrastructure provision in the long term, the differing and conflicting needs of these parties must be satisfied in the risk allocation process. The risk transfer should create efficiency incentives for each stakeholder who bears the risks and subsequent costs of inefficiency (Medda, 2007). Combined with the previous findings and discussions about the risk allocation in theory and practice, a three-tier risk management framework is proposed in this study (Fig. 17).

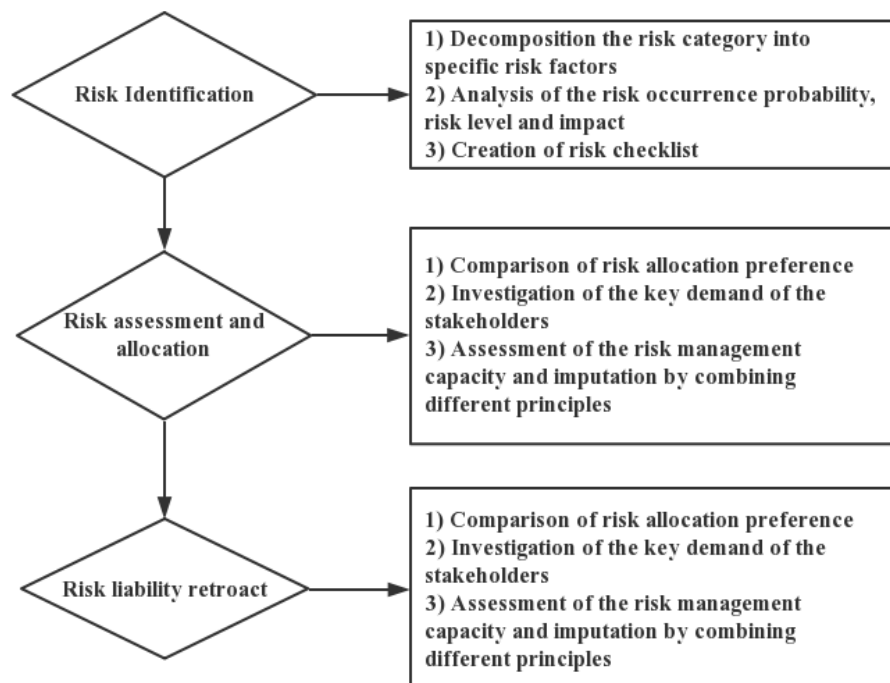


Figure 17 The three-tier risk management framework

The first tier is the risk identification by breaking down the risk category into specific risk factors, assessing the risk occurrence probability, risk level and impact on the project and creating the risk checklist. What is worth considering is the risk decomposition process in the identification process. For example, the payment risk falling under the category of construction and operation risks of a power plant project can be divided into the risks of price of the electricity tariff, demand, and the recovery of receivables from the government or user, etc. In this case, the on-grid power tariff and electricity purchase agreement are negotiated between the sponsor, operator and the government authority in the energy sector. In addition, the payment is processed in the form of user payment, which is in part subsidised by the public sector. Thus, the risk of the price of the tariff and recovery of the receivables should be partially attributed to the public authority rather than solely to the private sector for the most part of the current allocation scheme. The corresponding risk management measure allows certain flexibility for the renegotiation regarding the tariff price or employing the purchase guarantee agreement to ensure the sale of electricity at a preferred price for the sponsor, investor, and contractor/operator/supplier.

The second tier is constituted by the *ex-ante* risk, assessment, allocation design and contract negotiation. After the identification of the significant risks of the BRI infrastructure PPP project, the allocation should combine the considerations of the key demand of each stakeholder and principle. Thus, the demand of each stakeholder, stakeholders' risk management capacity and the origins of the specific risk factors should be assessed. The purpose of this multi-aspect assessment approach aims to propose a risk allocation framework, which can align the interests of specific stakeholders, rather than generally discuss the allocation between the public and private

sector based on the preference of these two parties. In addition, if one party is deemed to take more risk, the opportunity to charge the appropriate premium for taking the risk should be endorsed, which can also be regarded as the compensation or incentive.

The third tier of the risk management framework focuses on the adaptation of the cross-cycle liability retroactive approach. The risks are internally connected, the occurrence of one risk is likely to trigger the emergence of other risks along the life-cycle of the BRI PPP projects. Due to the close relevance of the different phases of the PPP project, the risks occurring in the later stages are often caused by the events in the previous stages. For example, the high maintenance costs incurred in the operation phase may represent the adverse outcome of the defects in the previous design or construction phase. Hence, it demonstrates the necessity to adopt the cross-cycle liability retroactive approach for risk management. If the operation cost overrun is derived from the defect of the design or construction, then the contractor should be the one to bear this risk correspondingly. Otherwise, the operator will be confronted with a disadvantaged position caused by an unfair risk allocation and the incentive for the operator will be negatively influenced. In addition, a certain level of involvement of the operator in the design and construction work should be allowed in order to further clarify the operational requirements and responsibilities.

6.5 Synthesis of results

The objective of this chapter aims to propose a feasible and effective risk management framework for the BRI infrastructure PPP projects. Such risk management framework, including identification and allocation, represents the core focus of contractual ability

and the enforceability of the PPP contracts noted in the previous chapters. In addition, the idiosyncratic features of the specific infrastructure project, stakeholder, jurisdiction, legal system and even the socio-economic condition are also incorporated into this risk management framework.

The principal risk factors are identified and categorised into major groups, such as political risk, economy and market risk, construction and operation risk, legal risk, environmental risk and force majeure risk, based on the failed BRI infrastructure PPP cases and actual procedures adopted to assess the BRI PPP risk profile. In the failed cases, the risks are taken into account in a flawed way, affecting the contractual ability and contract enforceability of PPP. In complementary, the principal risk factors identified from the actual risk procedures are the ones most frequently assessed in the due diligence phase, demonstrating their importance to the project feasibility. This study is also the first scholarly attempt to comprehensively identify and classify the specific risks that are critical BRI infrastructure PPP projects.

Following the risk identification and the creation of a risk factor checklist, the principles of risk allocation are scrutinised and compared with the risk allocation practice of BRI infrastructure PPP to explore their applicability in the context of the BRI. Currently, the most common principle for risk allocation in the PPP infrastructure development is that the risk should be borne by the party that can better manage the risks. However, some conflicts are derived from the fact that this allocation principle is not consistent with the imputation of the risks. For example, the payment risk and tariff risk are usually generated from the default of the government and piece-meal pricing policy of the public service, but the private sector is deemed to be the party who bears these two risks

in most studies without being compensated sufficiently for taking the risks. This is regarded as one of the negative factors discouraging the involvement of the private sector. In addition, the correlation between risk and return should be assessed more critically as a criterion for determining risk allocation so as to avoid the misassumption that there is a more significant chance to obtain more rewards by taking excessive risk beyond one's capacity. Therefore, it should be recognised that a single risk-sharing principle is not sufficient to effectively develop a risk-sharing strategy. In practice, it is important to adopt multiple principles for constructing the risk allocation scheme co-constituting of fairness and effectiveness, such as the principle of imputation, the alignment of the interests of specific stakeholders and the best risk management capacity.

To examine the application of the risk identification and allocation scheme in the context of the BRI infrastructure PPP provision, a risk matrix of an existing BRI energy project was constructed. The analysis illustrates that the actual risk allocation is mostly between the SPV and the government authorities, rather than the general allocation between the public and private sector without specific assignment. By allocating risks to the SPV in the PPP, the risks are isolated from the sponsors, primarily the parent company of the SPV via the PPP contract structure design. In addition, given that the BRI infrastructure PPP projects are cross-border, the offshore and onshore contract structure are often adopted and structured in the form of umbrella for the purpose of risk isolation. This finding also demonstrates that future research at the project level should further focus on the role of SPV in risk sharing and isolation, and how it can more effectively incentivise the private sector to participate in BRI infrastructure PPP projects.

Built upon these findings, a three-tier risk management framework is constructed to assist the risk identification, assessment and allocation of the BRI infrastructure PPP projects. The core of this risk framework lies in the decomposition of risk into the specific risk factors, risk factor allocation according to a multi-perspective assessment, as well as the cross-cycle liability retroactive management approach along the life-cycle of the BRI infrastructure PPP projects.

CHAPTER SEVEN: CONCLUSION

7.1 Statement of objectives

This thesis investigates the application of the PPP to infrastructure development and investment in the context of the BRI through the analysis of four core aspects: institutional governance, private stakeholder relationship, capital structure design and risk management. These four perspectives correspond to the new institutional economics (NIE) framework from the macro-domain to the micro-domain, and each one of them has direct impacts on the contractual ability and contract enforceability of the BRI infrastructure PPP provision. In addition, the contract theory, game theory, and principal-agent theory are embedded in the NIE framework to assist the in-depth analysis of the four core perspectives.

This study is also the first and most in-depth doctorate research in both Chinese and English literature that systematically analyse how the utility of the PPP model can be improved to meet the demand of infrastructure provision in the context of the BRI. Its contribution is three-fold. Firstly, it constructs a contextualised and integrated theoretical framework to extend the applicability and explaining capacity of new institutional economics, contract and principal-agent theories for the infrastructure provision PPP in the context of the BRI. Secondly, it provides an instructive, theoretical and empirical analysis as well as solutions to improve the contractual ability and contract enforceability of the BRI infrastructure PPP from the perspective of benefit and risk-sharing. Thirdly, the thesis provides an in-depth understanding of the infrastructure provision PPP model led by the Chinese stakeholders in the BRI and how it functions as a trigger for motivating international public and private sector

stakeholders to develop, invest in and operate infrastructure in a more sustainable and long-term manner, especially in emerging markets.

This concluding chapter firstly summarises the principal findings of each of the four substantive analytical chapters and their respective contributions to the practice and literature. Then, this chapter illustrates the broader theoretical implications for understanding the BRI infrastructure PPP from the perspective of contract and partnership. In addition, this chapter also provides practical implications for the public and private sector stakeholders in the establishment of a long-term partnership in infrastructure development, investment, and governance in the context of the BRI. Finally, this chapter suggests potential directions for future research.

7.2 Principal findings and contributions to literature

The thesis is structured as four substantive chapters in order to achieve an in-depth understanding of infrastructure development in the form of PPP in emerging markets, especially in the context of the BRI. The thesis employed both qualitative and quantitative approaches to investigate the critical aspects of the PPP in infrastructure investment. This section presents the principal findings and contributions to literature based on the four core analytical chapters under the four main research aims.

Aim 1. To examine how the public sector can provide a facilitating institutional environment for the BRI infrastructure provision in the form of PPP

The role of the government in facilitating PPP projects cannot be overstated. For example, Aziz (2007) argues that the public sector needs to establish a broad and comprehensive PPP legal framework, to assess the value for money, create a PPP unit for policy development, maintain transparency in the selection process, standardise the

procedures and contracts, and to use performance specifications. In this study, the first research question aims to explore a path guiding the public sector to provide a facilitating institutional environment for the BRI infrastructure PPP provision. Starting from the systematic analysis of the institutions, policies, and projects from the Chinese domestic angle, Chapter Three demonstrates that the changes in the institution and socio-economic norms lead to the development of infrastructure provision governance in the form of PPP. This process can be classed into four major phases: exploratory phase (pre-2002), rapid development phase (2003~2008), adjustment period (2009~2013), and thrive on the new norm (2014~today). These four phases demonstrate distinct features based on core evidence along the axes of socio-economic development, policy, and project in the Chinese domestic market. Subsequently, Chapter Three assessed the governance and development status of the current BRI infrastructure provision in the consistent paradigm. The results show that the current status of BRI infrastructure provision shares significant commonalities with the exploratory phase of governance in the Chinese domestic scenario. Hence, the current BRI infrastructure development can be defined as the initial phase.

In light of the domestic experiences, the infrastructure provision in the BRI countries indicates the necessity of a more effective and efficient institutional environment to motivate the involvement of the private sector by enhancing the vertical and horizontal coordination dually across government departments and explicitly clarifying the boundary of the governance. The adaptation of PPP in both domestic and BRI contexts needs to cope with the challenges of prevailing socio-economic circumstances, ad-hoc institution arrangements and self-reinforcing approaches, as well as the international influences. In both arenas, it is a process of learning-by-doing and thinking beyond the

canonical path-dependence. Thus, the administrative institutions' development that takes place is a function of a variety of context-specific variables. It is crucial to consider the diverse contexts of the countries under the BRI for the governance as the institutions have a historical, geographical and functional logic (Clark and Wójcik, 2007), and institutions are regarded as the social interactions between economic agents that develop upon rules and regulations in contingent ways (Bathelt and Glückler, 2014). In addition, since the private investment in BRI infrastructure has the potential to reshape cities and their development (O'Neill, 2017), the enhancement of the institutional capacity should incorporate the concepts of financial sustainability and commercial viability of infrastructure so as to motivate the involvement of qualified private investment. By illustrating the transition of institutional framework and governance of infrastructure provision in both the domestic and BRI context, this chapter also contributes to the contextualised application and extended explaining capacity of the NIE specific for the PPP in infrastructure provision.

Aim 2. To explore how private sector stakeholders should collaborate to deliver the BRI infrastructure

The contract is the core to governing the relationships among different stakeholders involved in the activities of investment, development and operation (Clark and Monk, 2014). Due to the complex politics of infrastructure (O'Neill, 2013), the contractual ability and contractual enforceability rely on the coordination of interests of various stakeholders. Concerted emphasis has been placed on the means by which the private and public sectors can forge partnerships to share risk and benefit (Bing et al., 2005; Brinkerhoff and Brinkerhoff, 2011; De Schepper et al., 2014; Grimsey and Lewis, 2002,

2002; Hodge and Greve, 2017). To date, however, the relationship among the private stakeholders in the PPP is yet to be thoroughly discussed.

The importance of coordination among the private sector for the performance of infrastructure development and operation is also equally important. However, it is observed that the private sector players are reluctant to participate in the BRI infrastructure provision due to the project's low contractual ability and low contractual enforceability. To fill the research gap in the private stakeholder coordination and motivate the involvement of the private stakeholders, Chapter Four discusses the relationships of the private stakeholders from the perspective of the cooperative game in the dimensions of payoff expectation and risk preference to explore the strategies enabling the private sector stakeholders to coordinate and deliver the BRI infrastructure collectively. First of all, Chapter Four explores the identities of private sector stakeholders and conceptualises the stakeholder framework in BRI infrastructure PPP project development. This framework lays the boundaries of the partnerships, clarifies the key stakeholders and highlights the knot function of the SPVs. Then, the analysis of this chapter moves to the relationships among the key private stakeholders. The challenge of the analysis is that the stakeholder relationship is difficult to measure by visible or easily identifiable indicators and needs to be analytically extracted from social practice. Therefore, in-depth interviews and close dialogue (Clark, 1998) with key individuals in financial institutions, contractors and operators were conducted to investigate the dynamics among private stakeholders.

The relational embeddedness, extended duration, self-enforcing behaviour and the dominance of SOEs have been observed in the PPP of BRI infrastructure provision.

The contractual enforceability of the BRI PPP stems from the reduction of the transaction cost. In terms of the design of the cooperative strategies, the approaches to achieve the maximisation of the collective payoff and fair allocation of the risks can be regarded as the measures of Pareto improvement. In addition, considering that the formal PPP contract is inevitably incomplete for the BRI infrastructure PPP provision, the dominance of SOE sponsors and state capital can be regarded as a measure to attenuate the cost and increase the management capacity for risk and contingencies internally through the informal contract.

The informal contract is a reflection of relational governance mechanisms, complementary to the formal contract. The informal contract is based upon social processes and internally linked ownership can safeguard, albeit informally, against exchange hazards and facilitate the enforcement of obligations as well as provide flexibility and dynamic adjustment. Hence, from the angle of relational governance, the internal and inclusive relationships between the SOEs and the other state-backed parties in the BRI infrastructure PPP are reinforced because of the shared state background and residual rights from the major ownership. The relationally integrated PPP can help to generate more successful joint risk management and a long-term positive payoff.

Aim 3. To understand how the capital structure should be designed so as to align the objectives and interests of critical stakeholders in the PPP

The most important pillar in the application of PPP to infrastructure investment is to widen and diversify the capital sources and reduce the burden of the public sector by leveraging the resources and expertise of various investors. Hence, the financing

process of the PPP can also be regarded as the collaboration between the principal and the agent. Within the principal-agent theory, the extended chain of principal-agent relationship is problematic, in particular, the introduction of new participants and incentives at each link of the chain changes the original objective of the asset owners. It is often the case that the ultimate investment decisions made by the agent maximised the utility of the asset managers but not the principal (Sheffer and Levitt, 2010). This broken agency phenomenon stems from a misalignment of interests due to information asymmetry (Bentz et al., 2001) and inappropriate distribution of risks and expected returns among the principals and agents. In infrastructure investment, the broken agency issue results in some contradictions of risks and rewards between the short-term and long-term parties, leading to suboptimal outcomes (Clark and Monk, 2017). It is thus necessary to address the conflicts and align the key parties' interests in the BRI infrastructure PPP investment, especially in the capital structure design process.

Through case study and questionnaire analysis, Part I of Chapter Five firstly classifies the asset classes, profiles the sponsors, summarises the typical capital structure, and identifies the major determinants of the BRI infrastructure PPP capital structure design. In terms of the asset categorisation, there are two types of BRI infrastructure PPP projects: (1) fixed asset investment and operation-oriented asset, and (2) engineering expertise and equipment input-oriented asset. For these projects with a high fixed asset investment and operation demand, the sponsors with a substantial capital investment capacity and operational expertise are more compatible with the need. For these projects with high engineering expertise and equipment input demand, the experienced contractors and suppliers of specialised equipment are more compatible. At present, these two types of assets are delivered in different forms of contracts. The fixed-asset

investment and the operation-oriented asset is often provided in the DBFOT or BOT contract, which entails a higher capital input demand in the form of equity. The engineering expertise and equipment input-oriented asset is usually delivered in the EPC with OM contract. In addition, the composition of sponsors reflects the combination of equity financing ability, construction engineering capacity, operation expertise, and equipment manufacturing ability. The compatibility between asset class features and sponsors' capacity is proposed as the first dimension for the design of the capital structure.

The determinants for debt/equity financing underpin the second dimension of the design of the capital structure. The top five determinant factors are in relation to project profitability, stakeholder interest, debt repayment capacity, management strategy, and macroeconomic condition. Financial institutions tend to be more sensitive to determinants such as the cost of debt and equity capital, ownership right, and the tax shield effect of debt in comparison to corporate investors.

Financing behaviour is the third dimension to consider in terms of capital structure design. The usage frequency of different financing methods shows that the selection of the financing methods should incorporate the project features at each phase. In the initial construction phase, the concessionary loan from the policy banks not only functions as the low-interest debt capital but also serves the enhancement of credit in order to obtain further investment. On the other hand, more liquidised financing methods, such as mezzanine finance can complement the short-term capital demand. In the operational phase, the frequency of using a long-term loan from policy banks and commercial banks decreases, given that the project is potentially able to generate cash

flow and demand less capital after the completion of construction. Bond issuance becomes a more common refinancing method in the operational phase than in the initial construction phase because the bond issuance is able to support the expansion of the project and improve the capital liquidity of infrastructure assets by supplementing operating cash flow.

Built upon the survey and case study analysis in Part I of Chapter Five, Part II provides the theoretical analysis to support the decision-making process for the equity structure and debt level of BRI infrastructure PPP projects. In the decision-making process of equity structure, it is observed from the case studies that the most common and major sponsors are still the engineering Chinese SOEs, who play the roles of contractors/operators/suppliers as well as the main equity investors in the projects. The financial institutions are regarded as the debt lenders and agents providing the financial service, often raising the concern of principal-agent issues. The effect of introducing financial institutions as shareholders is analysed based on the VNM (Von Neumann-Morgenstern) utility theorem (Ross, 1973) and the expected return function of the principal-agent theory (Laffont and Martimort, 2002). The results demonstrate that by bringing the financial institutions as shareholders together with the engineering SOEs, the overall project investment return will be higher due to the reduction of the principal-agent cost, the increase of competence and risk tolerance. The arrangement of the shareholding structure and its payoff effect extends the rationale of the incentive effect of the residual rights generated from the ownership.

In the decision-making process of the debt level, this study recognises that there is a remarkable consistency of debt level for projects in the same asset class. For the projects

with the more substantial fixed-asset investment demand, such as the DBFOT projects, the equity/debt ratio is higher, as leveraging less debt for the capital-intensive fixed-asset investment projects can reduce the debt repayment pressure. For the engineering expertise and equipment supply oriented BRI infrastructure assets, the equity/debt ratio is lower due to the cash flow being guaranteed by the EPC+ OM contracts and used to repay the principal and interest of the debt, which is regarded as a positive signal for the debt investors.

Based on the analytical results, Chapter Five provides the survey analysis, case studies and framework for the design of the capital structure, aiming to align the diverse interests and objectives of investors better. The procedures in the framework include: (1) Asset classification; (2) Profiling the stakeholder composition and ability; (3) PPP model selection; (3) Capital structure scoping; (4) Equity structure adjustment to align the interest of shareholders; (5) Debt level selection to meet the requirement of the lenders; (6) Guarantee structure design to assist the debt level arrangement.

Aim 4. To provide a risk management framework that supports the risk identification, assessment and allocation for the BRI infrastructure PPP project development and investment

Together with project capital design, risk allocation is another pillar of the partnership between the stakeholders in the BRI infrastructure PPP provision. Disputes often arise during the concession period due to various risks or default of the agreed obligations. The chance of dispute and project failure derived from risk allocation is higher when the status of the stakeholders is unequal, and the objectives are not aligned. Appropriate

risk allocation has also been recognised as critical to successful PPP projects (Chan et al., 2010; Zhang Xueqing, 2005) and should be done in the early stages of the projects. It is, therefore, necessary to develop a risk identification and allocation mechanism for the delivery of infrastructure in the form of PPP under the BRI.

Risk identification, risk assessment and risk allocation are considered as the three core components of risk management. The success of project management depends on the extent to which the risks are identified, understood, measured and allocated to the appropriate parties (Lam et al., 2007; Tah and Carr, 2010). Moreover, investigating the risk allocation preferences of the stakeholders prior to the contract negotiation is vital for value creation as well as reward balance in line (Delmon, 2017; Villani et al., 2017). Some studies examined the risk management of infrastructure PPP in different jurisdictions. For example, a comparative analysis of the cross-country risk allocation was conducted in order to summarise the commonalities and differences regarding the risk allocation of infrastructure projects (Chou and Pramudawardhani, 2015). However, there is still a significant research insufficiency pertaining to risk management, particularly the risk allocation of PPP infrastructure provision in the context of the BRI. The features of the infrastructure asset, PPP and BRI determine the complexity of designing a risk management scheme.

In this study, a three-tiered mechanism is constructed which looks at risk identification, assessment and allocation. The efficacy of this mechanism is achieved through decomposing risk into specific factors, assessing these factors from multiple perspectives and evaluating the compensation for a risk premium. A cross-cycle

liability retroactive management approach throughout the life-cycle should also be applied to assist the risk management of the BRI infrastructure PPP project.

The principal risk factors are identified based on the case studies and categorised into a number of major groups, such as political risk, economy and market risk, construction and operation risk, legal risk, environmental risk, and force majeure risk. The influence of risk allocation on the overall project cost can be generalised by three effects, including the productive cost effect, the transactional cost effect, and the risk-bearing cost effect. Within a reasonable scale, the transfer of risk from the public to the private sector can increase the value for money performance of the project. However, if the risk is transferred excessively, productivity will decline, while conversely, the transaction cost and risk tolerance will increase. The value for money is, therefore, inevitably eroded. The correlation between risk allocation and the overall value for money performance provides a complementary perspective on the design of the risk management framework. Moreover, it demonstrates the importance of adopting multiple principles for constructing the risk allocation scheme, including but not limited to the principle of imputation, the alignment of the interests of specific stakeholders, and the best risk management capacity, etc.

7.3 Contribution to the literature

Adopting the cooperative game model complementary to the non-cooperative game model in the analysis of the BRI infrastructure PPP

The existing application of game theory to the analysis of PPP mainly focuses on the relationship between the public and private parties in the non-collaborative scenarios. Ho (2006) established a non-cooperative game model to study the decision-making process of bidding compensation from the perspective of the public sector. Medaa (2007) analysed the bargaining process of risk allocation between public and private sectors in transport infrastructure agreements through a game framework when the players are confronted with opposite objectives in the allocation of risks. De Bettignies and Ross (2009) assessed the controversial situation when the private financing of public projects is more suitable than the public investment. However, little research has been conducted to analyse the collaborative game, and there is a lack of focus on the partnership among private stakeholders.

This study proposed a contextualised cooperative game theory model based on the ownership feature of private stakeholders involved in the BRI infrastructure PPP to analyse and provide governance implications for the partnership among the private stakeholders. The core underlying assumption for this proposition is the cooperation among the private stakeholders, supported by the features of private stakeholders, including:

- (1) All private stakeholders are willing to participate in the cooperation and reach a revenue distribution plan that all parties are willing to accept;
- (2) All private stakeholders are credible, and there is no deception and necessary information exchange;
- (3) The cooperative game decides the distribution of payoff and risk allocation through multi-party agreements to ensure the implementation of the plan.

These assumptions can also serve as indicators for assessing the applicability of the collaborative game theory in different contexts where the composition of players is diverse.

In the current Chinese-led BRI infrastructure development and investment, the ownerships of the private stakeholders are mainly state-owned, embedding the significant feature of cooperation. The private stakeholders play their capabilities and strive to maximise the economic as well as social benefits of the project while minimising risks and improving the efficiency of cooperation, reflecting the rights of residual control in the property rights economics (Kim and Mahoney, 2005). The concentration of state-owned property rights has a compulsory incentive for private sector participation. However, whether it can successfully implement PPP relates to asset specificity, environmental uncertainty, transaction costs, and the complementarity between benefits and risks. In terms of asset specificity, if the environment is complicated and uncertain, and the transactional cost is high, the government provides the service. In the context of the BRI, the environment is highly complex. Therefore, the state-owned ownerships of the private stakeholders are compatible with the concepts of property right economics and able to meet the assumptions of the collaborative game theory model.

Enhancing the explaining capacity of the contract theory in the context of the BRI infrastructure PPP

Contract theory is an important part of mainstream economics, and it can explain a wide range of phenomena and problems within and between organisations (Williamson,

2002). PPP can be regarded as a mixed organisational structure. In the countries along the Belt and Road, the legal, financial, and regulatory systems are immature, and the strong position of the public sector is ingrained. In this case, to contextualise the theoretical angle, this study systematically explores the contractual relationship and governance mechanism in PPP from the perspective of an incomplete contract. In addition, this study investigates which cooperation mechanism can enhance the contractual ability and contract enforceability and realise and achieve one important milestone for PPPs, financial closure. Through the research paradigm of contract theory, this study can theoretically contribute to the analysis of PPP by incorporating the institutional features of the BRI context.

This research also contributes to filling the theoretical gap of the contract theory. The neoclassical contract system has its limits, thus failing to provide a more comprehensive, dynamic, and flexible perspective (Macneil, 1977). In a complex context such as the BRI, the governance of stakeholder relationships under the incomplete contract needs to be assisted by relational governance. Relational governance mechanisms based upon social processes, such as trust relations, can safeguard, albeit informally, against exchange hazards, facilitate the enforcement of obligations, and provide flexibility and dynamic adjustment (Zheng et al., 2008). Similarly, unforeseeable contingencies may be accommodated by a well-constructed relation to problem-solving, which facilitates adaptations—particularly within a long-term contract (Zand, 1972). Therefore, the internal relations between the private stakeholders are reinforced because of the common state background and ownership. The concept of relational contracts for sustainable PPPs can improve the contractual ability and enforceability relationally and better manage the risks and payoff among stakeholders in the long term.

7.4 Implication for future research

Unfolding the application of the PPP model to infrastructure provision in the context of the BRI from the perspective of economic geography

As the substantive chapters in this thesis have shown, infrastructure investment and governance are highly contextual. The discipline of economic geography could be at the very centre of research on infrastructure investment in the context of the BRI. In order to advance the research of the contextualised PPP model of infrastructure investment and development in emerging markets, more empirical and comparative studies of the application of PPP between the developed and emerging economies could be conducted with the methods emphasising the institutional and relational contexts from the perspective of economic geography (Sharma, 2012). In addition, the concepts of institutional and relational turns in economic geography can provide a more comprehensive analytical lens to unfold the stakeholder relationships in the PPP under the context of BRI.

The role of financial institutions in reducing the risk of debt stress of infrastructure investment in the BRI countries

This study emphasises the significance of the engagement of financial institutions in the investment and operation of BRI infrastructure projects in the form of PPP. The current BRI infrastructure financing often entails lending to sovereign borrowers, raising the risk of debt distress. In order to tackle this potential risk, future research could explore how financial intuitions can contribute to identifying the risk of sovereign

debt distress that the BRI countries are facing and the degree to which BRI financing will add to the risk of debt distress. Furthermore, it is also imperative to explore the approaches that financial institutions could employ to mitigate the risk of debt stress.

Integrating the ESG factors into investment decision-making and risk management

Sustainability should be considered throughout the life-cycle of BRI infrastructure PPP projects. The scope of sustainability covers economic, environmental, social, and governance (ESG) aspects. For infrastructure projects, economic sustainability has a close relationship with environmental and social sustainability (Atmo and Duffield, 2014). The integration of the sustainability concept into the alignment of objectives, long-term cooperation and coordination also has the potential to improve the utility of investment decision and risk management schemes. In addition, the construction and operation of infrastructure projects are closely related to the natural environment since investors are facing potential unforeseen costs in preventing, mitigating, and remedying environmental damage (Asadabadi and Miller-Hooks, 2017). Climate change impacts infrastructure investment on a broader scale and many of the BRI countries are under stochastic climate change pressure. Therefore, the study on how climate resilience can be improved is a critical topic for both future research and practice.

7.5 Implication for policy-making and practice

The BRI infrastructure PPP development is confronted with institutional, political, investment, and operational bottlenecks. This study identified three major issues impacting the development and investment of the BRI infrastructure PPP. Firstly, the

demand for infrastructure is significant, but the investment recovery period is long. The contradiction remains to be solved urgently. Secondly, the financial systems of some BRI countries are underdeveloped, raising difficulties for the investment of the capital in the large-scale infrastructure projects. Thirdly, the lack of political stability in some BRI countries discourages international investors. Therefore, strengthening institutional construction, exploring feasible project investment and development models, and improving risk management and sustainability are the core aspects of policy-making and practice.

Strengthening institutional construction and capacity construction is also a prerequisite for the high-quality development of the BRI. The major cooperation initiatives often need to strengthen institutional capacity and reform governance, thereby effectively reducing institutional transaction costs and promoting cooperation. First, the Chinese government needs to improve the internal institutional framework of the BRI by further integrating the decentralised functions of relevant departments, facilitating internal and cross-departmental coordination, and gradually constructing the BRI infrastructure PPP management institution with clear responsibilities. In addition, the Chinese government can cooperate by entrusting existing international organisations or setting up new non-governmental organisations to promote the market-oriented investment and operation of BRI infrastructure PPP.

Improving the project investment mechanism and expanding financing sources are essential to developing BRI infrastructure PPP. Infrastructure projects are long-term and profoundly influential, requiring a large amount of political, and financial and human capital. Therefore, the project evaluation and selection mechanism should

calculate the political value, economic value and social value, offering priority to support those projects that have both political and economic value, and at the same time effectively stimulate local employment, increase residents' income, and promote local industrialisation and urbanisation. In the past few years, the achievement of the BRI financing mechanism has been recognised. However, in comparison with the massive demand for infrastructure, the financing capacity still needs to be enhanced. The public and private sectors should jointly coordinate direct and indirect financing to reduce debt pressure and widen financing sources. The public and private sectors should also consider further strengthening cooperation with Chinese and foreign sovereign funds and development financial institutions to enhance financing credit, while at the same time combining long-term capital such as insurance and pensions in order to promote private capital participation through equity investment. In terms of financial innovation, the development of asset securitisation products according to the characteristics of different infrastructure assets is also one of the options to raise funds for the BRI PPP project. In addition, institutional investors, especially multilateral financial institutions, play a vital role in leading the direction to identify green and low-carbon investment opportunities along the Belt and Road.

Enhancing the risk management model is the core to motivating the involvement of private sector stakeholders. The lack of information transparency and weak governance exacerbates the risks in BRI infrastructure investment. Therefore, the importance of risk identification at the initial project phase, contract standardisation, and risk mitigation mechanism cannot be overstated. The project preparation phase is the best time to effectively contain all types of risks. The public and private sectors should conduct a detailed life-cycle feasibility analysis during preparation to ensure risk management

and sustainable profitability. Based on this, take appropriate measures to reasonably allocate the identified risks. The development of standardised contracts for infrastructure projects is an important guarantee to prevent moral and commercial risks occurring in the project effectively. The Chinese and international stakeholders should develop standard contracts under the existing cooperation framework between the government and international organisations and implement contracts according to the contract at all stages of project construction, delivery and operation to adopt institutionalised measures and provide institutional guarantees for the private sector to participate in the BRI infrastructure investment. In terms of risk mitigation, the public and private stakeholders should explore the use of sovereign guarantees, international commercial guarantees, and various insurance products to ensure projects during the entire life-cycle of infrastructure projects to reduce risk losses.

APPENDIX

Appendix 1: List of Interviewees

Appendix 2: Public Sector Stakeholder Interview Questions

Appendix 3: List of Representative Belt and Road Initiative (BRI) Infrastructure
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Appendix 4: BRI Infrastructure PPP Project Developer and Operator Interview
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Appendix 5: BRI Infrastructure PPP Project Investor Interview Questions

Appendix 6: Salient Quotes from Interviewees

Appendix 7: Questionnaire Questions

APPENDIX 1: List of Interviewees

Assistant to Chief Representative	Sino-Saudi TEDA Industrial Park Co., LTD.
Business Development Manager	Beibu Gulf Port Group
Business Manager	China Communications Construction
Business Manager	China Three Gorges Corporation
Chairman	Tianjin TEDA Investment and Development Co., LTD.
Chairman	Yunnan Energy and Electronic Engineering Co., LTD.
Chief Executive Officer	BRI Data Technology Co., LTD.
Chief Executive Officer of European Branch	State Foreign Exchange Administration of the People's Republic of China/State Administration of Foreign Exchange
Chief Finance and Accounting Officer	14th Engineering Bureau of China Water Resources and Hydropower
Chief Manager	Three Gorges Pakistan Kohala Project
Chief Representative	TEDA Co., LTD.
China Office Country Manager	International Financial Corporation
Client Manager of Overseas Market	China Development Bank
Client Manager of Power Sector	China Development Bank
Client Manager of State-Owned Enterprises	China Development Bank
Client Manager of Transport Sector	China Development Bank
Consultant	World Bank
Contract Manager	China Railway Construction Co., LTD.
Director	China Fortune Land Development Co., LTD.
Director	China Public-Private Partnership Fund
Director	Development Research Centre of the State Council
Director	Insurance Asset Management Association of China
Director	Ministry of Transport of the People's Republic of China
Director	Yingkou Harbour Group
Director of Capital Market	China Development Bank
Director of Enterprise Client	China Development Bank
Director	National Development and Reform Committee
Director of International Cooperation Division	China Development Bank
Director of International Practice	China Export and Credit Insurance Corporation
Director of Large Client Division	China Development Bank
Director of Project Management	Sino Hydro Bureau 14 Co., LTD.
Executive Director	Société Générale China Office

General Manager	China Communications Construction Company, LTD.
Head of East Asia Unit	Asian Development Bank
Head of Public-Private Partnership Practice	Asian Development Bank, China Office
International Project Manager	No. 9 Metallurgical Construction Co., Ltd.
Investment Manager of Overseas Division	China Investment Corporation
Investment Officer	Asian Infrastructure Investment Bank
Investment Officer	Bank of China
Investment Officer	Industrial and Commercial Bank of China
Legal Officer	Three Gorges South Asia Investment Co., LTD
Manager	Tianjin Sino-Saudi Taida Industrial Park Management Co., Ltd.
Manager	China Communications Construction Company, LTD.
Manager	China Export and Credit Insurance Corporation
Manager	China Reinsurance Corporation
Manager	KPMG Advisory
Manager of Renewable Energy Industry	China Development Bank
Managing Director	CNIC Corporation
Managing Director	Macquarie Capital
Managing Director	Government of Singapore Investment Corporation
Operation Officer	China Railway 18 Bureau Group Co., LTD.
Operation Officer	Ministry of Water Resources of the People's Republic of China
Partner	Beijing Huanchen Law Firm
Partner	De Heng Law Offices
Policy analysis officer	Ministry of Finance of the People's Republic of China
Professor	Tsinghua University
Project Manager	China Guodian Corporation
Project Manager	China Machinery Engineering Corporation
Project Manager	China Road and Bridge Co., LTD.
Research Officer	Ministry of Housing and Urban-Rural Development
Risk Management Officer	Three Gorge South Asia Investment Co., LTD.
Secretary	Embassy of China in Islamabad, Pakistan
Senior Director	Huaneng Lancang River Co., LTD.
Senior Manager	The Export-Import Bank of China
Senior Manager	Tianjin Public-Private Partnership Asset Exchange
Senior Project Manager	China Communications Construction
Analyst	Silk Road Fund

Vice Director

Ministry of Commerce of the People's Republic
of China

Vice Director

State-Owned Assets Supervision and
Administration Commission

Vice General Manager

China Construction 5th Engineering Division
Corp., LTD.

Vice General Manager

Xinjiang Huoerguosi Huiyuan Consulting Co.,
LTD.

APPENDIX 2: List of Representative Belt and Road Initiative (BRI) Infrastructure Projects

Project name	Project type	Investment amount (USD)	Project scope	PPP mode	Ownership and financing arrangement	Status of the project	Project announcement date
Port Kyaukpyu Industrial Park, Myanmar ¹	Construction	7.2 billion	1,000 hectares, 10 berths in two ports	DFBOT	The Myanmar party of the deep-water port project holds for no less than 15%, and the industrial park project company holds for 49%.	under contract negotiation or procurement	2015
Thar Engro Coal Power Project (Thar-II), Pakistan ²	Energy	1.95 billion	150MW	EPC+O&M, Joint venture	Industrial and Commercial Bank of China provides 85% of the loans, and the rest is self-funded by Sachar Energy Development Co., Ltd.	under full commercial operation	2012
Karot Hydropower Project, Pakistan ³	Energy	1.64 billion	720 MW	BOOT	The Silk Road Fund, the Export-Import Bank of China, the China Development Bank, and the International Finance Corporation formed a syndicate to provide loan funding support for the project.	under construction	2015
Shahjibazar Power Plant, Bangladesh ⁴	Energy	338 million	100 MW	EPC + Joint Venture	N.A.	construction completed	2014
Palembang Coal-based Power Plant, Indonesia ⁵	Energy	98.43 million	150MW	BOOT	The project company has signed a 20-year natural gas supply contract with Indonesia's National Oil and Gas Company; it has signed a 20-year on-grid electricity sales agreement with Indonesia's National Power Company. At	under full operation	2003

					the same time, China National Chemical Engineering Corporation holds 90% of the project company's shares.		
Kamchay Hydroelectric Project, Cambodia ⁶	Energy	280 million	193MW	BOT	The equity investment accounts for 28% of the total investment, provided by the China Development Bank and Sinohydro Corporation. The Export-Import Bank of China provided 200 million USD debt finance, accounting for 72% of the total investment.	under full operation	J2004
Jawa-7 IPP Power Project ⁷	Energy	1.88 billion	2×1,050 MW	EPC + Joint Venture	The project is jointly invested by China Shenhua Energy Co., Ltd., a subsidiary of National Energy Group, and PJBI, a subsidiary of Indonesian National Power Corporation, at a 70%: 30% investment ratio. China Development Bank provided debt facility.	unit 1 is under operation	2015
Payra Fire Power Plant, Bangladesh ⁸	Energy	2.48 billion	2*660MW	BOO	China National Machinery Import & Export (Group) Co., Ltd. holds 50% of the shares; Bangladesh Northwest Electric Power Co., Ltd. (NWPGL, designated representative of the Bangladesh government) holds 50% of the shares.	under construction	2016
Port Qasim Coal-fired Power Plant, Pakistan ⁹	Energy	2.09 billion	2*660MW	BOO	Qasim Port Power Investment Co., Ltd., which is owned by China Power Construction Overseas Investment Company holds 51% of the shares and Qatar Al Mirqab Capital holds 49% of the shares. Export-Import Bank of China provides debt financing, accounting for 72% of the total investment.	under full operation	2015

Emeisai Downstream Power Plant, Cambodia ¹⁰	Energy	578 million	338MW	BOT	The project was invested and constructed by China Huadian Hong Kong Co., Ltd., a subsidiary of China Huadian Group Co., Ltd.	under full operation	2010
Cacho Wind Power Plant, Pakistan ¹¹	Energy	130 million	50MW	EPC+OM	The project is procured by Pakistan Federal Electricity Procurement Agency and provided with 85% loan from the Industrial and Commercial Bank of China, and the rest is self-funded by Sachar Energy Development Co., Ltd.	under full operation	2015
Ethio-Djibouti Railways ¹²	Rail	4 billion	752 km	EPC+OM	Export-Import Bank of China provides commercial loans totalling approximately US \$ 2.9 billion, covering 70% of the funds needed in the Ethiopian segment and 85% of the funds in the Djibouti segment.	under full operation	2011
China Cosco-Port of Piraeus, Greece ¹³	Port	660 million		Joint Venture	China Ocean Shipping Group obtained a majority stake in the Port Authority under the approval of the Greek Parliament and achieved the holding of 67% of the shares. The European Investment Bank agreed to extend a US \$154 million loan to help China Ocean Shipping Group with its investment plan.	under negotiation	2008
H2K North-South Highway Project, Jamaica ¹⁴	Highway	734 million	66.163km	BOT	The China Development Bank and the project company signed a long-term loan agreement, providing debt facility accounting for 75% of the total investment.	under partial operation	2012

Mar2 Highway, Colombia ¹⁵	Highway	656 million	245km	BOT	Led by China Harbour, a joint venture registered project company with 5 partners in Colombia, holding 5% to 20% of the shares of the project company.	under construction	2015
Colombo Port City, Sri Lanka ¹⁶	Urban construction complex	1.4 billion	269 hectares	BOOT	China Harbour has registered a project company in Sri Lanka, and the project company is responsible for the financing and implementation of the project.	under construction	2014
Mombasa–Nairobi Standard Gauge Railway, Kenya ¹⁷	Rail	3.8 billion	480km	EPC	90% of project investment is provided by China Export-Import Bank with credit loans, and 10% is financed by Kenya government.	under full operation	2014
Sino-Laos Railway ¹⁸	Rail	2.4 billion	509km	EPC+ Joint Venture	Laos Railway Company holds 30% of the shares, and Chinese stakeholders hold 70% of the shares, including Moding Vientiane Railway Company 40%, Beijing Yukun Investment Group 20% and Yunnan Construction Investment Group 10%.	under construction	2015
Chashma Nuclear Power Plant, Pakistan ¹⁹	Energy	6.5 billion	2,100 M	N.A.	N.A.	under partial operation	2013
Coastal Railway, Nigeria ²⁰	Rail	6.8 billion	1,400km	N.A.	N.A.	under negotiation on financing issues	2014
Nucleoeléctrica Nuclear Power Plant, Argentina ²¹	Energy	4.7 billion	N.A.	N.A.	N.A.	under negotiation on financing issues	2016

Kirchner and the Cepernic Hydroelectric Complex, Argentina ²²	Energy	3.7 billion	1,140MW	N.A.	N.A.	under construction	2015
Ogun Light Rail Project, Nigeria ²³	Rail	3.5 billion	334 km	N.A.	N.A.	N.A.	2015

Source of information:

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17. Li X., Deng Y., Forum on China-Africa Cooperation, 2019
 18. The Ministry of Commerce of the People's Republic of China, 2016
 19. China National Nuclear Corporation, 2016
 20. The Ministry of Commerce of the People's Republic of China, 2014
 21. The National Development and Reform Committee of the People's Republic of China, 2017
 22. China Gezhouba Group Company Limited, 2015
 23. Xinhua, China Railway Construction signs US \$ 3.5 billion intercity railway project in Ogun State, Nigeria, 2015

The projects listed above are those analysed within the scope of this study. Due to the limitation of the scope of work, the limited access to the non-official database, and the feasibility of information validation, the author admits that the list cannot cover the information of all BRT infrastructure projects at all stages.

APPENDIX 3: Public Sector Stakeholder Interview Questions

What role does the government department that you are working in play in PPP-related matters?

Is your institution involved in specific policy-making? At which level does it function?

Is your institution involved in specific industry regulation and guidance? At which level does it function?

What is the connection between your institution and other government agencies related to PPP?

What do you think are the factors that influence the cooperation and coordination between different government departments?

Is there a conflict of interest in the cooperation and coordination and what are the reasons?

Is your institution involved in the policy-making of the Belt and Road infrastructure PPP?

Is your institution involved in the project supervision of the Belt and Road infrastructure PPP?

What do you think of the development of PPP in the Belt and Road infrastructure provision?

What are the current problems in the development of the Belt and Road infrastructure PPP?

How would you solve these problems?

How do you view the development prospects of the Belt and Road infrastructure PPP?

APPENDIX 4: BRI Infrastructure PPP Project Developer and Operator Interview Questions

What role does your company usually play in PPP?

What is the business scope of your company?

When participating in a PPP project, what do you think is the most important responsibility of your company?

Does your company have experience in participating in the Belt and Road infrastructure PPP project?

What role does your company play in the Belt and Road infrastructure PPP project? What are the similarities and differences compared to participating in other projects?

Will your company participate in the equity investment in the Belt and Road infrastructure PPP project?

Which other organisations do you work with in PPP?

In what form does your company participate in the Belt and Road infrastructure PPP project?

What factors do you think will affect your organisation's participation in the Belt and Road infrastructure PPP project?

What is the link between your company and financial institutions in the infrastructure PPP project?

In the project due diligence phase, what is the most important reason for the success of the project?

What impact do you think the company's state-owned assets background has in PPP?

Compared with private companies, what advantages do you think state-owned enterprises have in the PPP project of the Belt and Road infrastructure?

When a private company participates in the Belt and Road infrastructure PPP project, what factors do you think will affect the participation of the private sector? What kind of strategy should private companies use to ensure cooperation?

How should state-owned enterprises and private enterprises cooperate?

What do you think about benefit sharing and risk sharing in the Belt and Road infrastructure PPP project?

What kind of benefit distribution and risk management strategies do you think can motivate companies to participate?

APPENDIX 5: BRI Infrastructure PPP Project Investor Interview Questions

How does the bank/fund balance the fund investment and direct investment?

In the direct investment approach, does the bank/fund manage the infrastructure asset in-house or outsource? What is the general exit approach?

In the fund investment approach, what are the important factors which the bank/fund would consider in the selection process?

What are the differences of the investment principal between sovereign wealth funds (SWF) and other commercial financial institutions? Are there any bank/fund unique infrastructure investment approaches which distinguish it from the other SWF from your perspective?

What are the frequently used investment approaches in the field of infrastructure according to your experience? e.g., Debt, equity and mezzanine financing etc.

From your perspective, what are the most important factors that impact the project capital structure? e.g., Profitability, debt repayment ability, regulation, the cost of capital, management ability and macroeconomic conditions.

Does the bank/fund have any preference for the type of infrastructure sectors? If so, what are the drivers?

How do you picture the future trend of the cross-border infrastructure investment, for example, in the context of the Belt and Road Initiative?

Can you share the most important philosophy that leads to the growth of infrastructure investment return from your perspective?

What do you think are the most important decision factors when lending a PPP project for the Belt and Road infrastructure?

What do you think are the most important decision factors when investing equity capital in a PPP project for the Belt and Road infrastructure?

What is the core logic of a risk management strategy?

What is the principle of profit distribution?

APPENDIX 6: Salient Quotes from Interviewees

1. PPP is not a one-off transaction. The private stakeholders must employ a long-term perspective to realise the sustainable risk allocation and payoff distribution with other private stakeholders and the public sector stakeholders, which highly emphasises the spirit of contract.

Interviewee background: PPP expert of National Development and Reform Commission, and Ministry of Finance

Experience: PPP policy analysis, academic research

2. What is the meaning of PPP? The government establishes long-term cooperative relations with social capital to make use of each other's advantages, share benefits, and share risks through franchising, service purchase, and investment cooperation. It will improve efficiency, innovate investment and financing mechanisms, broaden social capital investment channels, streamline government and market relations, and accelerate the transformation of government functions.

Interviewee background: PPP expert of National Development and Reform Commission, and Ministry of Finance

Experience: PPP policy analysis, academic research

-
3. The wholly private-owned enterprises have to bear high risk upfront to obtain an entry ticket of the BRT infrastructure market due to the barriers to obtaining financial and political support from the banks.

Interviewee background: Chairman, Yunnan Energy and Electronic Engineering Co., LTD.

Experience: entrepreneur in the energy sector in Southeast Asia

4. If you want to ensure that private enterprises have a place in the PPP projects that are increasingly standardized, it is necessary for the government to cultivate the spirit of integrity and compliance in the market, to apply applicable laws and regulations to meet the needs of practice as soon as possible.

Interviewee background: Chairman, Yunnan Energy and Electronic Engineering Co., LTD.

Experience: entrepreneur in the energy sector in Southeast Asia

5. Future-oriented investments are all uncertain and constitute risks. Each transaction is a contract that is uncertain, that is, a risk contract. Different risks use different management methods to form different risk contracts and different products on the financial market. Therefore, after the monopoly of the financial system is broken, it is inevitable for financial institutions to participate in PPP.

Interviewee background: Manager, China Development Bank

Experience: client relationship, lending business development

6. For the dilemma of unclear functions of the governmental departments and overlapping policies and management in the PPP model, there is an urgent need for

unified coordination at the national level and to issue special PPP laws to form a complete PPP legal regulation system.

Interviewee background: Manager, China Development Bank

Experience: PPP and private financing

7. Through the establishment of a comprehensive risk prevention and control system, the company's internal concerns about participating in PPP projects are reduced, and the company's confidence in participating in PPP projects is established. This is mainly reflected in the risk prevention and control before, during and after participating in PPP projects.

Interviewee background: Senior Manager, Export-Import Bank of China

Experience: risk management, export credit management

8. In the PPP model, the cooperative relationship between the government and enterprises makes use of their respective advantages and realizes mutual benefit. The private sector has a high degree of market sensitivity, and has extensive experience in project construction and operation, which can improve the efficiency of project construction and operation. Government departments should provide guarantees and policy support for private sector financing, and the private sector should choose reasonable financing tools to reduce financing risks and costs and improve the efficiency of the use of funds. In addition, government departments should also bear the political and legal policy risks faced during the implementation of PPP projects, such as planning changes, government transitions, etc. When such incidents occur, the government should effectively protect the interests of the private sector and avoid huge impacts on them.

Interviewee background: Manager, Export-Import Bank of China

Experience: risk management, export credit management

9. As the main stakeholders of market-oriented operation, private enterprises participate in PPP projects not for the purpose of providing welfare, but because of their nature of pursuing profit. By providing with a reasonable return on investment, it can encourage enterprises to participate more in PPP projects.

Interviewee background: Research officer, Ministry of Housing and Urban-Rural Development

Experience: policy analysis on urban and land asset management

10. China's economic reform in the past 40 years has started in the competitive field. Since the Eighteenth National Congress of the Communist Party of China, China has introduced the market's role in resource allocation into the field of infrastructure and public services, promoted PPP, and improved the quantity and provision efficiency of public goods and services. This helps improve the marketisation level of China's economy and is significant to promoting supply-side structural reform and high-quality development. However, in practice, problems such as too many interventions and full payment from the government appear in some places, which would cause concern. The emergence of this problem has a lot to do with the unclear positioning of PPP.

Interviewee background: Director, China Development Bank

Experience: asset management and financial product design

11. Changes in the financing environment require the simultaneous efforts of other market players, such as the state, financial institutions and enterprises.

Interviewee background: Director, China Development Bank

Experience: capital market and client relation

12. Existing financing channels provide very limited financing for the “Belt and Road” cross-border infrastructure and are insufficient to fill the huge funding gap. Therefore, it is necessary to fully introduce the participation of private capital and make use of financing channels such as government and social capital cooperation models to bridge the gap in public capital.

Interviewee background: Director, China Development Bank

Experience: capital market and client relation

13. The key to the success of PPP is to establish a reasonable mechanism of benefit sharing and risk sharing in accordance with the principle of incentive compatibility, to motivate the government and social capital, and to achieve the optimal allocation of resources and the maximisation of social benefits. PPP projects have long investment operation cycles, complicated technologies, large investments, and many uncertainties. Therefore, a reasonable risk sharing mechanism must be established between the government and social capital.

Interviewee background: Investment officer, Bank of China

Experience: real asset investment and portfolio management

14. In PPP projects, the government's responsibilities are market regulation, public goods, and services pricing, financial subsidies, performance supervision, etc. The

financing, construction, and operation of the project are all undertaken by social capital. In the short term, the implementation of PPP can alleviate the pressure of the government's current fiscal expenditure, but in the long term, the government must bear the expenditure responsibility of financial subsidies, etc., and the expenditure responsibility must be controlled within the financial capacity.

Interviewee background: Manager, China Communications Construction Company, LTD.

Experience: road infrastructure asset development

15. The development of PPP, which integrates urban development, infrastructure, public services, ecological and environmental protection, industrial support, industrial upgrading, and government fiscal revenue increase, can effectively promote coordinated regional development.

Interviewee background: Director, China Fortune Land Development Co., LTD.

Experience: industrial complex development and investment

16. For the foreseeable future, the cooperation between the government and social capital to provide public services will gradually shift from government financial subsidies to new value creation by social capital, from single facility services to integrated and comprehensive services.

Interviewee background: Director, China Fortune Land Development Co., LTD.

Experience: industrial complex development and investment

17. The organisational form of the PPP model is very complex, and it is inevitable that the parties in PPP will have different interests and responsibilities. Only when the

government and the social capital form a mechanism of cooperation, can the differences between the parties in PPP be blurred, and the goal of the project can be completed on the premise of seeking common ground while reserving differences.

Interviewee background: Partner, Beijing Huanchen Law Firm

Experience: international engineering project legal consulting

18. The PPP + EPC mode refers to the project that adopts the PPP mode for construction and operation. Due to the increasing size, complexity and integration of China's international infrastructure investment, the government tends to adopt the general contracting model for the owner, with a contractor to undertake all the engineering design, material and equipment procurement and project construction of a project.

Interviewee background: Partner, Beijing Huanchen Law Firm

Experience: international engineering project legal consulting

19. In the context of BRI, many companies without a state background in construction engineering, especially financial companies, are pouring into the field of infrastructure construction. These financial companies have a stronger advantage than engineering construction companies in terms of capital raising. However, the lack of experience in engineering construction makes these financial companies have to cooperate with engineering construction companies so that they can be more effective in the negotiation and negotiation with the government clients.

Interviewee background: Partner, Beijing Huanchen Law Firm

Experience: international engineering project legal consulting

20. The contract is very important, but no contract is complete, especially the PPP contract, because the project cycle is long and involves a wide range of stakeholders. Therefore, the PPP contract must be Dynamic (including triggering renegotiation mechanism and adjustment/price adjustment mechanism, etc.) rather than static.

Interviewee background: Partner, Beijing Huanchen Law Firm

Experience: international engineering project legal consulting

21. Why is PPP difficult to land? First, it is difficult to change perceptions, and some local governments have limited their thinking to ease debt pressure and have not turned their attention to strengthening supervision. Second, it is difficult to see the enthusiasm of social capital to participate in PPP. Third, the PPP operating procedures' transparency is not enough. Lack of contractual spirit leads to widespread arbitrary breach of contract.

Interviewee background: Policy analysis officer, Ministry of Finance of the People's Republic of China

Experience: fiscal policy analysis

22. PPP project investors/lenders all need a clear contract as a prerequisite for participation in controlling risks. Not all governments will prepare contracts and clarify the detailed responsibilities and rights of all parties, which may require complicated negotiations afterward and significantly increase the cost and risk of PPP projects.

Interviewee background: Contract Manager, China Railway Construction Co., LTD.

Experience: international engineering project contract management

APPENDIX 7 : Questionnaire Questions

BRI Infrastructure PPP Project Capital Structure Selection Questionnaire

01 Your name *

please enter

02 The name of your institution *

please enter

03 Your position *

please enter

04 The type of institution that you are working at * Checkboxes

- Bank
- Investment/asset management and other financial institutions
- Government departments
- Construction contractors and developers
- Designing agency
- Equipment suppliers
- Operators
- Consulting/legal/intermediary
- Other

05 How long have you been involved in the international infrastructure project *

- 0~3 years (including 3 years)
- 3~5 years (including 5 years)
- 5~10 years (including 10 years)
- More than 10 years

06 What is the responsibility of your role? * Checkboxes

- Investment and finance
- Design and construction
- Procurement
- Management and operation
- Consulting and legal affairs
- Other

07 What are the types of infrastructure that you have mainly covered? * Checkboxes

- Roads, bridges, railways
- Energy
- Ports and airports
- Urban development
- Internet, communication and telecom
- Other

08 Which of the following characteristics do you think is most prominent in your field? *

- Large investment scale
- High technical demand
- Complex operation
- High equipment requirements
- Other

09 From the perspective of your institution and based on your experience, please evaluate the importance of the relevant factors that affect the capital structure of BRI infrastructure projects. *

(option of 1-5. 1 means irrelevant, 2 means certain correlation, 3 means certain importance, 4 means higher importance, 5 means extremely important.)

Interest has the effect of deducting taxes

1	2	3	4	5
---	---	---	---	---

Increasing the proportion of liabilities can increase the return on net assets

1	2	3	4	5
---	---	---	---	---

More debt will increase corporate financial risk

1	2	3	4	5
---	---	---	---	---

High debt levels cause negative impact on credit ratings

1	2	3	4	5
---	---	---	---	---

Equity financing cost

1	2	3	4	5
---	---	---	---	---

Debt financing cost

1	2	3	4	5
---	---	---	---	---

Industry average debt level

1	2	3	4	5
---	---	---	---	---

Limit the amount of debt to ensure that shareholders share the benefits of the project

1	2	3	4	5
---	---	---	---	---

Guarantee financial flexibility and leave space for future debt financing

1	2	3	4	5
---	---	---	---	---

Reduce project benefits that are transferred to creditors

1	2	3	4	5
---	---	---	---	---

Guarantee the control right of existing controlling shareholders

1	2	3	4	5
---	---	---	---	---

Equity financing provided by contractors can leverage their expertise and reduce the risk of principal-agent

1	2	3	4	5
---	---	---	---	---

Macroeconomic and policy condition

1	2	3	4	5
---	---	---	---	---

The difficulty of obtaining debt financing

1	2	3	4	5
---	---	---	---	---

The difficulty of obtaining equity financing

1	2	3	4	5
---	---	---	---	---

Limit debt ratios to eliminate government concerns about project bankruptcy

1	2	3	4	5
---	---	---	---	---

Increase the proportion of equity to increase the confidence of consortium members in project success

1	2	3	4	5
---	---	---	---	---

Raise the proportion of equity and improve the evaluation of financial institutions on the solvency of projects

1	2	3	4	5
---	---	---	---	---

Appropriately increase the debt ratio, reduce the overall cost of capital, thereby reducing the price of future services and products, and improving government or user satisfaction

1	2	3	4	5
---	---	---	---	---

10 From the perspective of your institution and based on your experience, please evaluate the importance of the following factors for equity financing. *

Please press and hold the screen to the left to select the option of 1-5. 1 means irrelevant, 2 means certain correlation, 3 means certain importance, 4 means higher importance, 5 means extremely important

Reflect the ability of sponsors to reduce government concerns

1	2	3	4	5
---	---	---	---	---

Due to the long duration of the project, the introduction of equity financing can reduce the financial burden and diversify risks

1	2	3	4	5
---	---	---	---	---

11 In addition to equity financing, from the perspective of your institution and based on your experience, please evaluate the importance of the following factors for the adoption of debt financing.*

1 means irrelevant, 2 means certain correlation, 3 means certain importance, 4 means higher importance, 5 means extremely important

Attract investors who are pursuing high returns and are willing to take the corresponding risks

1	2	3	4	5
---	---	---	---	---

Easier to achieve than debt financing

1	2	3	4	5
---	---	---	---	---

There is no need to pay the principal, dividends can be flexibly controlled, and the financial risk of the project can be reduced

1	2	3	4	5
---	---	---	---	---

Reserve more equity capital, increase financial flexibility, and provide more space for potential debt financing needs

1	2	3	4	5
---	---	---	---	---

At the equity level, introduce contractors, operators and professional equipment technology providers to improve professional capabilities to reduce agency risk and transaction costs

1	2	3	4	5
---	---	---	---	---

Debt financing has lower cost and expense than equity financing, and has certain scale and time advantages

1	2	3	4	5
---	---	---	---	---

Debt financing is easier to achieve than equity financing

1	2	3	4	5
---	---	---	---	---

Debt interest is included in cost, saving tax expenditure

1	2	3	4	5
---	---	---	---	---

Future business expectations and cash flow forecasts are clearer, which will help increase leverage and increase the yield of own funds

1	2	3	4	5
---	---	---	---	---

Avoid reducing the controlling share of existing shareholders and losing control right

1	2	3	4	5
---	---	---	---	---

Avoid reducing the controlling share of existing shareholders and losing control right

1	2	3	4	5
---	---	---	---	---

Reducing the equity ratio can reduce investors' expectations of project benefits, thereby reducing the price of future public services or products and improving government or user satisfaction

1	2	3	4	5
---	---	---	---	---

12 Based on your experience, please rate the frequency of current funding sources for BRI infrastructure projects. *

1 means never, 2 means very little, 3 means occasionally, 4 means often, 5 means always.

Enterprise own capital

1	2	3	4	5
---	---	---	---	---

State-owned policy, development bank capital

1	2	3	4	5
---	---	---	---	---

State-owned commercial bank capital

1	2	3	4	5
---	---	---	---	---

Long-term capital such as insurance companies, pension funds, and sovereign funds

1	2	3	4	5
---	---	---	---	---

Trust funds and other financial institutions

1	2	3	4	5
---	---	---	---	---

Non-public market funds such as private equity funds and infrastructure funds

1	2	3	4	5
---	---	---	---	---

Government specialised funds

1	2	3	4	5
---	---	---	---	---

Foreign capital

1	2	3	4	5
---	---	---	---	---

International development bank capital

1	2	3	4	5
---	---	---	---	---

International commercial bank capital

1	2	3	4	5
---	---	---	---	---

13 Based on your experience, the equity in the capital structure of the BRI infrastructure PPP projects in your field: In what extent is the debt ratio? Checkboxes

- Equity: Debt less than or equal to 5%: 95%
- Equity: Debt 5%~10%: 95~90%
- Equity: Debt 10%~20%: 90%~80%
- Equity: Debt 20%~30%: 80%~70%
- Equity: Debt 30%~40%: 70%~60%
- Equity: Debt 40%~50%: 60%~50%
- Equity: Debt greater than or equal to 50%: 50%
- other

14 Based on your experience, what is the debt financing cost that can be accepted in the financing of BRI infrastructure PPP projects in your field? Checkboxes

- Less than or equal to 5%
- 5%~10%
- 10%~20%
- More than 20%
- other

15 Based on your experience, please evaluate the frequency of use of the following financing methods in the initial stage of BRI infrastructure PPP projects. *

1 means never, 2 means very few, 3 means occasionally, 4 means often, 5 means always.

1 5

Sponsors' direct investment as shareholders

1	2	3	4	5
---	---	---	---	---

Short-term loans (within one year)

1	2	3	4	5
---	---	---	---	---

Long-term loans (more than one year)

1	2	3	4	5
---	---	---	---	---

Chinese policy bank loans (Import and Export Bank, China Development Bank, etc.)

1	2	3	4	5
---	---	---	---	---

Short-term loans (within one year)

1	2	3	4	5
---	---	---	---	---

Long-term loans (more than one year)

1	2	3	4	5
---	---	---	---	---

Chinese policy bank loans (Import and Export Bank, China Development Bank, etc.)

1	2	3	4	5
---	---	---	---	---

International development financial institution loans (World Bank, Asian Development Bank, etc.)

1	2	3	4	5
---	---	---	---	---

Chinese commercial bank loan

1	2	3	4	5
---	---	---	---	---

International commercial bank loan

1	2	3	4	5
---	---	---	---	---

Financial leasing

1	2	3	4	5
---	---	---	---	---

Issuing bonds

1	2	3	4	5
---	---	---	---	---

Mezzanine financing

1	2	3	4	5
---	---	---	---	---

Specialised funds (such as Silk Road Fund, etc.)

1	2	3	4	5
---	---	---	---	---

Additional investment from original shareholder

1	2	3	4	5
---	---	---	---	---

Share expansion to introduce new shareholders

1	2	3	4	5
---	---	---	---	---

Equity transfer introduces new shareholders

1	2	3	4	5
---	---	---	---	---

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