Risk Allocation, Decision Rights, and Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

Chi A. Nguyen

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

In

Civil Engineering

Michael J. Garvin, Chair

Ralph P. Hall

Duc A. Nguyen

Tripp Shealy

April 26, 2023
Blacksburg, Virginia

Keywords: Public-Private Partnerships, uncertainty, risk, decision rights, lifecycle management

Copyright 2023, Chi A. Nguyen

Risk Allocation, Decision Rights, and Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

Chi A. Nguyen

Academic Abstract

Public-private partnerships (PPPs) are increasingly used to address pressing infrastructure demands. PPPs typically involve a long-term contract between governments and private firms for design, construction, operation, and maintenance of infrastructure where private finance is put at risk throughout the contract's duration. By bundling these key tasks in the hands of the private sector, PPPs are expected to address certain limitations of traditional delivery approaches by capitalizing on private sector expertise and capabilities. Yet, while studies have shown the feasibility of PPPs in many cases, key challenges such as asymmetric information, incentive misalignment, bounded rationality, high transaction costs, and contract incompleteness are greater in PPPs than in traditional projects. This is because PPPs involve numerous heterogeneous stakeholders and multiple discrete project phases spanning decades. These challenges interact and result in high uncertainty in PPPs. Thus, how to address uncertainties is crucial in designing and implementing a PPP contract. Using a deliberately sampled data set of 20 contemporary greenfield highway contracts in Australia, the Philippines, and India, three studies explore the current practices of three key areas in PPPs: risk allocation, decision rights allocation, and lifecycle project management. Together, these studies shed light on how contracting parties design contracts ex ante to address ex post uncertainty due to inevitable changes in circumstances and requirements.

In the study of risk allocation, the results support the risk transfer tenet and risk allocation principle and criteria. For instance, most of the comprehensive set of the 35 key risks investigated were transferred to the private sector or shared; exogenous risks had more consistent allocation and were shared more than endogenous risks across the three countries. A high level of similarity in risk allocation within each country and across the countries was uncovered regardless of remarkably different characteristics at both project and country levels. The similarities among these countries may indicate common risk allocation practices across other comparable countries in the region, and it provides the basis for revisiting existing literature such as studies about the relationship between institutional strength and the extent of risk transfer. Several silent or indeterminate provisions were also identified, indicating areas for improving current contractual designs. Some shift of responsibilities to the private sector in tolled projects (typically longer contract duration) compared with government-paid ones (typically shorter) was observed across the countries. Some

limited trends over time such as less silent or indeterminate provisions and more risks retained by the public sector in recent projects in the Philippines and India, respectively, were also observed.

For the examination of decision rights allocation, the key finding was the dominant level of owner control in a comprehensive set of 10 key provisions in almost all contracts regardless of the country's level of development and the substantial number of risks transferred to the private sector. The observed owner control aligns with agency theory, and this finding is likely driven by governments' accountability concerns and risk aversion. The extensive level of owner control does not support the argument that interprets property rights theory as applied to PPPs as providing the private sector with more extensive decision rights given their significant role in the decades-long duration of a PPP project. Contracts in Australia were more rigid, having distinctive, rigorous, and more detailed requirements with more ex-ante effort required to specify numerous provisions. Some limited national trends include contractual design evolvement over time in some provisions in the Philippines and India. The identified silent provisions indicate areas for improvement.

For the lifecycle project management inquiry, the practices explored specify project structure, requirements, processes, and procedures that function as key elements of measurement- and process-based management throughout a project's contract period. Implementing these elements can trigger corresponding governance mechanisms to promote contractual and relational governance. Contracts in Australia tend to be more comprehensive in many areas requiring more ex ante contracting efforts such as naming contractors in contracts and ex post implementation efforts to comply with many distinctive requirements such as those concerning environmental and community/user management. Meanwhile, contracts in Australia likely rely more on trust-based management versus monitoring/control-based management, having limited requirements for monitoring and safeguarding the contract.

Together, these findings provide insights to more comprehensively understand how contracts are designed to address uncertainties. The common and different practices revealed benefit both practitioners and scholars and consequently suggest pathways toward enhancing the potential benefits and efficiency of PPPs; the former by facilitating informed decisions such as market entry, project selection, and strategic contractual designs at both the project-level and policy-level, especially for evolving markets such as the Philippines, India, and other regional and comparable countries; the latter by providing a framework with supporting contractual evidence that (i) reinforces and supports numerous contractual and governance theories and principles and (ii) establishes a baseline for multiple subsequent inquiries such as examining the key factors affecting parties' contractual choices, the effectiveness of the practices uncovered, and the gaps with parties' preferences. The research is characterized by its broad scope exploring comprehensive sets of key provisions in 20 contracts spanning three countries and its important implications for both theory and practice of PPP contractual design.

Risk Allocation, Decision Rights, and Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

Chi A. Nguyen

General Audience Abstract

Public-private partnerships (PPPs) involve decades-long contracts between governments and private firms where a single private firm typically designs, builds, finances, operates, and maintains a specific infrastructure facility for revenues mainly from users (tolls) or governments. PPPs are theoretically expected to address certain limitations of traditional delivery approaches by capitalizing on private sector expertise and capabilities. Numerous studies have shown the feasibility of PPPs in many projects and sectors in various countries. However, PPP transactions are characterized by high uncertainty as a result of the involvement of numerous diverse stakeholders and the integration of multiple project lifecycle phases that span decades where changes in circumstances and requirements are inevitable. Contracts are the key and central instrument in project governance. Thus, addressing uncertainties is crucial in designing and implementing a PPP contract. Using a data set of 20 contemporary greenfield highway contracts in Australia, the Philippines, and India, this dissertation explored three key issues: risk allocation, decision rights allocation, and lifecycle project management. Risk allocation refers to which contracting party would take responsibility for certain contractual requirements with corresponding consequences or benefits. Decision rights allocation defines the boundaries of public sector involvement and consequently its control of the private sector's activities and decisions. Lifecycle project management is a set of contractual requirements, project structure, processes, and principles that steer the actions of and interactions between parties over a project's lifecycle.

For risk allocation, the results reveal that most of the 35 key risks investigated were either transferred to the private sector or shared. One interesting and, to some extent, unexpected finding was the relatively high level of similarity in risk allocation within each country and across the countries, despite remarkably different characteristics at both project and country levels. This suggests that similar risk allocation practices may be employed across regional and comparable countries and perhaps beyond. No noticeable transnational trends or variances were observed except some shift of responsibilities to the private sector in user-paid projects (typically longer contract duration) compared with government-paid ones (typically shorter). Some limited trends over time such as a decrease in silent or indeterminate provisions and more risks retained by the public sector in recent projects in the Philippines and India, respectively, were observed.

Additionally, exogenous risks (external to the project) had more consistent allocation and were shared more than endogenous risks (within a project's boundary). Some silent provisions were identified, indicating areas for improvement of contractual designs.

For decision rights allocation, the key finding was the dominant level of owner control in 10 key provisions in almost all contracts, regardless of the country's level of development and the substantial number of risks transferred to the private sector. Contracts in Australia were more rigid, having distinctive, rigorous, and more detailed requirements with more efforts required beforehand to specify numerous provisions. Some limited national trends include contractual design evolvement over time in some provisions in the Philippines and India. Some silent provisions were identified, indicating areas for improvement or consideration.

For lifecycle project management, parties designed contractual practices to rely on (1) contractual requirements with consequences for noncompliance and harmonious and collaborative relationships between parties, (2) rigid and detailed requirements and flexible ways to correspond to uncertainties, and (3) output-based management approaches (e.g., performance linked payments) and process-based management approaches (e.g., regular meetings and communication, procedures to resolve disputes) to address future uncertainties throughout a project's contract duration. Contracts in Australia tend to be more comprehensive in many areas requiring more ex ante contracting efforts such as naming contractors in contracts and ex post implementation efforts to comply with many distinctive requirements such as those concerning environment and community/user management. Meanwhile, contracts in Australia likely rely more on trust-based management versus monitoring/control-based management, having limited requirements for monitoring and safeguarding the contract.

Overall, the common and different practices revealed facilitate informed decisions such as market entry, project selection, and strategic contractual designs at both the project-level and policy-level, especially for evolving markets such as the Philippines, India, and other regional and comparable countries. For instance, international developers expecting high revenue can choose the Philippines over India since revenue risk is typically a private risk in the Philippines but shared in India. Additionally, governments in the Philippines and India might want to consider adopting more trust-based management practices so that their contracts would better attract and incentivize international developers. The findings also provide contractual evidence that supports numerous contract and governance theories and principles and establishes a baseline for subsequent inquiries such as investigating the effectiveness of the practices uncovered, the key reasons for parties' contractual choices, and the gaps with parties' preferences. The research is characterized by its broad scope exploring comprehensive sets of key provisions in 20 contracts spanning three countries and its important implications for both theory and practice of PPP contractual designs.

Dedication

To my family for being my family

To all people I love for loving me

To all hardships for polishing me

To all experiences for making me ME

Acknowledgments

Life is an ultra trail marathon with ups and downs! This is one of my mottos. Here I am near one important peak in my life looking back and feeling deeply grateful to all those who have helped and encouraged me during the journey.

My former advisors at the University of Tokyo, Dr. Ikuo Towhata, Dr. Junichi Koseki, and Dr. Taro Uchimura, deserve special mention. Their dedication to work greatly inspired me and their guidance helped me learn insightful knowledge regarding civil engineering in general and geotechnical engineering in particular. They helped shape the start of my career. Without their recommendations, I would not have been able to enroll in Virginia Tech.

I owe special gratitude to Dr. Hideo Arai, Dr. Akio Kasuga, Mr. Hitoshi Yamaji, Mr. Susumu Yanase, and many colleagues at my company for their "hard but with heart" training and support given to me during the last 16 years and many more years to come. Thanks to them, I was able to experience and learn from performing many key roles involving design, construction, administration, and management in many large-scale bridge and road projects. Such experience also proved helpful in doing this research.

I would like to express my sincere gratitude to my advisor, Dr. Michael J. Garvin, for guiding me through the research and inspiring me to enjoy the "beauty" of academic work. I am also thankful to my committee members, Dr. Ralph P. Hall, Dr. Duc A. Nguyen, and Dr. Tripp Shealy, for their encouragement and support. Their suggestions and examples of using Nvivo, streamlining research questions, avoiding the "defensive" writing style for more succinct writing, amplifying the importance of this research, and many others have greatly strengthened this dissertation.

I am grateful to Dr. Josh Iorio for many meaningful suggestions for writing and presentation.

I thank my lab mates, Dr. Manik Ahmed and Dr. Mayank Khurana, for their time and support, although the pandemic limited our chances to meet face-to-face. I thank Dr. Hall and Patton 315 research groups for our good times together sharing ideas and thoughts (and many sweets).

A heartfelt gratitude goes to my family. I would say no more since no words would be enough to express my gratitude.

Many names have not been highlighted due to the sake of space limit; yet, their support is vital and deeply appreciated. I am excited to benefit from the best of both worlds (industry, academic) and move forward to see many beautiful sceneries and pass similar aid to many others along the way ahead toward my lifelong goal of building bridges and roads for people in remote and inaccessible areas especially in developing countries.

Table of Contents

Academic Abstract ii

General Audience Abstract iv

Dedication vi

Acknowledgments vii

Table of Contents viii

List of Tables xii

List of Figures xiv

Preface xv

1. Introduction 1

1.1. Infrastructure Development Demand and the Need for Public-Private Partnerships (PPPs) 1

1.2. Overview of Public-Private Partnerships 1

1.2.1. Definition of PPPs 1

1.2.1. Global PPPs 2

1.2.2. PPPs' benefits 3

1.2.3. High Uncertainty as a Key Challenge of PPPs 5

1.3. Contracts' key role in project governance 6

1.4. Contract theories 7

1.5. Research focus, context, and approach 8

1.5.1. Focus - Addressing key issues in contracts 8

1.5.2. Context - Analyzing Asia Pacific 9

1.5.3. Research approach and structure 11

2. Risk Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India 16

2.1. Abstract 16

2.2. Introduction 16

2.3. Background 18

2.4. Literature Review 18
2.4.1. Risk Identification and Categorization 19
2.4.2. Risk allocation 19
2.5. Point of Departure 21
2.6. Research Methodology 22
2.6.1. Overview 22
2.6.2. Investigation scope 22
2.6.3. Contract collection and sampling 24
2.6.4. Risk matrix for investigation 25
2.6.5. Analysis Rubric 25
2.6.6. Internal Validation 29
2.6.7. External Validation 29
2.7. Risk Allocation Analysis Results 29
2.7.1. Overview of Risk Allocation Results 31
2.7.2. External Validation 32
2.7.3. Allocation of Exogenous Risks 33
2.7.4. Allocation of Endogenous Risks 34
2.7.5. Comparison of Uncovered Predominant Allocation with Preferred Allocation 37
2.8. Parametric and Comparative Analysis 38
2.8.1. Within Each Country 38
2.8.2. Transnational Analysis 39
2.9. Discussion 40
2.10. Conclusion 43
3. Decision Rights Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India 45
3.1. Abstract 45
3.2. Introduction 46
3.3. Literature Review 47

3.3.1. Bundling Effects in PPPs 47
3.3.2. Contracts' Role in Project Governance 48
3.3.3. Major Challenges of PPPs and Mitigation Strategies/Mechanisms in Contracts 50
3.4. Point of Departure 52
3.5. Research Methodology 52
3.6. Analysis Results 54
3.6.1. Project management approach over lifecycle 58
3.6.2. Performance measurement 58
3.6.3. Changes by parties 59
3.6.4. Competing facilities 60
3.6.5. Refinancing 61
3.6.6. Transfer 61
3.6.7. Handback / Residual value 61
3.6.8. Contracting with D&C contractors 62
3.6.9. Contracting with O&M service providers 62
3.6.10. Assignment of Independent Engineer 63
3.7. Discussion 63
3.8. Conclusion 66
4. Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India 68
4.1. Abstract 68
4.2. Introduction 68
4.3. Literature Review 70
4.3.1. Uncertainty in PPPs 70
4.3.2. Project governance in PPPs 70
4.3.3. Project management in PPPs 73
4.3.4. Contracts' key role in PPPs 74
4.4. Point of Departure 74

4.5. Research Methodology 75
4.6. Analysis Results 80
4.6.1. Contractual governance (measurement-based management) 80
4.6.2. Adaptive/Relational governance (process-based management) 86
4.7. Discussion 91
4.8. Conclusion 93
5. Summary, Contributions, and Future Research 95
5.1. Summary of Findings 95
5.2. Contributions and Implications 97
5.2.1. Unique contributions and implications of each study 97
5.2.2. Overall contributions and implications of all three studies 98
5.2.3. Conclusion 102
5.3. Future Research 102
References 104
Appendices 117
Appendix A. PPP Enabling Environment scores 117
Appendix B. List of PPPs' benefits 118
Appendix C. All and sampled contracts in Australia 120
Appendix D. All and sampled contracts in the Philippines 121
Appendix E. All and sampled contracts in India 122

List of Tables

Table 1. Selected studies showing PPP projects' superior performance 4

Table 2. Rapidly growing economy and population in Asia Pacific and the world 10

Table 3. Infrastructure assessment scores in Asia Pacific 10

Table 4. Cumulative investment amount in PPPs for Asia Pacific and the world..... 11

Table 5. Cumulative investment amount in infrastructure in key PPP markets in Asia Pacific... 12

Table 6. Characteristics of countries significantly contributing to greenfield highway PPPs in the Asia Pacific region..... 13

Table 7. Key characteristics of Australia, the Philippines, and India 14

Table 8. Key characteristics of Australia, the Philippines, and India 23

Table 9. Sampled contracts..... 24

Table 10. Characteristics of the sampled projects and all projects in the Philippines 25

Table 11. Developed risk matrix, incorporating all refinements during internal validation..... 27

Table 12. Predominant risk allocation 35

Table 13. Comparison of uncovered predominant allocation with preferred allocation 37

Table 14. Major challenges of PPPs and selective mitigation strategies or mechanisms..... 50

Table 15. Sampled contracts..... 53

Table 16. Characteristics of all projects and the sampled ones in the Philippines 53

Table 17. Contract provisions for exploring decision rights allocation..... 55

Table 18. Result summary 56

Table 19. Institutional strength 65

Table 20. Sampled contracts with key characteristics 76

Table 21. Characteristics of the sampled projects and all projects in the Philippines 77

Table 22. Key practices categories for exploration and their linkages with governance mechanisms..... 78

Table 23. Key practices concerning contractual governance (measurement-based management)81

Table 24. Key practices concerning adaptive/relational governance (process-based management) 82

Table 25. Sharing mechanisms 91
Table 26. Cultural indexes 92
Table 27. PPP enabling environment scores 117
Table 28. All and sampled contracts in Australia 120
Table 29. Characteristics of all and sampled projects in Australia 120
Table 30. All and sampled contracts in the Philippines 121
Table 31. Characteristics of all and sampled projects in the Philippines 121
Table 32. All and sampled contracts in India 122
Table 33. Characteristics of all, sampled, and accessible projects in India 126
Table 34. Project code and project name in India 127

List of Figures

Fig. 1. PPP enabling environment 2

Fig. 2. Global investment amount in PPPs 3

Fig. 3. Practitioners' ranking of importance of PPP benefits vs. challenges 4

Fig. 4. Contracts play a central and binding role in project governance 7

Fig. 5. Contract theories guiding how contracts deal with key challenges of PPPs 8

Fig. 6. Three studies exploring how contracts address the three key issues to deal with uncertainties 9

Fig. 7. Cumulative investment amount in PPPs in low- and middle-income countries 11

Fig. 8. Research methodology overview 23

Fig. 9. Risk allocation 30

Fig. 10. Risk allocation by sectors 31

Fig. 11. Ratio of risks having the same allocation in each country and across the three countries 32

Fig. 12. Ratio of risks having either the same allocation or the same predominant allocation in all contracts across the three countries 33

Fig. 13. Contractual evidence reinforcing the literature 99

Preface

Contributions of co-authors of each manuscript in this dissertation:

2. Risk Allocation: (target publication: Journal of Construction Engineering and Management)

- Nguyen, C., A.: conducted the research and was lead author
- Garvin, M., J.: supervised and advised on research design and implementation; reviewed and copy-edited the manuscript
- Manik, A.: served as second rater
- Varun, G.: served as second rater

3. Decision rights allocation: (target publication: Journal of Management in Engineering)

- Nguyen, C., A.: conducted the research and was lead author
- Garvin, M., J.: supervised and advised on research design and implementation; reviewed and copy-edited the manuscript
- Manik, A.: served as second rater
- Varun, G.: served as second rater

4. Lifecycle project management: (target publication: Journal of Management in Engineering)

- Nguyen, C., A.: conducted the research and was lead author
- Garvin, M., J.: supervised and advised on research design and implementation; reviewed and copy-edited the manuscript

1. Introduction

1.1. Infrastructure Development Demand and the Need for Public-Private Partnerships (PPPs)

Infrastructure is vital to the operation and efficiency of modern society (Guasch 2004; Keep 2021). From access to clean water for drinking, houses for shelter, schools for education, hospitals for health care, power lines for access to electricity, communication systems for internet and phone services, to roads for transporting goods and people, infrastructure provides assets and services for basic human needs, improves the quality of life, and sustains and bolsters economic development (Deep et al. 2019; Oxford Economics 2017). However, rapidly growing population and increasing economic activities have caused critical infrastructure deficits in key sectors such as power, transportation, and water and sanitation (Carbonara et al. 2015; World Economic Forum 2019). For instance, during the last four decades from 1980 to 2020, the global population and gross domestic product (GDP) have increased 1.7 times and 7.5 times, respectively (World Bank 2021a). Meanwhile, global infrastructure was assessed with an average score of 65, far from the optimal state of 100 (World Economic Forum 2019). An extensive gap in annual infrastructure investment from 2016 to 2040 was estimated as $736 billion or 19% of the demand (Oxford Economics 2017). Thus, in addition to the conventional public delivery methods, governments have been actively and increasingly adopting public-private partnerships (PPPs) in recent decades as one solution to address these pressing needs (ADB 2019; Soomro and Zhang 2016; Wang et al. 2018).

1.2. Overview of Public-Private Partnerships

1.2.1. Definition of PPPs

Public-private partnerships (PPPs) have numerous definitions, with no standard and internationally accepted one (Antillon et al. 2018). For instance, the Asian Development Bank (ADB) defines it as a:

> *"Contractual arrangement between public (national, state, provincial, or local) and private entities through which the skills, assets, and/or financial resources of each of the public and private sectors are allocated in a complementary manner, thereby sharing the risks and rewards, to seek to provide optimal service delivery and good value to citizens."* (ADB 2019, p. xxvi).

Alternatively, Garvin and Bosso (2008, p. 163) defined PPPs as:

"a long-term contractual arrangement between the public and private sectors where mutual benefits are sought and where ultimately (a) the private sector provides management and operating services and/or (b) puts private finance at risk"

Common PPP characteristics among most definitions are threefold: a long-term contractual arrangement between the public and private sectors including asset creation and operation and maintenance services provision, private finance being put at risk, and in return, payments to the private sector by governments or user fees collection (Antillon et al. 2018). Further, as observed in the quoted definitions, PPPs are expected to capitalize on the skills, assets, and financial resources of the private sector for better project delivery. In the following sections, global PPP implementation and PPP characteristics and challenges are further examined.

1.2.1. Global PPPs

PPPs are still emerging with each country and institution applying PPPs in different ways with diversified levels of development (Economist Intelligent Unit 2019). Fig. 1 depicts an assessment of the PPP enabling environment by the Economist Intelligent Unit that considers the readiness and capacity to implement sustainable and efficient PPPs in 67 countries where 64 countries are low and middle-income. The PPP enabling environment assessment ranges from nascent to mature with an average of 59, far from the "optimal" of 100 (see Appendix A for scores by country).

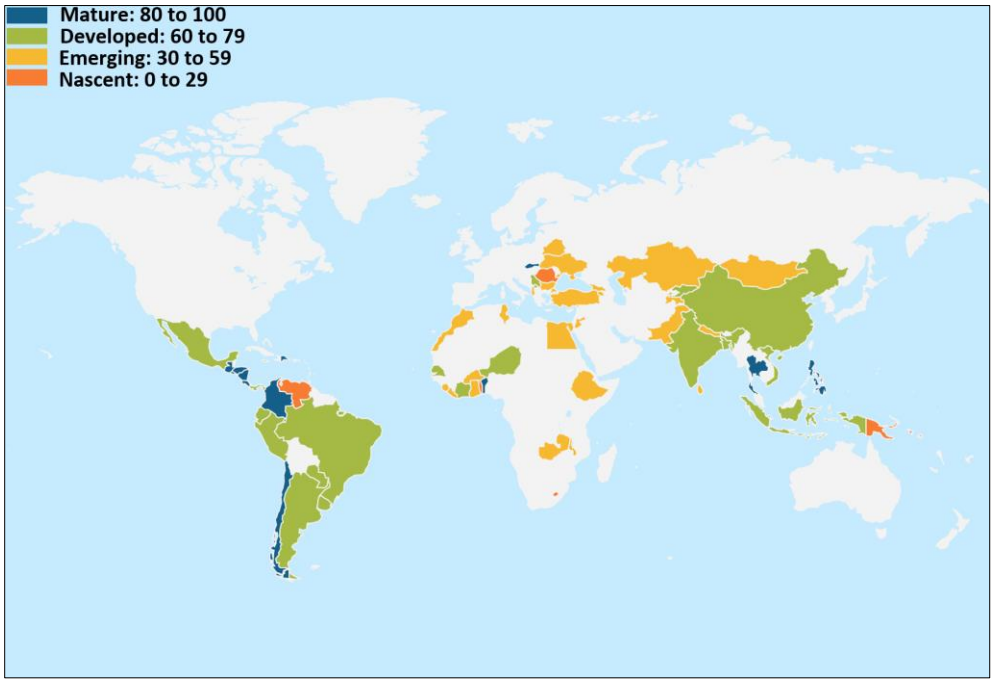


Fig. 1. PPP enabling environment

Source: Economist Intelligence Unit (2019) (white: no data)

PPPs are increasingly popular (Yescombe and Farquharson 2018). Over roughly the last two decades, the world's annual investment in PPPs has approximately quadrupled from $10 billion (2000) to $38 billion (2016) (Yescombe and Farquharson 2018) (Fig. 2). Specifically, the majority, almost 60% to 70% of the total, comes from annual investment in the transportation sector that has similarly quadrupled from $6 billion (2000) to $27 billion (2016) (Yescombe and Farquharson 2018).

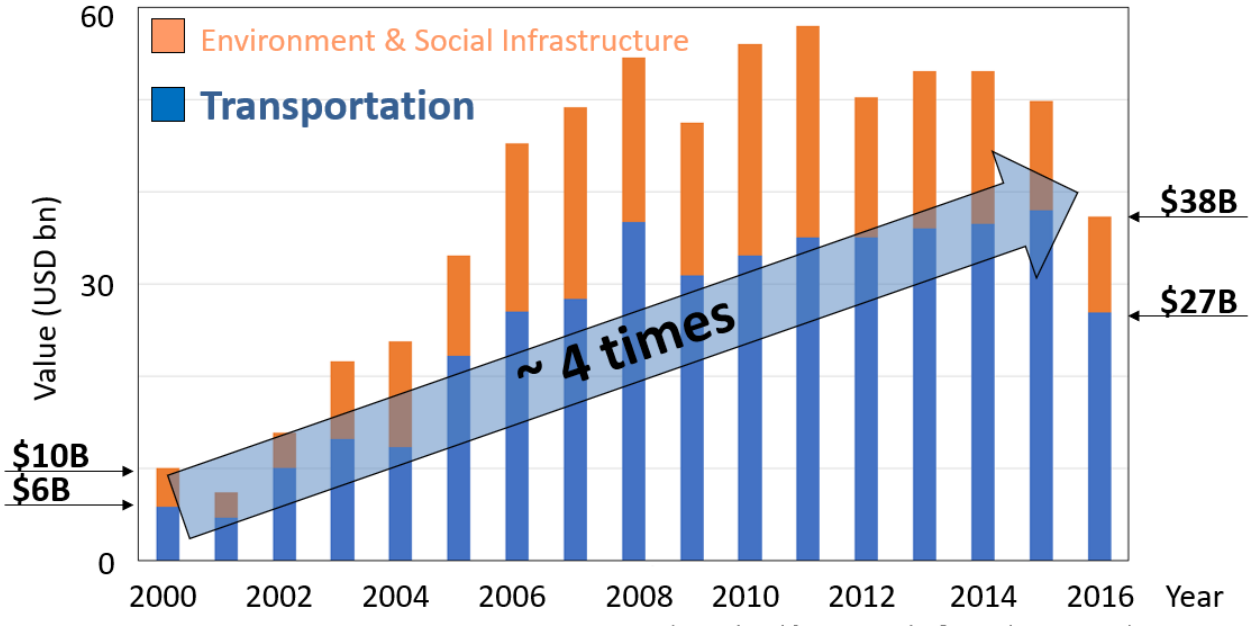


Fig. 2. Global investment amount in PPPs

Source: Adapted from Yescombe and Farquharson (2018).

1.2.2. PPPs' benefits

PPPs are characterized by bundling multiple discrete phases (design, build, finance, operate, and maintain) of project implementation in a single, but decades-long and complex, transaction that involves multiple heterogeneous stakeholders (Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a; Rybnicek et al. 2020). With such characteristics, PPPs can potentially address several limitations of and potentially have advantages over traditional delivery approaches by capitalizing on private sector expertise and capabilities and more actively and efficiently sharing risks and rewards between the public and private sectors (Cheung et al. 2009; Cheung et al. 2010; Chou and Pramudawardhani 2015; Grimsey and Lewis 2002; Li et al. 2005; Liu and Wilkinson 2011; Yescombe and Farquharson 2018). Research has illustrated that many PPP projects are superior in delivery time, cost efficiency, quality, and value for money compared with traditional ones in many countries and many sectors (Atmo et al. 2017; Gopalkrishna and Karnam 2015; Qin et al. 2021; Raisbeck et al. 2010) (Table 1). Further, the importance of PPPs' benefits is ranked higher than

challenges by practitioners, illustrating the suitability and feasibility of PPPs in many countries (Chan et al. 2009; Chan et al. 2010; Cheung et al. 2010; Dolla and Laishram 2019; Ismail 2013; Ismail and Harris 2014) (Fig. 3).

Table 1. Selected studies showing PPP projects' superior performance

Country, sector	Items	PPP projects	Traditional projects
Australia, Infrastructure	Time	3.4% ahead	24% behind
Australia, Infrastructure	Cost	11% more efficient	Less efficient
Indonesia, Power	Quality	Superior	Inferior
India, Roads	Value for money	Superior	Inferior

Source: Atmot et al. (2017); Gopalkrishna and Karnam (2015); Raisbeck et al. (2010).

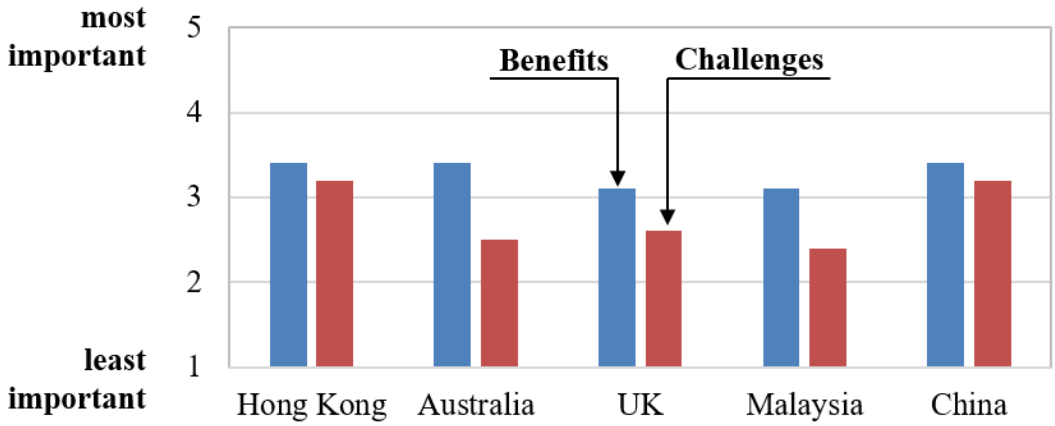


Fig. 3. Practitioners' ranking of importance of PPP benefits vs. challenges

Source: Chan et al. (2010); Cheung et al. (2010); Ismail and Haris (2014); Li (2003).

The major benefit and arguably the initial reason for PPP implementation is that PPPs provide governments a means to address their infrastructure investment gaps given their tight budgets (Soomro and Zhang 2016; Wang et al. 2018; ADB 2019). This is thanks to PPPs' effect of "off-balance-sheet financing", which arguably initiated early PPP projects in Australia, the United Kingdom, and other countries with high national debts (Liu and Wilkinson 2011). In many cases, PPPs lessen the necessity to wait for lengthy public budget arrangements, enabling earlier project delivery for positive social and economic effects. Recognizing the importance of PPPs, governments are keen to promote PPPs (ADB 2019). Additionally, risk transfer is another major benefit (Chan et al. 2009; Cheung et al. 2010; Chou and Pramudawardhani 2015; Dolla and

Laishram 2019; Ismail 2013; Li et al. 2005; Liu and Wilkinson 2011). The public sector can transfer the majority of project lifecycle risks to the private sector. Hence, it will be more likely to cap the final costs and reduce public sector administration costs (Chan et al. 2009; Cheung et al. 2010; Chou and Pramudawardhani 2015; Dolla and Laishram 2019; Ismail 2013; Li et al. 2005; Liu and Wilkinson 2011). Proper risk transfer can incentivize the private sector (Cheung et al. 2018), resulting in favorable results such as facilitating creative and innovative approaches, delivering projects earlier, and improving project quality since the private sector is expected to better manage many risks (Chou and Pramudawardhani 2015; Ismail 2013). Appropriate risk allocation is perceived as a critical success factor (Li et al. 2005; Tariq and Zhang 2021; Zou et al. 2008). Refer to Appendix B for a more comprehensive list of benefits.

1.2.3. High Uncertainty as a Key Challenge of PPPs

PPPs are not free from key barriers or constraints in enabling environments: regulations and contracts, institution, investment and business climate, financial markets, and maturity (Economist Intelligence Unit 2019). Particularly, the lengthy duration of PPPs and the involvement of various stakeholders with differing, and sometimes conflicting, goals and interests results in high *uncertainty* due to the interplay of asymmetric information, incentive misalignment, opportunism, bounded rationality, and transaction costs (Eisenhardt 1989; Hart 2009; Henisz et al. 2012; Khurana et al. 2022; Nguyen D. and Garvin 2019a; Scott 2008; Williamson 1979). Uncertainties include behavioral and environmental uncertainties. Behavioral uncertainties are more associated with or derived from stakeholders' actions and include incentive misalignment, opportunism, and the displaced agency hazard (Chung and Hensher 2016; Gao et al. 2018; Hart 2009; Levitt et al. 2014; Mansor and Rashid 2016). Environmental uncertainties are more linked with or result from changing or unanticipated circumstances (e.g., differing site conditions, unanticipated inflation, pandemic) or expectations (e.g., adoption of new technologies or concepts such as sustainability or CO2 reduction) due to bounded rationality, incomplete contracts, and other reasons (Gao et al. 2018). These uncertainties cause difficulties in PPP implementation in general and PPP contractual design in particular where contracting parties must form a contract ex ante to address ex post uncertainties in the presence of asymmetric information, incentive misalignment, opportunism, bounded rationality, and transaction costs (Eisenhardt 1989; Hart 2009; Henisz et al. 2012; Khurana et al. 2022; Nguyen D. and Garvin 2019a; Scott 2008; Williamson 1979). Contractual issues are cited in almost 60% of the literature concerning risks in PPPs (Rybnicek et al. 2020). Further, 68% of PPP projects in Latin America and the Caribbean suffered from significant contractual issues due to failure to address uncertainties resulting in renegotiations that were often lengthy and costly (Guash 2004; Guasch et al. 2014). Thus, this research is motivated to explore how contracts address uncertainties to enhance contractual designs for better project governance and PPP implementation given the scarcity of the relevant literature. Further discussions on the

key role of contracts in project governance and relevant contract theories guiding contractual designs are described in the next sections to illustrate both the importance and the overall theoretical framework of the research.

1.3. Contracts' key role in project governance

A project can be governed by the interplay of laws, regulations, culture, relations, norms, and contracts (Athias and Saussier 2018; Chung and Hensher 2015; Dewulf et al. 2016; Dewulf and Garvin 2020; Khurana et al. 2022; Henisz et al. 2012; Scott 2008) (Fig. 4). Clearly, contracts form the baseline of project governance since they establish how the public and private sectors should and have to act and interact against anticipated and unanticipated circumstances and expectations as well as corresponding consequences or benefits (Nguyen D. et al. 2018). Contracts can embed practices to trigger relevant regulative, normative, and cognitive mechanisms; these mechanisms promote contractual governance and relational governance in response to uncertainties (Henisz et al. 2012; Khurana et al. 2022; Scott 2008). Ideally, contractual designs should also balance flexibility and rigidity and standardization and contextualization (Athias and Saussier 2018; Chung and Hensher 2015; Dewulf et al. 2016; Domingues and Zlatkovic 2015). Essentially, contracts play a central and binding role in project governance (Khurana 2021; Nguyen D. et al. 2018). For instance, contracts prescribe rights and obligations of contracting parties including risk allocation, decision rights allocation, and penalties and rewards to align incentives and limit opportunism (Gao et al. 2018; Stinchcombe 1990). Contracts also specify routines, procedures, or principles that guide parties' interactions to solve disputes, adjust compensation, negotiate, and deal with events such as force majeure and change in law when such uncertainties materialize, and to enhance relationships and build trust (Gao et al. 2018; Khurana et al. 2022; Stinchcombe 1990). Thus, one of the most fundamental challenges in PPPs is to structure a contract that appropriately copes with uncertainties. The goal is to address asymmetric information, align the goals and interests of contracting parties, and minimize opportunistic behaviors such as moral hazard and hold-up problems (Levitt et al. 2014; Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a) to minimize transaction costs and other challenges.

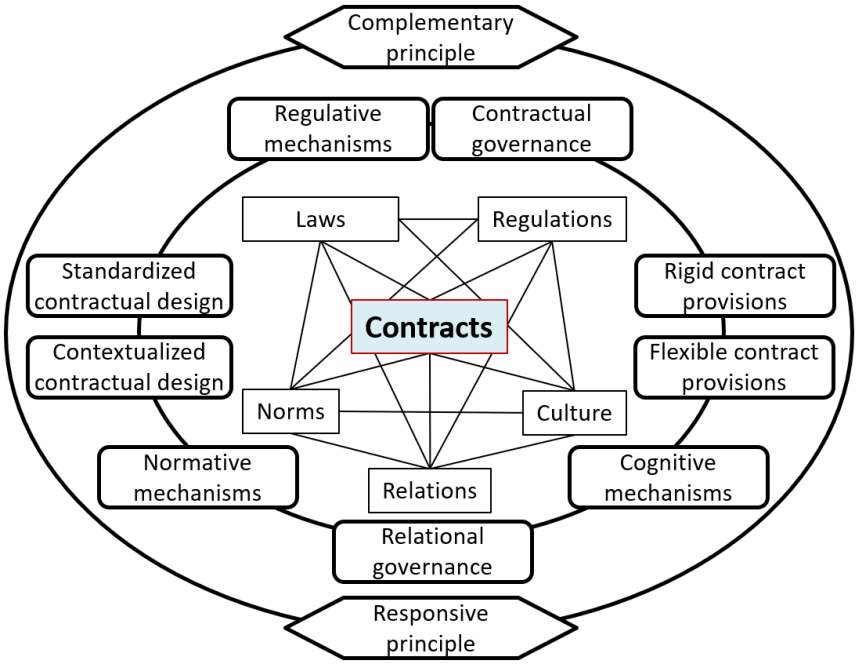


Fig. 4. Contracts play a central and binding role in project governance

(Compiled from Athias and Saussier 2018; Chung and Hensher 2015; Dewulf et al. 2016; Dewulf and Garvin 2020; Khurana et al. 2022; Henisz et al. 2012; Scott 2008)

1.4. Contract theories

Fig. 5 depicts several well-known and interrelated contract theories that underpin and guide contractual designs (Chung and Hensher 2016; Nguyen D. and Garvin 2019a). Under transaction costs economic theory, a principal (e.g., the public sector) can contract out a task (e.g., construction) by hiring an agent (e.g., the private sector) if it is more economical and efficient to do so, taking into account the transaction costs (Williamson 1979). In doing so, the principal *allocates some risks* to the agent. Yet, the principal-agent problem exists as explained by agency theory (Coase 1937; Sappington 1991). Given the differing goals and interests of the agent, the principal would need to properly incentivize and monitor/control the agent's performance as the principal desires (Eisenhardt 1989). However, incomplete contract theory suggests that contracts are unavoidably incomplete due to numerous reasons such as high transaction costs, bounded rationality, and opportunism, among others (Aghion and Holden 2011; Chung and Hensher 2016; Grout and Stevens 2003; Hart 2009; Mansor and Rashid 2016). Contract incompleteness can be addressed via *decisions rights allocation*, i.e., assignment of control rights to the party with the asset's residual right (Hart 2009), to ensure some flexibilities (or adaptabilities) to cope with future uncertainties as suggested by property rights theory (Chung and Hensher 2016). Unlike public procurement or privatization, the hybrid form of PPPs (Benítez-Ávila et al. 2019) makes it harder

to determine absolute residual rights although one might argue that the private sector "owns" the project, at least nominally, given its significant role in design, construction, finance, operation, and maintenance for typically 20 or 30 years (or more) from commercial close to handback. Contract incompleteness can also be addressed by specifying baseline and responsive *lifecycle project management* strategies in contracts. Examples include performance monitoring and measuring protocols, reporting and payment procedures, safeguarding measures for contractual compliance, and, perhaps more importantly, managerial structures and principles that guide parties' interactions to respond to future events by enhancing relationships and building trust for better project outcomes (Gao et al. 2018; Khurana et al. 2022; Stinchcombe 1990).

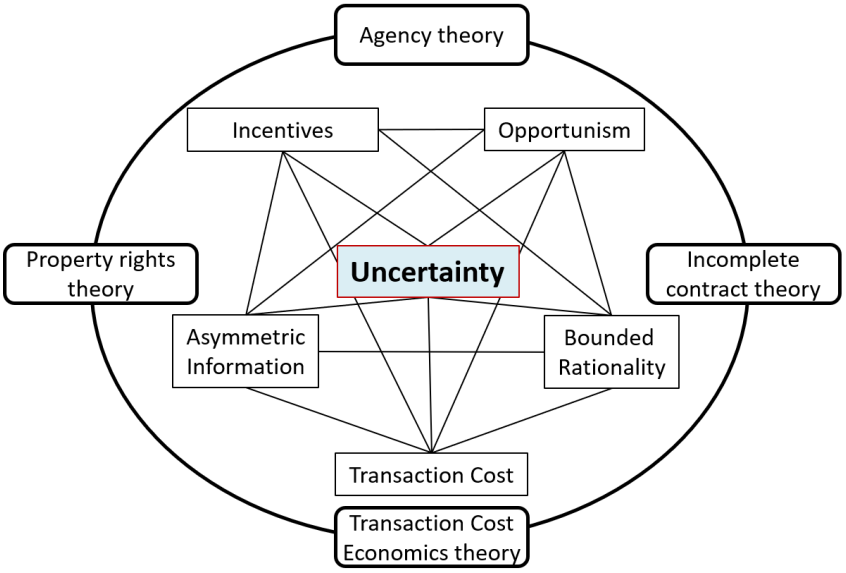


Fig. 5. Contract theories guiding how contracts deal with key challenges of PPPs

(Adapted from Nguyen D. and Garvin 2019) (Compiled from Eisenhardt 1989; Hart 2009; Henisz et al. 2012; Khurana 2021; Scott 2008; Williamson 1979)

1.5. Research focus, context, and approach

1.5.1. Focus - Addressing key issues in contracts

As previously discussed, several key issues must be properly addressed in decades-long PPP contracts to improve project performance under uncertainty, especially since they are also critical success factors (Chou and Pramudawardhani 2015; Dewulf and Garvin 2020; Kim and Thuc 2019; Liu et al. 2015; Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a; Soomro and Zhang 2016; Tariq and Zhang 2021; Zou et al. 2008). First, risks must be thoroughly identified, adequately assessed, and properly allocated following risk allocation principles; proper risk allocation is expected to appropriately incentivize the private sector, driven by profits, to perform as desired by the public sector (Chan et al. 2011; Shrestha et al. 2019). Second, regardless of whether or not a

risk has been transferred or shared, governments, driven by legitimacy and accountability to the general public and higher authorities, generally want to monitor and/or control concessionaire actions in key activities to a certain extent to address asymmetric information and opportunism (Nguyen D. and Garvin 2019a). For instance, even though refinancing, construction, and operation risks are typically borne by the private sector, the public sector may still want to review and give prior approval before refinancing implementation or contracting with contractors or operational service providers to avoid any harmful or unexpected impacts to the project or the public sector's rights and obligations (e.g., unqualified incoming financiers, contractors, or providers) (Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a). Yet, the tension between owner monitoring/control and concessionaire latitude for decision making has been debated given the "nominal" ownership of the private sector in PPPs (Benítez-Ávila et al. 2019). Excessive monitoring/control might hinder the private sector's innovations and expertise, an expected key advantage of PPPs. While risk allocation and decision rights allocation are critical, they are more output-based approaches with little or no focus on learning and improving processes such as relationships and trust between the public and private sectors over a contract's duration (Haponava and Al-Jibouri 2012; Robinson and Scott 2009). As such, lifecycle project management is the third focus of this research since it is rigorously imposed to steer the actions of and interactions between parties over a project's lifecycle to promote contractual and relational governance for better project performance (Khurana et al. 2022; Liu et al. 2015; Meng 2015). The below figure schematically illustrates the three studies implemented.

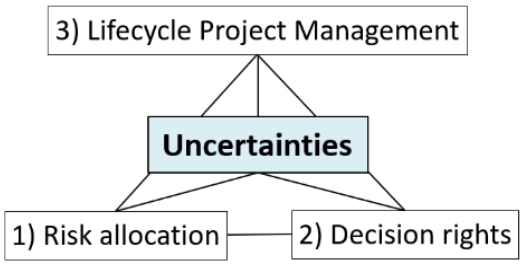


Fig. 6. Three studies exploring how contracts address the three key issues to deal with uncertainties

1.5.2. Context - Analyzing Asia Pacific

Asia Pacific is the target region due to the author's professional interest and the region's dominant share in global population, economy, and PPP activities. The region is the most populous region and the largest regional economy in the world (World Bank 2021a). Home to approximately 52% of the world's population, the region has had a significantly high GDP growth from 1980 to 2020 of 14.8 times, nearly twice the average of the world (World Bank 2021a) (Table 2). In addition, the region's share of the global GDP is estimated to reach 66% by 2040 from 51% in 2015 (Oxford Economist 2017). Moreover, its population has increased 1.7 times from 1980 to 2020 (World

Bank 2021a). The region's infrastructure assessment scores have a median of 68.5, far from the ideal state of 100 (World Economic Forum 2019) (Table 3). The rapidly growing population and economy and the insufficient infrastructure contribute to the region's pressing infrastructure investment needs. Infrastructure investment needs and gaps in Asia Pacific are estimated as $54.3 trillion and $6.3 trillion, respectively, from 2016 to 2040 (Oxford Economist 2017). Thus, in addition to the conventional public delivery methods, the region has actively and continuously implemented PPPs in all key infrastructure sectors such as power, transportation, water, and sewerage, especially since 2006 (ADB 2019; IJ Global 2021; World Bank 2021b). The cumulative investment amount up to 2020 in PPPs is $1.0 trillion (36% of the globe) (IJ Global 2021; World Bank 2021b) (Table 4). For low- and middle-income countries, the region has implemented more than 4,200 projects and $864 billion up to 2020, accounting for approximately 51% and 43% of the world's PPP activity, respectively (World Bank 2021b) (Fig. 7). Regional countries have different levels of development in general and PPPs in particular (ADB 2019) (See 1.5.3 for more details). For instance, an assessment of the PPP enabling environment, i.e., the readiness and capacity to implement sustainable and efficient PPPs, of major regional countries ranges from nascent, emerging, developed, to mature with the majority assessed as emerging or developed (Economist Intelligence Unit 2019).

Table 2. Rapidly growing economy and population in Asia Pacific and the world

	Population (billion)		**GDP (current $, trillion)**	
Year	**Asia Pacific**	**World**	**Asia Pacific**	**World**
1980	2.460	4.433	2.048	11.288
2020	4.209	7.753	30.39	84.578
Ratio	**1.7**	**1.7**	**14.8**	**7.5**

Source: World Bank (2021a).

Table 3. Infrastructure assessment scores in Asia Pacific

Country	**Score**	**Country**	**Score**	**Country**	**Score**
Bangladesh	51	Indonesia	68	Australia	79
Nepal	52	Thailand	68	Taiwan	87
Cambodia	55	India	68	Korea, Rep	92
Pakistan	56	Sri Lanka	69	Japan	93
Mongolia	57	Brunei Darussalam	70	Hong Kong (China)	94
Philippines	58	New Zealand	76	Average	71.3
Lao PDR	59	China	78	**Median**	**68.5**
Vietnam	66	Malaysia	78		

Source: World Economic Forum (2019).

Table 4. Cumulative investment amount in PPPs for Asia Pacific and the world

Region	Income group	Cumulative investment amount ($B)
Asia Pacific	Low and middle-income	863.6
	High-income	153.8
	Sub-total	**1017.4 (36%)**
World	Low and middle-income	2046.1
	High-income	794.2
	Grand total	**2840.3 (100%)**

Source: IJ Global (2021); World Bank (2021b).

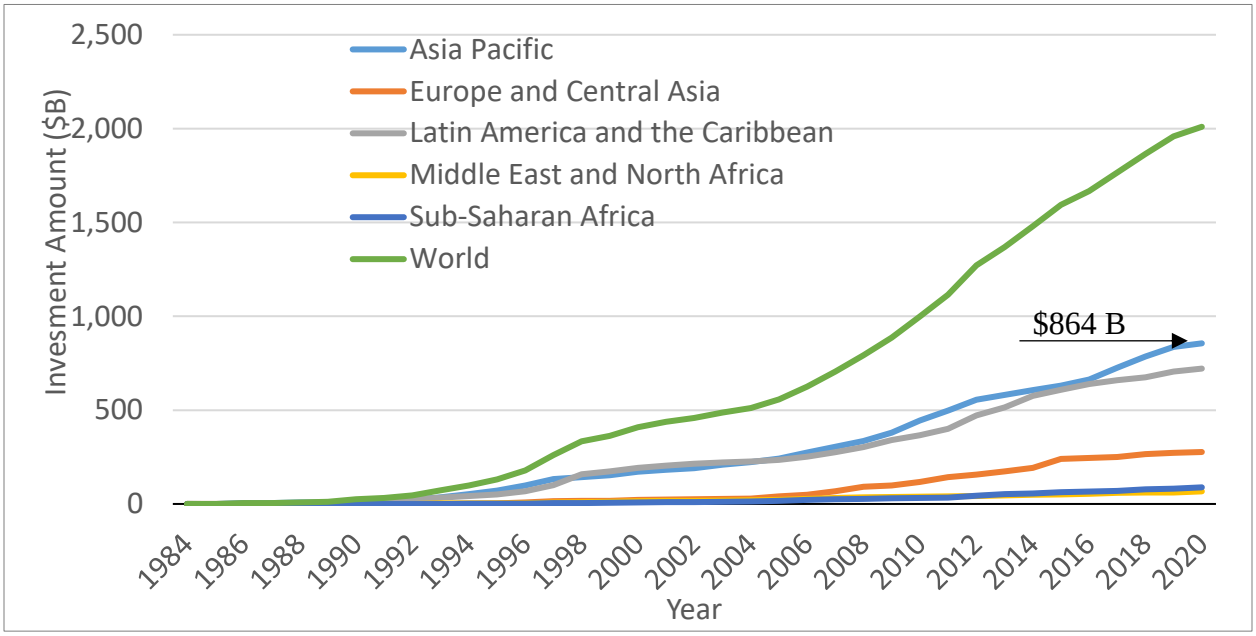


Fig. 7. Cumulative investment amount in PPPs in low- and middle-income countries

Source: World Bank (2021b).

1.5.3. Research approach and structure

The research is motivated to investigate contracts in several countries for two reasons. First, studies conducting contract analysis are relatively scarce compared with other methodologies such as case studies, interviews, or questionnaire surveys (Yu et al. 2018; Nguyen D. et al. 2018; Tallaki and Bracci 2021), not to mention a transnational analysis. Contracts also play a central and binding role in project governance (Nguyen D. et al. 2018; Khurana 2021). Second, a transnational analysis can explore and compare contractual practices in countries with diversified levels of development and other characteristics. The similarities and differences revealed are essential to understand contractual practices and the underlying reasons for contractual choices (Athias and Saussier 2018). Such insights will provide a baseline or reference point for governments and practitioners

to better shape contractual designs and PPP implementation strategies (Chou and Pramudawardhani 2015; Garvin et al. 2011).

Greenfield projects were selected to explore key issues from design to handback. Projects with commercial close from 2006 were selected to reflect this recent and more active period of PPP implementation (World Bank 2021b). Australia (AU), the Philippines (PH), and India (ID) were selected for their significant shares of the region's total investment in PPPs in infrastructure and greenfield highways (more than 41%) (IJ Global 2021; Philippines PPP Center 2021; World Bank 2021b) (Table 5, Table 6). Additionally, the similarities and differences between them and other regional and comparable countries facilitate a transnational study and generalization of findings. They represent various: (a) income groups - high-income countries (Australia) and middle-income countries (the Philippines and India); (b) sub-regions of Asia Pacific - East Asia and Pacific (Australia), South East Asia (the Philippines), and South Asia (India); and (c) PPP environments - more developed PPP environment (Australia) and less developed PPP environment (the Philippines and India) (Table 6). The Philippines and India are similar and Australia is different in many key characteristics (Table 6, Table 7) that might impact contractual designs as suggested by some studies. For instance, the weaker institutional environments in the Philippines and India may favor less risk transfer and more rigidity as suggested by Iossa and Martimort (2015) and Athias and Saussier (2018), respectively. Hence, a comparative analysis between the Philippines or India with Australia may disclose the effect of these characteristics and confirm and reinforce the relevant literature. Further, the similarities between the Philippines and Southeast Asian countries and between India and South Asian countries as well as the differences between the Philippines and India with Australia enhance the possibility of generalizing findings to other regional countries due to the principle of maximum variation sampling (Patton 2015).

Table 5. Cumulative investment amount in infrastructure in key PPP markets in Asia Pacific

Country	**Cumulative investment amount ($B)**	**Ratio to the regional total**
Australia*	103.7	10.2%
China**	249.0	24.5%
India**	278.6	27.4%
Indonesia**	67.3	6.6%
Korea, Rep.*	32.0	3.1%
Malaysia**	56.0	5.5%
Pakistan**	33.0	3.2%
Philippines**	57.7	5.7%
Thailand**	45.6	4.5%
Vietnam**	25.6	2.5%
Sub-total	948.5	93.2%
Regional total	1017.4	100.0%

Source: * = IJ Global (2021); ** = World Bank (2021a).

Note: Sub-total = summary of the listed countries; Australia + Philippines + India = 43.3%.

Table 6. Characteristics of countries significantly contributing to greenfield highway PPPs in the Asia Pacific region

Country	Asia Pacific sub-region	Income group	2020 GNI per capita ($)	Greenfield highway projects		PPP indexes[(1)]					
				Number of project (ratio)	Investment Amount ($B)	Enabling environ.	Maturity	Regula-tions	Institu-tions	Invest.& Busi.Clim	Financing
Australia	**East**	**High**	**53,730**	**35 (9.8%)**	**40.4 (27.3%)**	**92**	**60**	**100**	**100**	**91**	**94**
New Zealand	East	High	42,610	2 (0.6%)	1.4 (1.0%)	n/a	n/a	n/a	n/a	n/a	n/a
Korea	East	High	32,860	4 (1.1%)	1.9 (1.3%)	n/a	n/a	n/a	n/a	n/a	n/a
China	East	Middle	10,610	179 (50.0%)	64.9 (43.9%)	78	80	70	94	78	67
Malaysia	South East	Middle	10,580	17 (4.7%)	6.5 (4.4%)	n/a	n/a	n/a	n/a	n/a	n/a
Thailand	South East	Middle	7,050	4 (1.1%)	2.2 (1.5%)	80	72	87	97	76	58
Indonesia	South East	Middle	3,870	13 (3.6%)	7.1 (4.8%)	59	42	78	53	72	58
Philippines	**South East**	**Middle**	**3,430**	**16 (4.5%)**	**7.6 (5.1%)**	**75**	**58**	**85**	**94**	**81**	**68**
Vietnam	South East	Middle	2,660	3 (0.8%)	0.9 (0.6%)	64	67	61	84	59	50
Bangladesh	South	Middle	2,010	1 (0.3%)	0.9 (0.6%)	66	71	65	90	56	47
India	**South**	**Middle**	**1,900**	**80 (22.3%)**	**13.0 (8.8%)**	**75**	**58**	**77**	**94**	**81**	**73**
Australia, Philippines, India				**131 (36.6%)**	**60.4 (41.1%)**	-					
Total (Region)				**358 (100%)**	**147.1 (100%)**	-					
Grand Total (World)				**729**	**368.9**	-					
Source	World Bank (2021a)			Multiple[(2)]		Economist Intelligence Unit (2014, 2019)					

Note: 1) The PPP indexes include an aggregated index (i.e., enabling environment) and five sub-indexes (i.e., maturity, regulations, institutions, investment & business climate, and financing); 2014 indexes were used for Australia for reference (different investigation methods between 2014 and 2019 are acknowledged). 2) World Bank (2021b) (World Bank PPI Database) for low and middle-income countries except Philippines PPP Center (2021) for the Philippines; IJ Global (2021) (including non-greenfield projects) for Australia, New Zealand, and Korea.

Table 7. Key characteristics of Australia, the Philippines, and India

Characteristics (range)	Australia	Philippines	India
Economic and enabling environment (0~100)			
Competitiveness[1]	79	62	61
Macro-economic stability[1]	100	90	90
Financial system[1]	86	68	69
Country credit ratings[2]	90	61	61
PPP enabling environment	91[3]	75[4]	75[4]
Legal and institutional (0 to 100)			
Rule of Law[5]	80	47	50
Enforcing contract[6]	79	46	41
PPP Regulatory Framework[7]	78	77	71
Cultural[8] (1 to 7)			
Power Distance	4.74	5.44	5.47
Uncertainty Avoidance	4.39	3.89	4.15
Future Orientation	4.09	4.15	4.19

Note: 1) World Economic Forum (2019); 2) Institutional Investor (2016); 3) Economist Intelligence Unit (2014); 4) Economist Intelligence Unit (2019); 5) World Justice Project (2020); 6) World Bank (2020a); 7) World Bank (2020b) (an average of the original four sub-indexes); 8) House et al. (2004), practice scores.

Contracts were collected from official sources for AU (all eight) and ID (44 among 153) (National Highways Authority of India 2021, 2022; New South Wales state 2022; Queensland state 2022; Victoria state 2022) and formal requests to the PH government (five among 12). Unsolicited contracts, representing less than 20% of the total contracts in ID, were not accessible. Twenty contracts were sampled deliberately to cover the widest possible range of key project characteristics to explore the differences and similarities of contracts reflecting key project characteristics (Patton 2015): payment mechanisms, project initiation mechanisms, commercial close, contract amount, and contract duration (Appendix C, Appendix D, Appendix E). The research investigated three key issues concerning risk allocation, decision rights allocation, and project lifecycle management; all three of these areas are viewed as critical to the success of PPPs (Chou and Pramudawardhani 2015; Dewulf and Garvin 2020; Kim and Thuc 2019; Liu et al. 2015; Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a; Soomro and Zhang 2016; Tariq and Zhang 2021; Zou et al. 2008).

As such, the research aims to answer this overarching research question:

How were the practices concerning

1) risk allocation,

2) decision rights allocation, and

3) lifecycle project management

in PPP greenfield highway contracts designed ex ante to deal with ex post uncertainty in Australia, the Philippines, and India?

To address this question, three studies were conducted:

- Study 1) Risk Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India (Chapter 2)
- Study 2) Decision Rights Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India (Chapter 3)
- Study 3) Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India (Chapter 4)

2. Risk Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

2.1. Abstract

Given the complex nature of decades-long public-private partnership (PPP) projects and the principal-agent problem, it is crucial to properly allocate risks to reduce transaction costs and incentivize the private sector for desired performance. Yet, little is known regarding the current practices of comprehensive risk allocation in the context of a country, not to mention a transnational analysis. This research remedied this gap by examining a deliberately sampled data set of 20 contemporary PPP greenfield highway contracts in Australia, the Philippines, and India. The results were internally and externally validated. The results support the risk transfer tenet and risk allocation principle and criteria: most of the 35 key risks investigated were transferred to the private sector or shared; exogenous risks had more consistent allocation and were shared more than endogenous risks. A high level of similarity in risk allocation within each country and across the countries was uncovered regardless of remarkably different characteristics at both project and country levels, suggesting similar practices in regional and comparable countries. Some shift of responsibilities to the private sector in tolled projects (typically longer contract duration) compared with government-paid ones (typically shorter) was observed across the countries. Some limited trends such as less silent or indeterminate provisions and more public risks in recent projects in the Philippines and India, respectively, were observed. The results benefit both practitioners and scholars; the former by facilitating informed decisions regarding market entry, project selection, and design of contracts and policies to reduce transaction costs, especially for evolving markets; the latter by reinforcing the literature concerning risks and establishing a baseline for multiple subsequent meaningful inquiries including examination of the effectiveness of specific risk allocation schemes or the level of standardization uncovered. As such, the research is unique in its scope as one of the first known efforts to conduct a transnational analysis and its broad implications for both theory and practice of PPP risk allocation and contractual designs.

Keywords: Public-private partnerships; Risk allocation; Highways; Contracts; Transnational analysis; Asia Pacific.

2.2. Introduction

Infrastructure is vital to the operation and efficiency of our society, serving basic human needs, improving quality of life, and supporting economic development (Guasch 2004; Keep 2021; Oxford Economics 2017). However, infrastructure deficits are an urgent concern due to rapidly

growing population, increasing economic activities, and deteriorating infrastructure (Carbonara et al. 2015; World Economic Forum 2019). Thus, public-private partnerships (PPPs) have been increasingly adopted in recent decades as a means to address these pressing needs (ADB 2019; Soomro and Zhang 2016; Wang et al. 2018).

PPPs are long-term contractual arrangements in which many risks from design to operation and maintenance are transferred to the private sector (Garvin and Bosso 2008; Nguyen D. et al. 2018). PPPs can address several limitations of public procurement by capitalizing on private sector expertise and more efficiently sharing risks and rewards between the public and private sectors (Li et al. 2005; Cheung et al. 2009; Cheung et al. 2010; Chou and Pramudawardhani 2015; Grimsey and Lewis 2002; Liu and Wilkinson 2011; Yescombe and Farquharson 2018). Many PPP projects are superior in cost efficiency, delivery time, and value for money compared with traditional ones (Gopalkrishna and Karnam 2015; Qin et al. 2021; Raisbeck et al. 2010). PPPs are perceived by numerous stakeholders to have more advantages than disadvantages (Chan et al. 2010; Cheung et al. 2010; Dolla and Laishram 2019; Ismail 2013; Ismail and Harris 2014).

Risk allocation is a critical success factor in PPPs (Chou and Pramudawardhani 2015; Tariq and Zhang 2021; Zhang 2005) given PPPs' long-term and complex nature bundling many project phases and involving numerous heterogeneous stakeholders (Carbonara et al. 2015; Shrestha et al. 2019; Rybnicek et al. 2020). Inappropriate risk allocation results in issues such as high transaction costs, increased disputes, and hinderance of private sector participation (Chou and Pramudawardhani 2015; Nguyen D. et al. 2018). Inappropriate risk allocation is still a common challenge in many countries, globally and regionally (ADB 2019; Hashim et al. 2017; Le et al. 2020; Likhitruangsilp et al. 2017; Nguyen C. and Garvin 2022; Sarvari et al. 2014). This might be because even though the theoretical principles of risk allocation are well established, in reality, *what is normatively considered appropriate* may not align with actual allocation practices given the context and characteristics of a project and the differing risk preferences of key stakeholders (Kakati and Baruah 2016; Quiggin 2004). This paper addresses a part of this critical issue by exploring the practices of risk allocation in Asia Pacific via a transnational analysis. Home to half of the world's population and Gross Domestic Product (GDP), the region has experienced active and continuous PPP implementation over the past three decades to address insufficient infrastructure (ADB 2019; World Bank 2021a; World Economic Forum 2019). The study focuses on Australia (AU), the Philippines (PH), and India (ID) since their different levels of development facilitate a transnational analysis. The scarce or dated literature on risk allocation in the region and these countries further highlights the study's need.

Consequently, the research investigated risk allocation in a deliberately sampled data set of 20 PPP greenfield highway contracts in AU, PH, and ID. Results were internally and externally validated to enhance consistency and reliability. Areas of agreement and variance were parametrically analyzed. Areas for improvement were uncovered to mitigate transaction costs. The findings can be a basis for practitioners, especially in evolving markets and international developers, to enhance relevant policies and contractual designs and consider market entry and project selection (Chou and Pramudawardhani 2015). As such, it can facilitate informed decisions, enhance market access, and narrow perspective gaps between practitioners, potentially encouraging more active involvement in PPPs and resulting in decreased transaction costs, improved contractual designs, and more efficient PPP transactions. The research is unique in its scope as one of the first known efforts to conduct a transnational analysis and its broad implications for both theory and practice of PPP risk allocation and contractual designs.

2.3. Background

Asia Pacific has the world's largest and rapidly growing economy and population; the region has actively and continuously implemented PPPs to address its insufficient infrastructure (Oxford Economist 2017; World Bank 2021a, b; World Economic Forum 2019). The region has observed a significantly high GDP growth from 1980 to 2020 (two times of the world's average) (World Bank 2021a). The region's share of global GDP is estimated to reach 66% by 2040 from 51% in 2015 (Oxford Economist 2017). Moreover, its population has increased 1.7 times from 1980 to 2020, accounting for half of the global population (World Bank 2021a). The infrastructure assessment scores for regional countries have a median of 68.5, far from the ideal state of 100 (World Economic Forum 2019). Infrastructure investment needs and gaps in Asia Pacific are estimated as $54.3 trillion and $6.3 trillion, respectively, from 2016 to 2040 (Oxford Economist 2017). The region invested $1.0 trillion through 2020 (36% of the globe) (World Bank 2021b; IJ Global 2021). For low- and middle-income countries, it has implemented more than 4,200 projects and $864 billion through 2020, accounting for 51% and 43% of the world's activity, respectively (World Bank 2021b). The readiness and capacity to implement sustainable and efficient PPPs of major regional countries range from nascent, emerging, and developed to mature with the majority assessed as emerging or developed (ADB 2019; Economist Intelligence Unit 2019).

2.4. Literature Review

Risk is the effect of uncertainty on objectives (ISO 2018) that can be positive (opportunity) or negative (threat) (PMI 2017). Risk in PPP contracts is more significant than in traditional ones because of bundling and PPPs' long-term and complex nature (Rybnicek et al. 2020). Risk transfer

to the private sector is the underlying foundation of PPPs; the expectation is that the private sector can better manage many risks (Grimsey and Lewis 2002). Risk allocation is a key success factor of PPP projects (Ahmed and Garvin 2022; Grimsey and Lewis 2002; Tariq and Zhang 2021). Thus, risk identification and risk allocation have attracted scholars' attention (Rybnicek et al. 2020).

2.4.1. Risk Identification and Categorization

Risks have been identified and categorized by many scholars (Carbonara et al. 2015; Chan et al. 2011; Patel et al. 2020). Thomas et al. (2003) surveyed and categorized 22 risks in Indian highway projects by criticality: demand and revenue, land acquisition, financial arrangement, construction, cost overrun, debt servicing, and direct political risks were assessed as very critical. Li et al. (2005) revealed and categorized 46 risks in the United Kingdom's transportation and other sectors into groups of macro level (political and government policy, macroeconomic, legal, social, natural), meso level (project selection, finance, residual, design, construction, operation), and micro level (relationship, third party). Macro level risks are exogenous (i.e., external to the project). Meso level and micro level risks are endogenous (i.e., within the project). Roy et al. (2014) identified land acquisition, revenue, permits/approvals, cost overrun, and political risks were the most critical risks in Indian PPP road projects among a total of 22 risks. Overall, the terminology and definition of each risk as well as the overall risk profile were somewhat inconsistent across studies (Le et al. 2019; Nguyen C. and Garvin 2022).

Thus, another avenue of literature focuses on synthesizing identified risks across sectors or countries. Rybnicek et al. (2020) reviewed 159 articles identifying infrastructure PPP risks worldwide in 92 journals. Interestingly, the most common risk was contract risk, which involves opportunistic behaviors involving lengthy and costly negotiation and contract incompleteness; such issues were cited in 59% of the total articles. Le et al. (2019) explored 72 articles about transportation PPPs in 24 developing and developed countries. Their work synthesized and categorized 86 risks according to specific project phases and issues across a project's lifecycle (i.e., commercial, financial, legal, political, economic, force majeure, and other). Nguyen C. and Garvin (2022) synthesized and categorized 39 risks in transportation in the Philippines, Thailand, Malaysia, Indonesia, and Vietnam into general and project-level risks. Appropriate risk allocation was among the most common risks.

2.4.2. Risk allocation

Scholars have emphasized the criticality of proper risk allocation and suggested relevant principles (Zou et al. 2008). Shrestha et al. (2019) summarized three criteria to assign a risk to a particular party. In addition to the common "control" criterion (i.e., the party must be able to control the risk), the "superior risk bearer" criterion suggests that the risk bearer should have superior

information on the risks, especially regarding assessment, efficient allocation, and mitigation. The third criterion concerns incentives: the risk bearer should be adequately incentivized by rewards or penalties to control and manage the risk. Identified risks are mutually discussed and allocated to the public sector, the private sector, or shared. Many factors may affect contracting parties' choices of risk allocation such as differences in risk perceptions (Tallaki and Bracci 2021), knowledge, power, and opportunistic behaviors (Shrestha et al. 2019), or institutional strength (Iossa and Martimort 2015). For instance, Iossa and Martimort (2015) recommended lesser risk transfer in weaker institutional environments by providing numerous examples of government opportunism that hindered private sector participation, resulting in higher risk premiums and lesser risk transfer.

Investigation of risk allocation is an active research topic. First, preferred risk allocation has been explored via practitioner survey in a number of countries (Li et al. 2005; Chan et al. 2010; Chung et al. 2010; Ke et al. 2010). In Indian highways, the preferred allocation for a number of risks differed: the government viewed that the private sector should bear demand and revenue risks, contrasting with the private sector's view (Thomas et al. 2003). Yet, both parties agreed that the public sector should bear land acquisition and political risks while the private sector should bear construction and debt service risks. In the United Kingdom, practitioners generally preferred to allocate exogenous risks to the public sector (political, government stability) or share (force majeure, legislation change), and assign some exogenous risks (inflation, influential economic events) and most endogenous risks (design, residual value, financing, demand, third party, construction, weather, environment, geology) to the private sector (Li et al. 2005). Site availability should be a public risk; lack of commitment should be shared. Four risks (public support, project approval and permits, variation, lack of experience) should be determined case by case. In China, practitioners preferred to allocate political, public opposition, legislation change, and project approval and permits risks to the public sector, allocate 22 risks (e.g., industrial regulation change, environment, interest rate, geology, weather-related) to the private sector, and share 11 risks (e.g., force majeure, excessive variation, financial market, influential economic events) (Ke et al. 2010). In Australian toll road projects, Chung et al. (2010) revealed risks to be allocated to the public sector (political, sovereign, unclear project objectives), the private sector (traffic, finance, design, construction, operation, maintenance), and shared (network, force majeure, media, public support).

Second, the current practices of risk allocation were also investigated in a number of countries mostly through practitioners' perceptions (Tallaki and Bracci 2021). Zou et al. (2008) revealed the allocation of and studied unsuccessful circumstances concerning major risks (financial, public acceptance/rejection, political) in three highway projects in Australia and China with commercial close through 2002. Practitioners should adequately identify, assess, and allocate risks from the

feasibility study stage and explicitly cover risks such as network in contracts. Roy et al. (2014) explored the allocation of five critical risks (land acquisition, revenue, permits/approvals, cost overrun, political) in four highway concession agreements in Indian highway projects with commercial close through 2006. This research suggests a necessity to explore detailed agreements on consequences beyond asking practitioners who is responsible for what risk. For example, while the public sector was responsible for land acquisition, further inquiry uncovered a huge risk to the private sector due to the inadequate level of compensation. However, these studies only targeted a limited number of earlier projects with a focus on practitioners' perceptions. A recent avenue of literature directly explores risk allocation in numerous contemporary contracts. Nguyen D. et al. (2018) is arguably one of the first known attempts to exhaustively capture risk allocation in the context of a country by exploring 21 (of the total 22) contemporary PPP highway contracts in the United States (US) with commercial close through 2016. They confirmed the risk transfer tenet of PPPs; most of the explored 31 risks were either transferred to the private sector or shared. Specific trends of risk allocation across various project characteristics (contract amount, commercial close, jurisdiction, contract duration, highway types) were not confirmed, except for payment mechanism. Subsequently, Castelblanco and Guevara (2020) and Castelblanco et al. (2020) explored six (of the total 17) highway contracts in Colombia and 10 Chilean highway contracts with financial closure through 2019, respectively. The results confirmed the risk transfer tenet and indicated no significant difference in risk allocation between solicited and unsolicited projects, with some exceptions, in both countries.

2.5. Point of Departure

Compared with the literature discussing and revealing risk allocation principles and criteria (e.g., Chan et al. 2011; Lam et al. 2007; Shrestha et al. 2019) or preferred risk allocation (e.g., Li et al. 2005; Chan et al. 2010; Chung et al. 2010; Ke et al. 2010), a smaller body of research focuses on the current practices of risk allocation. Here, recent studies (Castelblanco and Guevara 2020; Castelblanco et al. 2020; Nguyen D. et al. 2018) have contributed to the body of knowledge, most of which explored a limited number of risks or projects or used only interview or survey, by exhaustively capturing risk allocation within a country via exploring large data sets of recent PPP highway contracts in the US, Colombia, and Chile. Yet, these efforts have not covered many countries such as those in Asia Pacific, despite the scale of these markets, not to mention a transnational analysis.

Contracts are a central governance mechanism as the binding agreement between parties (Nguyen D. et al. 2018; Rybnicek et al. 2020; Sinha and Jha 2020). Contracts are a valuable data source, documenting risk allocation within their express provisions (Nguyen D. et al. 2018). Exploring

sampled contracts within a country and beyond can generalize findings, execute comparative studies across projects and countries, and inform a baseline of risk allocation for practitioners to enhance policies and contractual designs for more PPP efficiency. With proper validation, exploring contracts can enable accurate findings with less subjective biases (Nguyen D. et al. 2018; Nguyen D. and Garvin 2019). However, studies investigating actual contract practices (e.g., risk allocation) are limited, mainly focusing on a limited number of contracts or specific contractual provisions. Clearly, an opportunity exists to explore *how risk allocation is similar and different in PPP highway contracts across countries in Asia Pacific*.

2.6. Research Methodology

2.6.1. Overview

Fig. 8 depicts the overall research methodology. Investigation scope was determined to best address the question given the available resources (Saunders et al. 2007). Contracts were collected via official sources and deliberately sampled to represent key project characteristics. Content analysis started by developing a risk matrix via literature review. Then, a pilot study explored a randomly selected contract in Nguyen D. et al. (2018) and three contracts in this investigation to confirm the first author's ability in contract interpretation and establish an analysis rubric. The rubric was refined during internal validation. Internal validation was implemented by comparing and discussing the findings of the first author and two second raters; limited disagreements were subject to a supervisor's (the first author's advisor) final decision. The results were subject to external validation to further enhance reliability. Finally, the similarities and differences were identified via parametric and comparative analysis.

2.6.2. Investigation scope

Greenfield projects were selected to explore risks associated with design and construction. Projects with commercial close from 2006 were selected to reflect this recent and more active period of PPP implementation (World Bank 2021a). Australia (AU), the Philippines (PH), and India (ID) were selected for their significant shares of the region's total investment in PPPs in infrastructure and greenfield highways (over 41%) (IJ Global 2021; Philippines PPP Center 2021; World Bank 2021a). Moreover, the similarities and differences between them and other regional and comparable countries facilitate a transnational study and generalization of findings. For instance, PH and ID are similar and AU is different in many key characteristics (Table 8). Hence, a comparative analysis between ID or PH with AU may disclose the effect of these characteristics. The similarities between PH and Southeast Asian countries and between ID and South Asian countries enhance the possibility of generalizing findings to other regional countries.

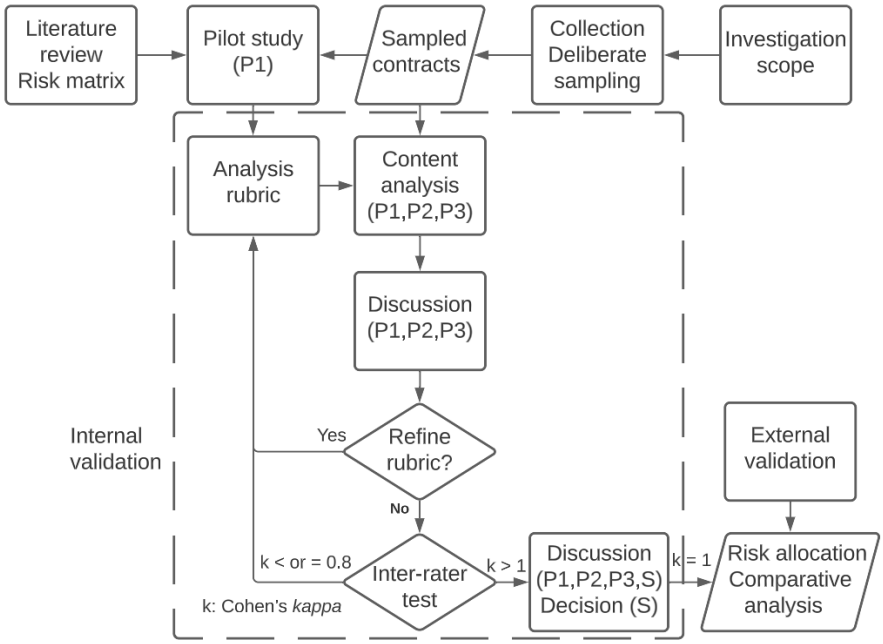


Fig. 8. Research methodology overview

Note: P1 = first author; P2, P3 = second raters; S = supervisor.

Table 8. Key characteristics of Australia, the Philippines, and India

Characteristics (range)	Australia	Philippines	India
Economic and enabling environment (0~100)			
Competitiveness[(1)]	79	62	61
Macro-economic stability[(1)]	100	90	90
Financial system[(1)]	86	68	69
Country credit ratings[(2)]	90	61	61
PPP enabling environment	91[(3)]	75[(4)]	75[(4)]
Legal and institutional (0 to 100)			
Rule of Law[(5)]	80	47	50
Enforcing contract[(6)]	79	46	41
PPP Regulatory Framework[(7)]	78	77	71
Cultural[(8)] (1 to 7)			
Power Distance	4.74	5.44	5.47
Uncertainty Avoidance	4.39	3.89	4.15
Future Orientation	4.09	4.15	4.19

Note: 1) World Economic Forum (2019); 2) Institutional Investor (2016); 3) Economist Intelligence Unit (2014); 4) Economist Intelligence Unit (2019); 5) World Justice Project (2020); 6) World Bank (2020a). 7) World Bank (2020b) (an average of the original four sub-indexes); 8) House et al. (2004), practice scores.

2.6.3. Contract collection and sampling

Contracts were collected from official sources for AU (all eight) and ID (44 among 153) (National Highways Authority of India 2021, 2022; New South Wales state 2022; Queensland state 2022; Victoria state 2022) and formal requests to the PH government (five among 12). Unsolicited contracts, representing less than 20% of the total contracts in ID, were not accessible. Twenty contracts were sampled deliberately to cover the widest possible range of key project characteristics to explore the differences and similarities of contracts reflecting key project characteristics (Patton 2015) (Table 9). Table 10 depicts the characteristics of the sampled contracts for the Philippines to illustrate its general representativeness.

Table 9. Sampled contracts

Project code (Name)	Payment & project initiation mechanisms	Commercial close	Duration (years)	Amount (USD)	
Australia					
AU1 (Airport Link M7)	Tolled Solicited	2008	45	4.8	($B)
AU2 (Peninsula Link)	Government Solicited	2010	27	0.7	($B)
AU8 (West Gate Tunnel)	Tolled Unsolicited	2017	28	6.7	($B)
AU6 (WestConnex M4-M5 Link)	Tolled Solicited	2018	42	1.3	($B)
Philippines					
PH3 (Tarlac-La Union Expressway)	Tolled Solicited	2008	35	722	($M)
PH7 (Daang Hari-SLEX Link Road)	Tolled Solicited	2012	30	46	($M)
PH9 (Cavite-Laguna Expressway)	Tolled Solicited	2015	35	736	($M)
PH10 (NLEX-SLEX Connector Road)	Tolled Unsolicited	2016	37	479	($M)
India					
ID51 (Km16 to Km96.127 (NH-75))	Government Solicited	2006	20	244	($M)
ID65 (Nagpur-Saoner-Betul (NH-69))	Government Solicited	2010	20	336	($M)
ID150 (Delhi-Meerut Package III)	Government Solicited	2016	18	137	($M)
ID111 (Delhi Meerut Package II)	Government Solicited	2017	18	184	($M)
ID142 (Salem to Ulundurpet (NH-68))	Tolled Solicited	2007	25	126	($M)
ID157 (Jaipur-Tonk-Deoli (NH-12))	Tolled Solicited	2009	25	158	($M)
ID19 (Varanasi-Aurangabad (NH-2))	Tolled Solicited	2010	30	345	($M)
ID78 (Chandikhole-Bhubaneshwar (NH-5))	Tolled Solicited	2010	26	140	($M)
ID104 (Delhi-Agra (NH-2))	Tolled Solicited	2010	26	256	($M)
ID147 (Farakka-Raiganj (NH-34))	Tolled Solicited	2010	30	141	($M)
ID117 (Jetpur-Somnath (NH-8D))	Tolled Solicited	2011	30	110	($M)
ID74 (Km510 to Km650.794 (NH-6))	Tolled Solicited	2015	19	251	($M)

Note: Project code will be referenced hereinafter. Government = government-paid projects.

Table 10. Characteristics of the sampled projects and all projects in the Philippines

Characteristics	All projects	Sampled projects
User-paid / government-paid	12 / 0	4 / 0
Solicited / Unsolicited	8 / 4	3 / 1
Commercial close	2006 to 2018	2008 to 2016
Contract duration (years)	25 to 37 (average = 32)	30 to 37 (average = 34)
Contract value ($M)	46 to 937 (average = 551)	46 to 736 (average = 496)

2.6.4. Risk matrix for investigation

A matrix of 35 risks (Table 11) was developed based on the matrix used in Nguyen D. et al. (2018). Four risks (*currency exchange*, *construction*, *revenue*, and *termination due to public sector default*) were added due to their commonality and importance revealed in the relevant literature concerning risks in the region or the target countries (e.g., Nguyen C. and Garvin 2022). Further, *revenue during construction* was excluded since all projects investigated were greenfield ones with no such revenue during construction; *environmental permit* was segregated into two risks corresponding to project-level and construction-related permits.

A pilot study was executed where one contract in Nguyen D. et al. (2018) was randomly selected (I-4 Ultimate project) and explored. The Cohen's *kappa* was 0.9, indicating an almost perfect agreement (Landis and Koch 1977), confirming the principal analyst's ability to perform contract content analysis. Some limited disagreements were noted, but this is not surprising given the complexity of contracts. Moreover, three typical contracts, representing the common characteristics of the projects in AU, PH, and ID, were explored to establish the analysis rubric.

2.6.5. Analysis Rubric

The analysis rubric guided the investigation by indicating the risks' definitions, typical locations of relevant clauses, and related keywords for searching. The rubric was established referencing Nguyen D. et al. (2018) and adjusted taking into account the diverse contractual languages and structures of each contract, especially those of different countries. The rubric was refined during internal validation via enhancing risk definitions and adding keywords related to certain risks.

First, the table of contents and relevant keywords were used to identify relevant contract clauses for each risk in the sampled contracts that had been digitized and text-recognized. The keywords include generic ones – such as interest, cost, and expense for *interest rates* – to capture all possible relevant clauses. Second, the identified languages were coded by using Nvivo. Multiple clauses were interpreted together to assess a risk in many instances, especially in AU. Notes were added to record the rationale for the risk allocation choice. Third, a thorough reading of all provisions of the contracts was executed to confirm the recorded allocation. Special attention was given to

relatively complex and generic provisions such as definitions, representations and warranties, force majeure, termination and default, government material adverse action, payment adjustment, disclaimer, and "all-risks" clauses. Such attention is necessary because, for instance, in many contracts, *currency exchange*, *interest rates*, and *inflation* were not assessed as silent or indeterminate in the absence of other relevant clauses but as private risks due to an all-risks clause where the private sector bears "all risks (and the cost of such risks) in connection with delivering the Project" "except as otherwise expressly provided" (e.g., AU8 Clause 5).

Table 11. Developed risk matrix, incorporating all refinements during internal validation

No.	Risk	Category	Description *(rationale for addition)*
1	Financing	General	Difficulty in finding financial investors and/or favorable terms.
2	Socio-political opposition and protesters		Opposition to the project by government agency or citizens, e.g., political issues, protests, strikes.
3	Change in law		Adoption of any new law, any change in any law or its interpretation by any governmental authority after the effective date. *Law includes codes and standards.*
4	Interest rates		Changes in interest rates.
5	Refinancing		Difficulty in changing a project's current financial structures or agreements to better suit developer or sponsor needs.
6	Inflation		High inflation drives up project costs while reducing the real value of money.
7	*Currency exchange*		*Significant rate fluctuation of and unavailability or limitation of currency exchange. (Common risk (Nguyen C. and Garvin 2022); Major concern of foreign investors and lenders (Chan et al. 2011; Roy et al. 2014)*
8	Design	Construction	Inadequate/defective design impacts may emerge during construction and operation.
9	*Construction*		*Difficulties causing issues such as delays and cost overruns in construction. (Common risk (Chung et al. 2010); Critical risk (Chan et al. 2011)*
10	Right of way (ROW) and easements		Difficulty in acquiring necessary ROW and easements for the project.
11	Additional properties		Difficulty in acquiring properties outside of ROW but necessary for the project.
12	Site geology		Site geology may be different from what is known by the project developer and/or sponsor by commercial close, which can increase costs and cause delays.
13	Environmental risks		Presence of known or unknown *pre-existing* environmental conditions.
14	Archaeology, fossils, or protected species		Discovery of important archaeology, fossils, or endangered species on the project site that may seriously delay construction or require revisions of construction plans.
15	Access and adjustment to utilities		Difficulties in coordinating with third parties during utility adjustments and relocation or permitting.
16	Permits		Difficulties in getting general permits from authorities or third parties.
17	Environmental permits *(Project-level)*		Difficulties in getting *project-level* environmental permits from authorities *(e.g., environmental and endangered species impact assessment)*.

No.	Risk	Category	Description *(rationale for addition)*
18	*Environmental permits (Construction-related)*		*Difficulties in getting construction-related environmental permits from authorities (e.g., hazardous waste, dredging material, batching plant).*
19	Commodity price adjustments		Changes in commodity (i.e., materials, fuel) prices over time.
20	Changes by the public authority		Changes in specifications, scope, or schedule by the public authority after financial close.
21	Performance		Project fails to meet milestones or perform as specified.
22	Usage/demand risk	Operation	Demand may be lower than projections because of factors such as inaccurate traffic forecast, economic recession, or changes in local population/demographics.
23	*Revenue risk*		*Actual revenue differs from projected revenue. (Common risk (Chung et al. 2010; Nguyen C. and Garvin 2022); Critical risk (Roy et al. 2014; Le et al. 2020)*
24	Network		Changes in transportation policies or plans by the public authority (e.g., the building of competing roads) affect usage or performance of the project.
25	*Timely* payment for services		Failure of public authority *or users* to make timely payments (e.g., due to shortage of budgetary funds, *users avoiding toll payments*).
26	Availability and service		Facility fails to meet specified availability or service standards/measures.
27	Operation expenses		Increase in actual operation expenses.
28	Maintenance		Unscheduled maintenance that impairs availability or maintenance costs higher than expected.
29	Latent defects *of the pre-existing facilities*		A fault in the *existing* facility that is not patent, i.e., the fault could not have been discovered ex-ante through reasonable investigation.
30	Transfer		Changes in organizational or financial structure of contracting parties.
31	*Termination due to* project company default		Termination due to project company default.
32	*Termination due to public sector default*		*Termination due to public sector default. (To balance with termination by project company default)*
33	Termination by the public authority*'s decision*		Termination due to the public authority's decision.
34	Force majeure		Unusual events that cause temporary interruption or irrecoverable damages to the project.
35	Residual value		At end of contract duration, the facility (quality or value) does not meet specified requirements.

Note: Italic = a) added risks and rationales of addition to the risk matrix of Nguyen D. et al. (2018), or b) additional explanations for clarification; they do not substantially change the description of the risks initially available in Nguyen D. et al. (2018).

2.6.6. Internal Validation

Internal validation was executed by having two second raters assess the same contract(s) following a process similar to Nguyen D. et al. (2018). Two second raters were provided the risk matrix, keywords, and locations (clauses) of the relevant languages for each specific risk. As such, each rater explored half of the number of contracts in each country to enhance the results' consistency and reliability compared with the case of only one second rater. The principal analyst and the second raters discussed and reached an almost perfect agreement; the Cohen's *kappa* averaged 0.96 with a minimum of 0.81 (Cohen 1960; Landis and Koch 1977). Limited disagreements were further discussed and determined by the supervisor based on the contractual language.

2.6.7. External Validation

The results were triangulated by two means to enhance validity and reliability (Nguyen D. et al. 2018). First, the results were compared with project summaries published online (three projects in AU) or provided by the government upon formal request (one project in PH). These documents were prepared and published by government authorities such as the "Responsible Agency" project directors with the assistance of legal, technical, and other experts and legally required to be finally authored by or declared correct by qualified and experienced legal experts (New South Wales 2017) or were approved by the Treasurer and responsible portfolio minister(s) (Victoria 2016). They have risk allocation tables clearly marking the party responsible and supplementary descriptions in plain language, enabling a straightforward confirmation of the allocation for most risks. Second, the results were further validated using the principle of risk allocation concerning risk sources; exogenous risks, more prone to macro-level factors, are expected to allocate more consistently than endogenous ones (Nguyen D. et al. 2018).

2.7. Risk Allocation Analysis Results

Fig. 9 shows the risk allocation uncovered. Projects are sorted by commercial close in AU and PH and by payment mechanism and commercial close in ID. Risks are sorted by sources. The figure highlights key project characteristics in the leftmost columns and key statistics of risk allocation in the rightmost columns (number of risks by allocation type) and the bottom lines (same or predominant allocation for each risk in each country and across the three countries).

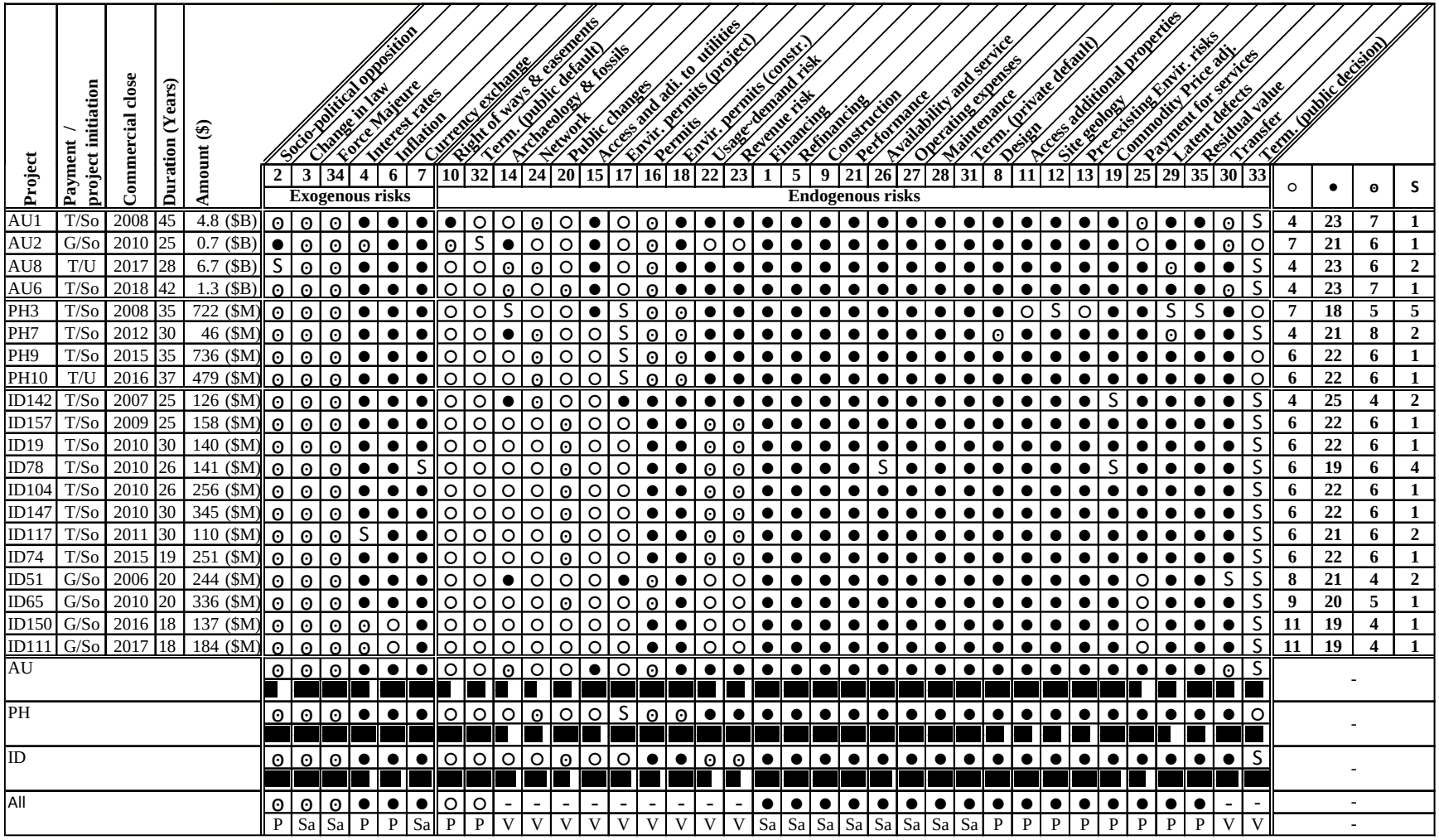


Fig. 9. Risk allocation

Note: ○ = Public; ● = Private; ◉ = Shared; S = Silent or indeterminate; T = Tolled; G = Government-paid; So = Solicited; U = Unsolicited; AU, PH, ID, All = same or predominant allocation in each country or all three countries, respectively; Bars visualize the ratio of contracts having the same or predominant allocation in each country; Sa = same allocation in all contracts across AU, PH, and ID (one variable allocation in ID was allowed given the large number of contracts in ID); P = predominant allocation within each country is the same; V = predominant allocation varies.

2.7.1. Overview of Risk Allocation Results

Fig. 10 shows similar ratios of risk allocation across AU, PH, and ID notwithstanding sources of risks. For all risks, the majority (59%~64%) were borne by the private sector, confirming the risk transfer tenet of PPPs. The remaining risks were borne by the public sector (14%~20%) or shared (15%~19%). Some risks were silent or indeterminate (~6%), requiring improvement or consideration by parties. They mainly concerned *termination by public decision* in most contracts, *environmental permits (construction)* in all four PH contracts, or other risks in earlier contracts such as PH3. Exogenous risks were shared more than endogenous risks (46%~53% vs. 7%~13%). Exogenous risks were only minimally retained by the public sector (0~3%); some were transferred to the private sector (42%~50%); most were shared (46%~53%). Whereas the public sector retained a greater proportion of endogenous risks (16%~24%), the majority were transferred to the private sector (61%~67%), and some were shared (7%~13%).

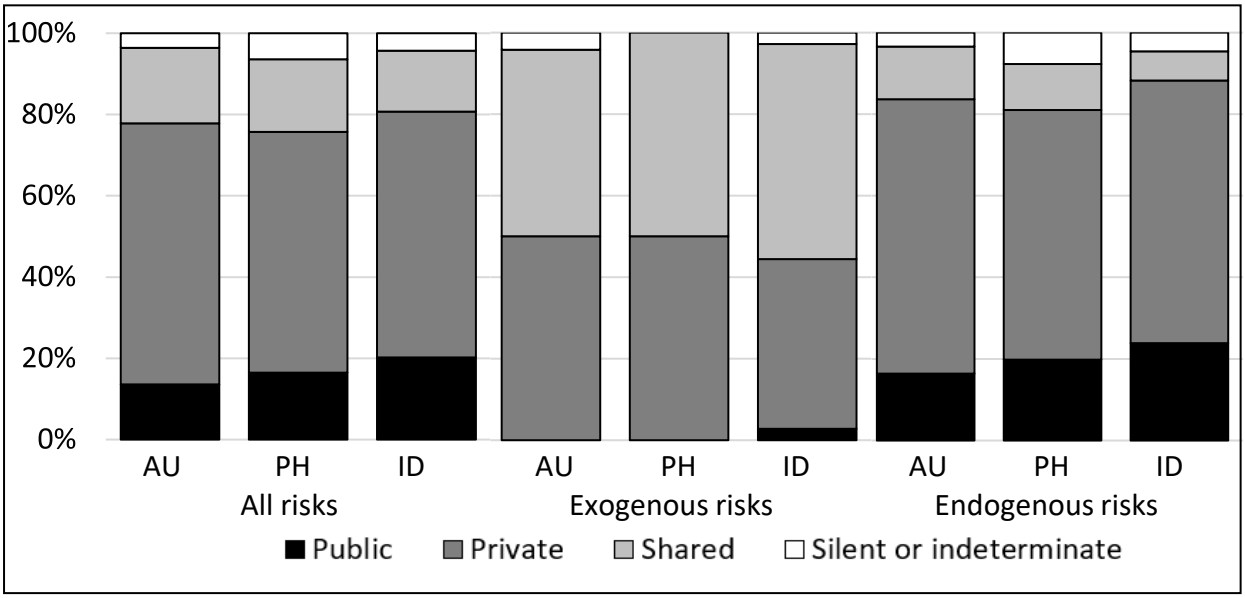


Fig. 10. Risk allocation by sectors

Fig. 11 illustrates most risks (61%~69%) had the same allocation within each country while 31% of risks had the same allocation in all countries; this is regardless of each project's characteristics. For instance, *change in law* and *force majeure* were shared in all contracts across the three countries while *socio-political opposition and protesters* was shared in all contracts in PH and ID but only in half of AU contracts.

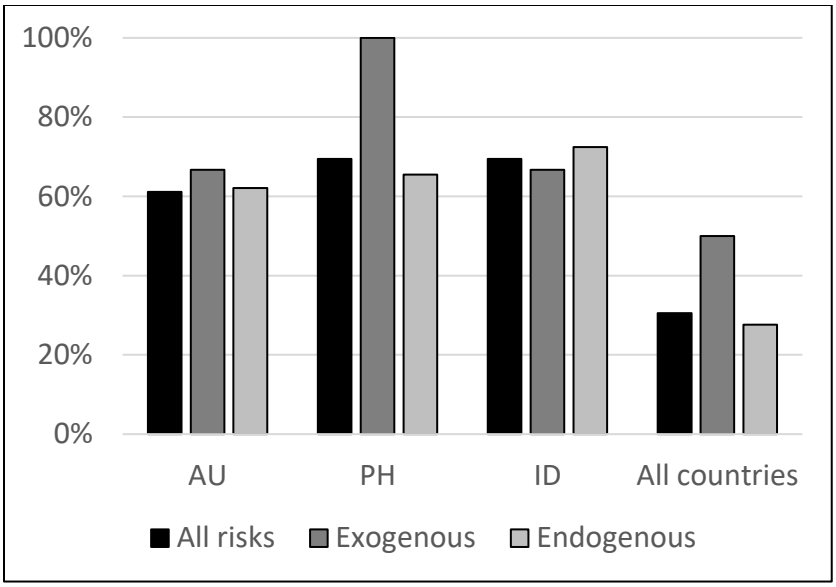


Fig. 11. Ratio of risks having the same allocation in each country and across the three countries

2.7.2. External Validation

The allocation of 15, 21, and 18 risks (total 54) was available in the summaries for AU2, AU8, and AU6, respectively. Nearly perfect alignment (52) was observed, confirming the validity of the results. The two exceptions were carefully reviewed to confirm the allocation decisions reached. For instance, *archaeology, fossils, or protected species* in AU2 was documented as a public risk in the corresponding summary but assessed as a private risk because the contractual language stated: "the State will not be liable … for any Loss which Project Company suffers or incurs as a result of … the discovery of Artefacts" (AU2 Clause 10). "Artefacts" mean any places or objects of "scientific, geological, historical, aesthetic, social, spiritual, cultural or archaeological interest or significance" (AU2 Clause 1). For PH10, the risk allocation matrix provided by the government included 19 risks that matched the allocation derived in this research. As such, while limitations regarding the number of contracts or risks available are acknowledged, this comparison demonstrates the results' trustworthiness. For ID contracts, the predominant allocation uncovered substantially aligned with the primary allocation in Kakati and Baruah (2016) in 17 among the common 19 risks. Two exceptions are *usage/demand* and *revenue* risks that were predominantly shared in this research but primarily allocated to the private sector in Kakati and Baruah (2016).

The ratios of risks having the *same* allocation within each country and across three countries were generally *higher* in exogenous risks (67% to 100% and 50%, respectively) than in endogenous risks (62% to 72% and 28%, respectively) (Fig. 11). Alternatively, the ratios of risks having *variable* allocation across the countries were much *less* in exogenous risks (0%) than endogenous risks (38%) (Table 12, Fig. 12). As such, exogenous risks had more consistent allocation than

endogenous ones. This observation generally aligns with the expectation that exogenous risks are more influenced by macro or global factors and the empirical evidence in the US (Nguyen D. et al. 2018). Overall, the results were extensively confirmed by comparing with project summaries and the principle of risk allocation regarding sources of risks.

2.7.3. Allocation of Exogenous Risks

All exogenous risks have either the same allocation or the same predominant allocation in all contracts across the three countries (Table 12, Fig. 12). No exogenous risks were retained by the public sector: they were private risks (*currency exchange, interest rates, inflation*) or shared (*change in law, force majeure, socio-political opposition and protesters*).

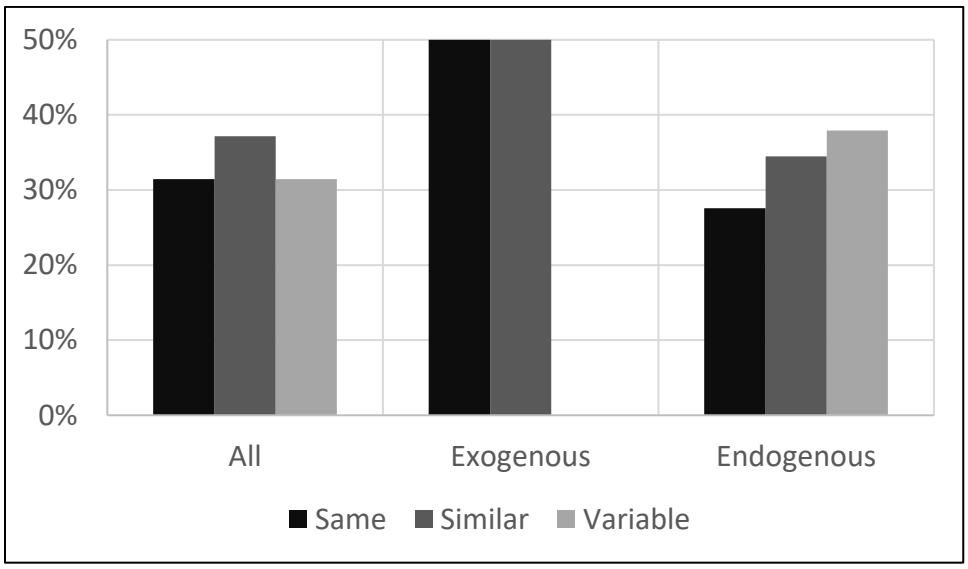


Fig. 12. Ratio of risks having either the same allocation or the same predominant allocation in all contracts across the three countries

a) Shared risks

For *change in law*, negotiation was applied in almost all contracts in AU, PH, and ID. *Change in law* was broken down to project-specific and general ones only in AU. In most contracts in AU, only a project-specific change or a general change in Federal Environmental Law was subject to negotiation in good faith to put the private sector "in the same or similar [financial] position" "were it not for the relevant" change (e.g., AU6 Clauses 1 and 23A). In doing so, parties can vary contract terms, vary the financial or other contributions, and adjust the tolls (e.g., AU6). The private sector bears other general changes in law.

In PH and ID, compensation would be paid if incurred costs increased beyond a threshold amount, regardless of sources of legal changes. The threshold was typically roughly $1.7M incurred within the previous five years in PH or the higher of roughly $0.14M or 0.5% of the annual toll fee in ID.

Similar to AU, negotiation objectives in ID were to "place the Concessionaire in the same financial position" had there been no such Change in Law (e.g., ID19 Clause 41). In PH, the private sector's incurred costs would be compensated, mainly by varying contract conditions and extension of construction schedule or concession period before monetary compensation.

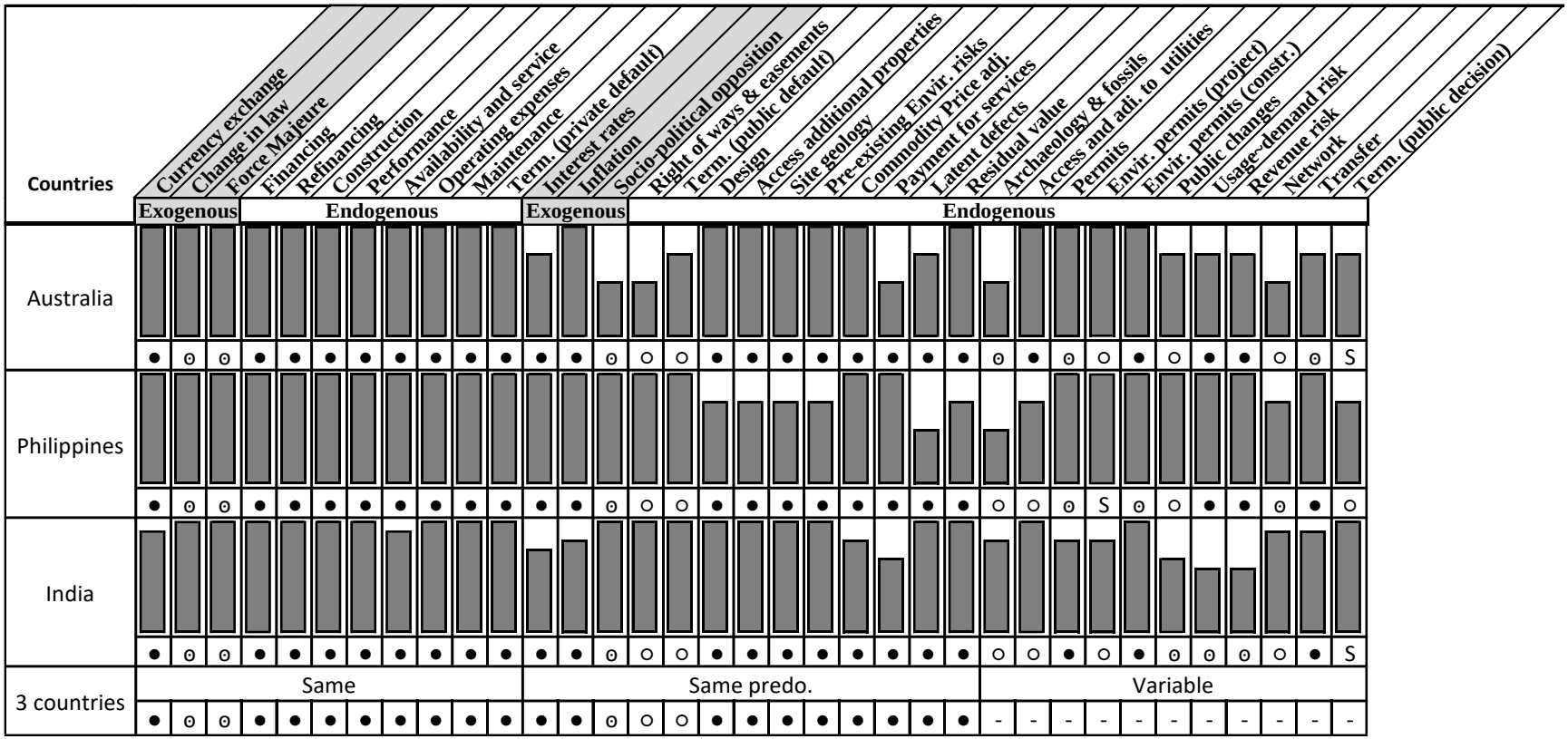
b) Private risks

Currency exchange, *interest rates*, and *inflation* were private risks mainly due to an all-risks clause. *Interest rates* was borne by the private sector in most contracts but silent or indeterminate in ID117 and shared in recent government-paid projects (AU2, ID150, ID111). In ID150 and ID111, the owner would pay the interest rate of the Reserve Bank of India plus 3%. In AU2, the owner would reimburse up to a predefined "Market Disruption Event Cap" amount. *Inflation* was a private risk in all projects but shared in the two recent government-paid projects in ID (ID150, ID111). In the former case, some contracts allowed concessionaires to adjust applicable toll base rates annually subject to typically forty percent of the increase in wholesale price index (e.g., ID119 Schedule R). This was assessed as a private risk but not shared since the general public (not owners) would pay the tolls. In the latter case, "additional costs arising on account of variation in Price Index" shall be payable to concessionaires (e.g., ID111 Clause 23).

2.7.4. Allocation of Endogenous Risks

As expected, endogenous risk allocation varied across projects and countries more than exogenous ones (Table 12, Fig. 12). Variable allocation was observed in 38% of the endogenous risks. Analysis of the allocation of some typical endogenous risks follows. First, among 11 risks having the *same allocation*, some express the nature of PPPs' bundling: the private sector *finances*/*refinances*, *constructs*, *maintains*, and *operates* the project with a long-term commitment to its *performance* and *availability and service*. *Design* risk was a private risk in all projects but shared in PH7 where the concessionaire must follow the provided detailed design for one segment, of which some construction work had been done by other firms.

Table 12. Predominant risk allocation



Note: ○ = Public; ● = Private; ◉ = Shared; S = Silent or indeterminate; Bars visualize the ratio of contracts having the same or predominant allocation in a country; Same = same allocation in all contracts across AU, PH, and ID (one variable allocation in ID was allowed given the large number of contracts in ID); Same predo. = predominant allocation being the same across the countries; Variable = predominant allocation varies.

Second, among 13 risks having the *same predominant allocation, right of ways and easements* was a private risk in all projects except two (AU1, AU2). The following illustrates typical provisions: "the constructive possession of the Site, together with all way leaves, easements, unrestricted access" "shall be provided and granted by the Authority to the Concessionaire" (e.g., ID74 Clause 10 and Definitions). Yet, in AU2, the private sector had to gain access from and to the Land provided by the owner (AU2). Regarding *termination due to public sector default*, in AU, most contracts required owners to pay Debt and Equity Return. In PH, contracts did not provide detailed provisions. For instance, PH3 only required the public sector to "pay just compensation". In ID, most contracts required owners to pay the Debt and 150% of Equity (tolled projects) or the remaining annuity payments (government-paid projects). In all contracts, *timely payment for services* was a private and public risk in tolled and government-paid projects, respectively. The only exception was AU1: the risk was shared by treating toll non-payment as a material adverse event, which would lead to negotiation. For *residual value*, most contracts in AU and PH required joint inspections by owners and concessionaires due to a pre-agreed schedule (e.g., from three years before handing over at six-month intervals) to jointly agree on the maintenance and repair works required to meet pre-agreed handover conditions. Concessionaires must provide securities (escrow account, bond) for remedy obligations. Similar provisions were observed in ID except that an independent engineer would inspect and determine the maintenance and repair works required.

Third, regarding 11 risks that have *varied predominant allocation across three countries*, they generally have similar predominant allocation in two countries and most were shared (8). Contracting parties chose from relatively close allocation options: *archaeology and fossils*, *environmental permits*, *changes by the public authority*, and *network* were either public risks or shared (not private); *permits*, *usage/demand*, *revenue*, and *transfer* were either private risks or shared (not public). Regarding *changes by the public authority*, owners reserved the right to direct a change (in many cases, even pending outcomes of disputes), subject to some restrictions, e.g., not more than 10% of the total project cost (ID142); the private sector will be compensated accordingly. Some AU owners can require concessionaires to conduct a tender for the change. In some cases, the risk became shared because a portion of the savings must be repaid by concessionaires to owners (AU) or concessionaires must bear the costs up to a pre-agreed ceiling amount (ID) such as 0.25% of the Total Project Cost (e.g., ID65 Clause 16). In tolled projects, *usage/demand* and *revenue* risks were private risks (AU, PH) or predominantly shared (ID). In PH, toll rates were adjusted based on consumer price index; this is still assessed as a private risk but not shared since the general public (not owners) will pay the tolls. In ID, concession period will be adjusted, subject to a maximum adjustment period (e.g., 20% of the initial concession

period), proportionally (1.5 times) to the ratio of the difference between the actual traffic with the projected one when such ratio exceeds a certain amount (e.g., 2.5%) (ID74 Clause 29).

An all-risks clause or a disclaimer clause determined numerous risks as private risks in many contracts, including *site geology*, *commodity price adjustment*, *timely payment for services*, and *latent defects for pre-existing facilities*. For instance, *site geology* was a private risk mostly due to an all-risks clause in AU or a disclaimer clause in PH (except PH3) and ID. A disclaimer clause protects owners from concessionaire claims regarding "the accuracy, adequacy, correctness, reliability and/or completeness of any assessment, assumptions, statement or information" provided or implied during bidding and contracting (e.g., ID74 Clause 8). It also states that concessionaires must have satisfactorily evaluated all information, the "Site, existing structures, local conditions, physical qualities of ground, subsoil and geology, traffic volumes", and the "nature and extent of difficulties, risks and hazards" concerning the work (e.g., ID74 Clause 8).

2.7.5. Comparison of Uncovered Predominant Allocation with Preferred Allocation

In AU tolled projects, the uncovered predominant allocation of the "most mentioned" risks as perceived by Australian PPP practitioners (Chung et al. 2010) aligns with their preferred risk allocation for 9 of the total 11 (Table 13). They were either borne by the private sector (*financing*, *design*, *construction*, *usage/demand*, *revenue*, *operation expenses*, *maintenance*) or shared (*network*, *force majeure*). However, *socio-political opposition and protesters* and *change in law* risks were predominantly shared but not borne by the public sector as preferred. In PH, the revealed predominant allocation broadly aligns with the preferred one in 20 among the total 26 risks as published by the government (PH PPP Center 2016). It is noteworthy that the referenced literature did not distinguish preferred risk allocation by each sector.

Table 13. Comparison of uncovered predominant allocation with preferred allocation

No.	Risk	Australia	Philippines
1	Financing	Private (Private)	Private (Private)
2	Socio-political opposition and protesters	*Shared (Public)*	
3	Change in law	*Shared (Public)*	Shared (Shared)
4	Interest rates		Private (Private)
6	Inflation		Private (Private)
7	Currency exchange		Private (Private)
8	Design	Private (Private)	Private (Private)
9	Construction	Private (Private)	
10	Right of way and easements		Public (Public)
12	Site geology		*Private (Shared)*
13	Environmental risks		*Private (Shared)*

No.	Risk	Australia	Philippines
14	Archaeology, fossils, or protected species		*Public (Shared)*
16	Permits		Shared (Shared)
17	Environmental permits (project-level)		*Silent (Public)*
18	Environmental permits (construction-related)		Shared (Shared)
21	Performance		Private (Private)
22	Usage/demand risk (tolled)	Private (Private)	Private (Private)
23	Revenue risk (tolled)	Private (Private)	Private (Private)
24	Network	Shared (Shared)	*Shared (Private)*
26	Availability and service		Private (Private)
27	Operation expenses	Private (Private)	Private (Private)
28	Maintenance	Private (Private)	Private (Private)
29	Latent defects		*Private (Shared)*
30	Transfer		Private (Private)
31	Termination by private default		Private (Private)
32	Termination by public default		Public (Public)
33	Termination by public decision		Public (Public)
34	Force majeure	Shared (Shared)	
35	Residual value		Private (Private)
	Alignment/Total	9/11	20/26
	Public/Private/Shared/Silent (uncovered)	0/7/4/0	4/17/4/1

Note: Allocation in parentheses shows the preferred allocation for AU (Chung et al. 2010) and PH (PH PPP Center 2016); Italic shows misalignment between the practices uncovered and preferred allocation.

2.8. Parametric and Comparative Analysis

2.8.1. Within Each Country

In *Australia*, the government-paid project (AU2, shortest duration of 25 years) had more public risks than the three tolled projects (28~45 years). This is expected since *usage/demand*, *revenue*, *network,* and *timely payment for services* were naturally borne by the public sector in government-paid projects. No remarkable variations were observed regarding other project characteristics. In the *Philippines*, all four projects have relatively similar contract duration (30~37 years) and are tolled projects with the most recent project being unsolicited. The number of silent or indeterminate risks decreased from 5 in the earliest project to 1 in more recent projects, suggesting contractual design evolvement. The numbers of risks allocated to either sector were similar in all contracts. In the smallest project (PH7, $46M), the contracting parties shared some risks (e.g., *design* and *latent defects of pre-existing facilities*) rather than allocating them to either sector as in other contracts. The unsolicited project (PH10) had the same risk allocation as the recent and solicited project (PH9). In *India*, all 12 contracts were solicited with relatively similar contract

amounts. The contract duration (14~30 years) was shorter than in AU and PH. As in AU, more public and fewer private risks were observed in government-paid (shorter duration of 18~20 years) projects compared with tolled (longer duration of 25~30 years, except 19 years for ID74) ones: 8~11 vs. 4~6 and 19~21 vs. 21~25 (except 19 for ID78), respectively. Moreover, while recent tolled projects had similar risk allocation with earlier ones, recent government-paid projects had more public risks and fewer private risks than the earliest one: 6 vs. 4 and 19~22 vs. 25, respectively. This is because risks such as *interest rates* and *inflation*, initially private risks, became public risks. No remarkable variations were observed regarding other characteristics. Overall, contractual language was more similar in PH and ID (especially within the same payment category) than in AU. Thus, the public sector in PH and ID might be more reluctant to changes from the frequently used languages given their accountability and legitimacy responsibilities.

2.8.2. Transnational Analysis

Meaningful transnational variations were found for only two parameters, payment mechanism and contract duration. For *payment mechanism*, more private risks and fewer public risks were observed in tolled projects compared with government-paid projects, except in PH (all tolled projects). This is mainly, and obviously, because *usage/demand*, *revenue*, and *timely payment for services* became private risks in tolled projects. Such shift of responsibilities from owners (or shared) toward concessionaires (or at least shared) in tolled projects was also observed in other risks such as *interest rates* (AU), *inflation* (ID), and *changes by the public authority* (ID). For *contract duration*, in longer contracts with higher uncertainty, concessionaires tended to bear more risks: more private risks, more shared risks, and fewer public risks were observed. This trend was observed in PH (30~37 years) but more clearly in AU and ID where the duration varied more (25~45 years and 18~30 years, respectively). This may suggest that owners might want to limit their exposure to more uncertainties in longer contracts, which were also tolled projects. For *commercial close*, risk allocation in recent projects was generally similar to earlier projects. Minor exceptions include silent or indeterminate risks in PH decreased from 5 to 1, suggesting contractual design evolvement. Another exception involves ID where public risks increased from 4 to 6 and 8 to 11 and private risks decreased from between 22 to 25 to between 19 to 22 and 21 to 19 in tolled and government-paid projects, respectively, indicating more risks being assumed by owners in more recent projects. Yet, this shift of responsibilities was not observed in AU or PH, so it does not constitute a transnational trend. Despite huge differences in *contract amount* ($46M to $6.7B), risk allocation in larger projects showed no evident variations compared with smaller projects across these three countries. Limited trends observed in one country were not common in other countries. For instance, public risks in larger projects decreased in AU from 7 (AU2, $0.7B) to 4 (AU8, $6.7B) but conversely increased in PH from 4 (PH7, $46M) to 6 (PH9, $736M). For

initiation mechanism, no remarkable variations of risk allocation between solicited and unsolicited projects were found, generally aligning with findings in Chile (Castelblanco et al. 2020). For instance, risk allocation in PH9 (solicited) was the same as in PH10 (unsolicited).

2.9. Discussion

Not surprisingly, most risks were borne by the private sector, ranging from finance, design, construction, operation, and maintenance to transfer. This dominant share of private risks is evidence of PPPs' risk transfer tenet (Nguyen D. et al. 2018). Moreover, exogenous risks had more consistent allocation than endogenous ones. This aligns with the principle of risk allocation that exogenous risks are more influenced by macro or global factors and the empirical evidence in the US (Nguyen D. et al. 2018). In addition, the allocation uncovered further illustrates certain well-known risk allocation criteria. For instance, exogenous risks were shared more than endogenous risks. This can be explained by the "control" criterion (Shrestha et al. 2019) since exogenous risks such as *force majeure* and, to some extent, *change in law* and *socio-political opposition and protesters* cannot be controlled by any contracting party and thus were shared. *Design*, *construction*, *operation*, and *maintenance* were private risks since the private sector is expected to have more expertise. Contracts stipulated penalties to incentivize the private sector's *performance* and *availability and service*. Together, these examples demonstrate the three criteria of "control", "superior risk bearer", and "incentivize" (Shrestha et al. 2019). Yet, some exceptions exist, illustrating the influence of other potential reasons such as mitigating instruments, risk preferences, or expectations of future revenue. For example, macroeconomic exogenous risks such as *currency exchange*, *interest rates*, and *inflation* were predominantly private risks perhaps because financial hedging (Yescombe and Farquharson 2018) can help concessionaires control or limit the risks' impact to their affordable extent. While beyond the scope of this paper, investigating potential reasons is an area for future research to enhance understanding of drivers of risk allocation.

Parametric and transnational analysis uncovered a broadly consistent allocation of risks regarding commercial close, contract amount, and the project initiation mechanism. Some shift of more responsibilities to the private sector in tolled projects (typically longer contracts with more uncertainties) compared with government-paid ones (typically shorter contracts) was observed. These findings were observed in all three countries and are generally similar to what was uncovered in the US (except duration) (Nguyen D. et al. 2018) and, to some extent, Chile (Castelblanco et al. 2020). More specifically, the allocation uncovered was generally homogenous in most risks across the three countries investigated despite significant differences between AU, a high-income country and a more developed PPP market, and PH and ID, middle-income countries and less developed PPP markets. In other words, the results suggest that both standardization and

contextualization impacted contractual designs, with the former being more prevalent. For instance, the ratio of risk allocation was broadly similar. Across the three countries, 69% of risks (100% of exogenous risks and 62% of endogenous risks) had the same allocation or the same predominant allocation. In each country, most risks (61%~69%) had the same allocation regardless of project characteristics. The observed similarities suggest a certain level of standardization in each country (especially in PH and ID where not only risk allocation but contractual languages were also relatively homogenous within each country) and perhaps in the region. As such, practitioners have implemented both standardization and contextualization, reinforcing the relevant literature (e.g., Dewulf et al. 2016). Standardization is likely driven by governments' motivations to fulfill transparency, accountability, and legitimacy and to reduce transaction costs via applying standardized contracts while contextualization allows flexibility and adjustment to country-specific and project-specific characteristics (Dewulf et al. 2016; National Highways Authority of India 2021). Ideally, an optimum tension between standardization and contextualization is expected to lower transaction costs. Given the level of standardization uncovered and the extensive adoption of the same standard contractual provisions in ID where different project initiation mechanisms were employed (National Highways Authority of India 2021), the inaccessible unsolicited ID contracts might not be very different from the explored solicited contracts.

Some notable differences compared with the allocation uncovered in the US were observed. For instance, the ratio of shared risks was much more prevalent in greenfield projects in the US (41%) (Nguyen D. et al. 2018) compared with only 19%, 18%, and 15% in AU, PH, and ID, respectively. The risks that were predominantly shared in the US but not in AU, PH, or ID include *inflation*, *right of ways and easements*, *site geology*, *environment*, *access and adjustment to utilities*, *termination by project company default*, and *termination by public decision*. Given the similarity in research approach and especially the country-level similarities (AU with US, PH with ID) and differences (AU and US with PH and ID) in many aspects (e.g., economic and enabling environment, legal and institutional, or cultural), explanations of the uncovered similarities in AU, PH, and ID and the differences with the US are subject to further studies.

Negotiation was similarly adopted for shared risks such as *change in law*, *socio-political opposition and protesters*, and *force majeure* in AU, with a stronger institutional environment, and PH and ID, with weaker institutional environments (see Table 8). This probably suggests a similar level of flexibility in contractual designs in the provisions explored regardless of institutional strength, which does not align with Athias and Saussier's (2018) finding of more flexibility in toll adjustment provisions in stronger institutional environments. Since Athias and Saussier (2018) studied PPP highway contracts with commercial close from 1970 to 2005 mainly in France and

other European countries, the differences in research scope including the number of provisions explored or the region targeted might account for this variance. Perhaps, flexibility should be measured through a more comprehensive set of contract provisions with insightful input from practitioners.

The results have multiple practical implications. First and foremost, the different allocation in key risks can inform developers and governments for market entry, policy shaping, and contractual design decisions. For instance, *revenue risk* was predominantly a private risk in PH and a shared risk in ID. Thus, international developers expecting high revenue might choose PH over ID. Otherwise, they can choose ID over PH if they want to share the risk with the government. Moreover, *termination by the public authority's decision* was predominantly a public risk in PH but silent in ID. Thus, by referencing PH contracts, the ID government might consider establishing a relevant policy or adding necessary language to the currently used model contract and practitioners in ID should address this silent risk to limit future conflicts in prospective and ongoing projects. Further, governments in PH and ID might want to consider adopting more trust-based management practices to attract and incentivize international developers who might be familiar with and favor trust-based management practices as observed in AU. Second, with AU, PH, and ID being considerably different in many facets, the similarities identified may reveal common or more regional practices thanks to the principle of maximum variation sampling (Patton 2015). This finding is important for governments and developers since such information is limited in the literature, especially in evolving regional markets (ADB 2019; Nguyen C. and Garvin 2022). For instance, *change in law* might also be shared in regional and comparable countries such as Vietnam and Indonesia given that the risk was shared in AU, PH, and ID. Third, parties should properly address silent or indeterminate provisions for both existing and prospective contracts to avoid potential conflicts or litigation and reduce transaction costs. Fourth, parties might reference some risk sharing mechanisms uncovered to strategically design contracts. For instance, *change in law* can be shared by further interpreting sources of changes (as observed in AU) or comparing concessionaires' incurred costs with a predefined threshold amount (as observed in PH and ID). Fifth, developers, especially those new to complex PPP contracts, should carefully review their ongoing or prospective contracts for the existence of an all-risks clause and a disclaimer clause since these few sentences push all responsibilities to the private sector except expressly mentioned otherwise and significantly limit concessionaire claims. Overlooking these few sentences might result in huge and unexpected losses. Further, parties should also pay attention to other generic and complex clauses such as definitions, representations and warranties, force majeure, termination and default, government material adverse action, and payment adjustment because these clauses also affect the allocation of many risks. Given the overall complexity of a contract,

contracting parties might use the risk allocation matrix developed for this research to compare their understanding of risk allocation in their contracts. Such a comparison might increase transparency, limit opportunism, and mitigate misunderstandings and eventually lengthy and costly future contractual issues in PPPs and beyond.

The results set the stage for multiple subsequent inquiries to explore: 1) the overall managerial approach beyond risk allocation that is applied to manage and incentivize the private sector's contractual compliance, 2) the effectiveness of specific risk allocation schemes or the level of standardization uncovered, 3) how risks are shared including which sector would significantly bear the risk, and 4) highway PPP contracts in other countries and regions to seek the general pattern of risk allocation with possible causes.

2.10. Conclusion

The major contribution of the research is to comprehensively reveal the baseline of the current practices of risk allocation in large PPP markets, namely, Australia, the Philippines, and India, in an active region in PPPs, i.e., Asia Pacific, via rigorously investigating a deliberately sampled data set of 20 contemporary PPP greenfield highway projects. Consistency and reliability of the results were enhanced by internal and external validation. The implications are numerous, both pragmatic and academic. First and foremost, practitioners considering and implementing PPPs including governments and international developers eagerly in need of prior knowledge of the host country or other countries' PPP implementation can use the results for more informed decisions regarding market entry, project selection, and strategies for bidding documents preparation, contract negotiation, finalization, and implementation. The results uncovered a more prevalent level of standardization in contracts compared with contextualization in each country and across the three countries even though large-scale PPP projects are frequently viewed as one-size-does-not-fit-all transactions with various unique project characteristics. This level of standardization might result from governments' move to publish and implement model PPP contracts for enhanced transparency, accountability, and legitimacy and lowered transaction costs.

Other implications include that practitioners can strategically and systematically mitigate potential contractual conflicts and disputes by addressing typically silent or indeterminate risks during contract negotiation, finalization, and implementation. The results also provided a basis for generalizing the findings for other countries. At least, areas of similarities potentially suggest more regional practices due to the principle of maximum variation sampling. This is a valuable contribution especially given the scarcity of risk allocation literature in many countries. Finally, the research suggested multiple avenues for further important studies.

To sum up, with risk allocation being a critical success factor, the results can be used to improve contractual designs, reduce transaction costs, and potentially further advance PPPs in the region and perhaps beyond to address the pressing infrastructure gaps. The research is unique in its broad scope as one of the first known efforts to conduct a transnational analysis, and its numerous implications for both theory and practice of PPP risk allocation and contractual designs.

3. Decision Rights Allocation in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

3.1. Abstract

Decision rights allocation plays an important role in monitoring and controlling the desired performance of and incentivizing innovations by the private sector in decades-long public-private partnership (PPP) projects. Given the substantial risk transfer to the private sector in the presence of high uncertainty due to the bundling effects and PPPs' complexity, how much should an owner control and manage a PPP project? Agency theory suggests owner control; conversely, property rights theory suggests assigning decision rights to the party with the asset's residual right, who can be argued as the private sector to a considerable extent due to its tremendously significant role in PPPs. Limited research has comprehensively examined the current practices of decision rights allocation. The study investigated the level of owner control in ten key provisions in 20 recent greenfield highway contracts in Australia, the Philippines, and India, deliberately sampled to represent key project characteristics. The results were internally validated to enhance consistency and reliability. The key finding was the dominant level of owner monitoring and control, as suggested by agency theory, regardless of the substantial risk transfer in PPPs. This consistent level of extensive owner control across the countries and projects explored despite their different characteristics suggests a more global practice. Contracts in Australia were more rigid, having distinctive, rigorous, and more detailed requirements with more ex-ante efforts required to reach mutual agreement in numerous provisions. Within a country, more similarities than variances were observed regardless of project characteristics; exceptions include contractual design evolvement over time in some provisions in the Philippines and India. Some silent provisions were identified, indicating areas for improvement or consideration. Practitioners can use the similarities and differences found to make informed decisions regarding contractual design, policy design, and market entry selection to fit their specific context. The findings demonstrate various correlated elements of contractual theories and governance strategies adopted to mitigate challenges. Exploring the gaps with parties' preferences, the effectiveness of the practices revealed, and the reasons affecting parties' contractual choices would further advance the body of knowledge. The research is characterized by its broad scope covering three countries and its numerous implications for both theory and practice of decision rights allocation and contractual design in PPPs.

Keywords: Public-private partnerships; Decision rights; Highways; Contract; Transnational.

3.2. Introduction

Public-private partnerships (PPPs) are increasingly used as a means to provide public services. While PPPs have numerous benefits, they also have challenges (Nguyen C. and Garvin 2022; Yescombe and Farquharson 2018). These challenges are arguably rooted in the high degree of uncertainties that arise from the bundling of multiple project phases and the involvement of numerous heterogeneous stakeholders over a decades-long transaction within a changing environment (Levitt et al. 2014; Yescombe and Farquharson 2018). Scholars have suggested governance strategies to deal with uncertainties such as the three institutional pillars (Henisz et al. 2012; Scott 2008), optimizing flexibility and rigidity (Athias and Saussier 2018; Chung and Hensher 2015), balancing standardization and contextualization (Dewulf et al. 2016), and complementing contractual governance with relational governance (Khurana et al. 2022).

Contracts embed governance strategies to deal with uncertainties, playing a central and binding role in project governance (Khurana 2021; Nguyen D. et al. 2018). For instance, contracts prescribe rights, obligations, procedures, and principles to incentivize parties, limit opportunism, solve disputes, respond to future events, enhance relationships, and build trust (Gao et al. 2018; Khurana et al. 2022; Stinchcombe 1990). Contracts provide the basis to delineate a non-market and project-specific hierarchy to deal with uncertainties (Stinchcombe 1990). Thus, one of the most fundamental challenges in PPPs is to structure a contract that effectively copes with uncertainties to minimize transaction costs and other challenges (Levitt et al. 2014; Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a).

Several well-known and interrelated contract theories lay the foundation of and guide contractual design (Chung and Hensher 2016; Nguyen D. and Garvin 2019a). Agency theory suggests the public sector properly incentivizes, monitors, and controls the private sector's performance given their differing interests (Eisenhardt 1989). However, incomplete contract theory suggests that contracts are unavoidably incomplete due to factors such as high transaction costs, bounded rationality, and opportunism (Aghion and Holden 2011; Chung and Hensher 2016; Grout and Stevens 2003; Hart 2009; Mansor and Rashid 2016). Contract incompleteness can be addressed by allocating decision rights to the party with the asset's residual right, as suggested by property rights theory (Chung and Hensher 2016; Hart 2009). Unlike public procurement or privatization, the hybrid form of PPPs (Benítez-Ávila et al. 2019) makes it harder to determine absolute residual rights although one might argue that the private sector "owns" the project, at least nominally, given its significant role in design, construction (D&C), finance, operation, and maintenance (O&M) for 20 years or more.

Consequently, decision rights become a focal point of governance and contractual design since they delineate the public sector's control of the private sector's actions, performance, and commitment (Nguyen D. and Garvin 2019a). The extent of requirements and enforcement imposed by the public sector as well as the latitude for incentives and innovation granted to the private sector will hinge largely on how decision rights are allocated. However, its current practices in the context of a country and beyond have not been extensively revealed (Nguyen D. and Garvin 2019a). Uncovering the current practices of decision rights allocation in multiple countries advances the body of knowledge by showcasing the baseline of decision rights allocation and setting the stage to explore how and why they are allocated similarly and differently. This knowledge benefits scholars and practitioners: the former in gauging the adoption of governance strategies and contract theories and understanding the potential connection with project-level and country-level characteristics; the latter in strategically designing contracts and policies.

The research explored decision rights allocation in 20 PPP highway contracts in Australia, the Philippines, and India that were deliberately sampled to cover key project characteristics. These countries contribute dominantly to highway PPPs in Asia Pacific, the world's largest regional population, economy, and PPP market (World Bank 2021a, b; IJ Global 2021). Their similar and different country-level factors facilitate a transnational analysis and finding generalization. Results were internally validated to enhance consistency and reliability followed by parametric analysis. The key finding across the countries was that while the private sector might enjoy more freedom in PPPs compared with public procurement, its relationship with the public sector is still close to the traditional owner-contractor one, where the public sector retains decision rights in most key issues.

3.3. Literature Review

PPPs are long-term and complex, resulting in high uncertainty (Rybnicek et al. 2020). Thus, appropriate decision rights allocation to address uncertainties is crucial (Soomro and Zhang 2016). This section discusses the literature concerning: (a) challenges resulting from the bundling of services in PPP projects, (b) contracts' role in project governance and the prevailing contractual theories, and (c) decision rights allocation and other strategies to mitigate major challenges.

3.3.1. Bundling Effects in PPPs

In PPPs, governments generally hire private entities to finance and deliver a project from D&C to O&M (Garvin and Bosso 2008). This bundling of asset creation and service provision has advantages such as appropriate transfer of risks, incentivizing the private sector to provide its expertise to increase a project's value for money (ADB 2019; Valero 2014), and economies of

scope (Dolla and Laishram 2019). Yet, bundling heightens the degree of risks and uncertainties (Rybnicek et al. 2020) in PPPs, especially when challenges such as asymmetric information and bounded rationality exist. For instance, opportunism may occur if the private sector attempts to "cut costs and quality, while staying within the letter of the contract" (Hart 2003 p. 71) by utilizing its superior skills and knowledge, especially when perfect monitoring by governments is impossible. Government opportunism, relatively more prevalent in weaker institutional frameworks, is also a concern. Examples include expropriation, bureaucratic delays in contractual compliance, changes in law, or political violence or interference. Knowing or fearing such behaviors by governments can significantly and negatively affect the cost efficiency of PPPs (Valero 2014). Bundling efficiency can be improved by relying on outcome-based performance measurement rather than building provisions (Eisenhardt 1989) as well as strengthening institutional frameworks (Valero 2014).

3.3.2. Contracts' Role in Project Governance

Project governance is underpinned by three institutional pillars, namely, regulative, normative, and cognitive (Henisz et al. 2012). Contractual governance and relational governance complement each other to deal with uncertainties in PPPs (Khurana et al. 2022). Clearly, contracts are crucial to project governance, forming the foundation and baseline for interactions between parties during anticipated and unanticipated circumstances as well as consequences of non-conformances (Nguyen D. et al. 2018). Specifically, contracts explicitly manifest decision rights allocation. Three related contract theories discussed below guide contractual design (Chung and Hensher 2016).

a) Agency Theory

Agency theory suggests that divergent goals and knowledge of both parties can cause incentive misalignment and opportunistic behaviors, especially in the presence of asymmetric information and bounded rationality (Eisenhardt 1989; Parker and Dressel 2019; Pinz et al. 2018). For instance, the main goals are legitimacy and accountability for governments (Chung and Hensher 2016) and profits for concessionaires. In essence, contracts should specify practices to incentivize (via, e.g., risk transfer, payments), monitor (information revelation), and control (i.e., requesting owner prior approval) concessionaire performance and actions (Cheung et al. 2018; Chung and Hensher 2016; Holmström 1979). A balance point between these mechanisms is recommended since it is practically impossible to monitor and control all concessionaire performance and actions (Eisenhardt 1989). Additionally, governments also need to empower concessionaires to capitalize on their expertise and capabilities (ADB 2019).

b) Transaction Cost Economics Theory

Transaction costs are "the ex-ante costs of drafting, negotiating, and safeguarding an agreement and, more especially, the ex post costs of maladaptation and adjustment that arise when contract execution is misaligned as a result of gaps, errors, omissions, and unanticipated disturbances; the costs of running the economic system" (Williamson 1996 p. 379). Transaction costs are the costs of contracting and implementing a contract, spent to make contracts less incomplete and address incompleteness consequences. PPPs can be viewed as economic transactions where governments seek asset creation and service provision from the private sector to minimize total costs or avoid unbearable large transaction costs (Ho et al. 2015; Nguyen D. and Garvin 2019a).

Transaction costs are expensive due to issues such as bounded rationality, opportunism, asset specificity, and degree and type of uncertainty (Chung and Hensher 2016; Williamson 1979). Bounded rationality, i.e., "intendedly rational [behavior] but only limitedly so" (Simon 1961 p. xxiv), and opportunism, i.e., "calculated efforts to mislead, deceive, obfuscate, and otherwise confuse" (Williamson 1996 p. 378), attribute to "all contractual hazard" (Williamson 1996 p. 12), including an increased transaction cost. Opportunism includes hold-up problems, or shifting of bargaining power, caused by asymmetric information, asset specificity, and other project and institutional characteristics (Ho et al. 2015). Bounded rationality and opportunism, in the presence of contract incompleteness, asymmetric information, and differing perceptions and capabilities, can result in challenges such as moral hazard and adverse selection (Chung and Hensher 2016; Eisenhardt 1989).

c) Incomplete Contract Theory

Incomplete contract theory suggests that in an ideal world (with zero transaction costs and a mutual agreement perfectly addressing all circumstances), contracts should completely cover all risks and uncertainties (Hart 1988). In reality, however, transaction costs are expensive due to inevitably unforeseen contingencies, writing and enforcing contracts, renegotiation, and involving a third party to solve project issues. Thus, contracts (even standardized ones) are unavoidably incomplete, having gaps, missing provisions, misrepresentation, and fraud (Hart 1988; Mansor and Rashid 2016). Given contract incompleteness, parties can strategically allocate decision/control rights to deal with uncertainties (Chung and Hensher 2016; Hart 2009). Such assignment is imperative (Hart 1995) in many scenarios to limit non-conformances and effectively deal with events affecting the project. Owners want to retain control for its legitimacy and accountability (Hart 1995). Likewise, concessionaires want some control in a trade-off with its efficiency and key role in PPPs. Parties can also strategically associate risks and rewards with the changing environment such as linking

compensation with the actual consumer price index, limit ex-ante efforts for ex-post negotiation, and adopt relational mechanisms (Hart 2009; Khurana et al. 2022).

3.3.3. Major Challenges of PPPs and Mitigation Strategies/Mechanisms in Contracts

Table 14 depicts the major challenges pointed out by the contract theories and selective mitigation strategies or mechanisms in PPP contractual design. The complex interaction of these challenges essentially results in uncertainty, the central challenge of designing and executing a PPP contract (Nguyen D. and Garvin 2019a). The table focuses more on contractual design even though it also mentions other governance. The table does not illustrate the complex interplay between challenges and strategies given the scope of this paper.

Table 14. Major challenges of PPPs and selective mitigation strategies or mechanisms

Selective mitigation strategies or mechanisms	Major challenges				
	Asymmetric information	Differing Incentives	Opportunism	Transaction costs	Incomplete contracts
Decision rights allocation		✓	✓	✓	✓
Monitoring and reporting	✓		✓		
Performance-linked payment		✓	✓		
Risk allocation		✓		✓	
Flexible/adaptive contractual designs				✓	✓
Negotiation or renegotiation				✓	✓
Relational governance				✓	✓
Norms or culture				✓	✓
Shadow of the future		✓			
Enhancement of institutional strength			✓	✓	
Key references	[1], [2], [3]	[2], [4]	[5], [6]	[6], [7]	[6], [8]

Note: [1] = Ceric (2012); [2] = Hart (2003); [3] = Schieg (2008); [4] = Cheung et al. (2018); [5] = Ho et al. 2015; [6] = Athias and Saussier (2018); [7] = Dewulf et al. (2016); [8] = Hart (2009).

Decision rights allocation, often used in tandem with monitoring, is a key mechanism to address major challenges (Nguyen D. and Garvin 2019a). While risk allocation mainly refers to the ex-post consequences of uncertainties, decision rights allocation primarily specifies required ex-ante activities and guides parties' ex-post interactions under a pre-agreed degree of control. Thus, risk allocation and decision rights allocation deal with uncertainties in a complementary way. Soomro and Zhang (2016) emphasized the significance of decision rights by demonstrating the effects of inappropriate allocation and implementation. Their work uncovered impacts such as failure to

achieve expected value for money, contract cancellation, and project nationalization in many PPP transportation projects worldwide due to ineffective project monitoring, unreasonable shifting of pricing control to the concessionaire, and vague contract provisions. Thus, how much governments retain control is important to project performance (Hart 2003). Governments may retain decision rights and request information revelation via reports, meetings, and inspections to mitigate asymmetric information and opportunism (Dewatripont and Legros 2005; Ho et al. 2015). Alternatively, following property rights theory, governments may assign control/decision rights to incentivize concessionaires who "own" the project given their significant role in PPPs (Hart 2009).

Contractual flexibility also addresses uncertainties (Domingues and Zlatkovic 2015). Chan (2010) summarized MacNeil's (1974) work and categorized three contract types: classical, neo-classical, and relational. Classical contracts are rigid with little or no emphasis on contingencies. Relational contracts are the most flexible contracts, relying on relationships between parties rather than contractual mechanisms. Neo-classical contracts are among the two extreme contract types. Athias and Saussier (2018) found that institutional strength and contract enforcement encourage more contract flexibility. Appropriate contract flexibility was suggested to balance potential opportunistic behaviors and the probable loss of welfare-enhancing adjustments. Contract flexibility paves the way for multiple strategies or mechanisms such as renegotiation, relational governance, and norms, which can complement contractual governance to reduce transaction costs and other challenges (Brinkerhoff and Brinkerhoff 2011; Caniëls et al. 2012; Chan 2010; Cheung et al. 2018; Ho et al. 2015; Khurana et al. 2022; Nguyen D. and Garvin 2019a).

As previously described, most literature has focused on suggesting how parties *should* manage the project; there is far less research on the *current practices* of decision rights allocation (Nguyen D. and Garvin 2019a). Some studies, however, exist. Foster (2013) examined contractual flexibility in variation, change in law, and government termination clauses in standardized contracts in Australia, India, South Africa, and the United Kingdom. Foster suggested key principles for managing variations by including governments' right to request changes for both asset conditions and service delivery, mechanisms to assess value for money for the change, pre-agreed rates for small and common variations, mechanisms to reflect market prices for large variations, and pre-agreed changes in contracts. Chung and Hensher (2015) compared the contractual and actual practices of risk management in the lifecycle of a motorway project in Australia. They concluded that a robust contractual framework and good relationship skills enabled innovation and effective negotiation in the absence of contractual requirements, contributing to the project's positive outcomes. Nguyen D. and Garvin (2019a) is arguably the first known attempt to exhaustively capture the current practices of decision rights allocation in a country by exploring multiple key provisions in almost all contemporary PPP highway projects in the United States. They found that

the public sector was still in control in many aspects rather than empowering the private sector regardless of project characteristics.

3.4. Point of Departure

Given the inherent and unavoidable high level of complexity and uncertainties in PPP projects (Levitt et al. 2014; Yescombe and Farquharson 2018), the literature suggests contracting parties should employ contract theories and governance strategies/mechanisms for enhanced project outcomes (Athias and Saussier 2018; Chung and Hensher 2015; Henisz et al. 2012; Khurana et al. 2022; Scott 2008). Contractual counterparties negotiate and allocate certain decision rights to delineate the extent governments incentivize, monitor, and control concessionaire performance and actions for better project implementation under uncertainty. Despite its significant role, scholarly efforts to explore the practices of decision rights allocation including confirmation of alignment with relevant theories and strategies/mechanisms are scarce (Nguyen D. and Garvin 2019a) or absent, especially regarding contemporary projects in Asia Pacific. With contracts being a central governance mechanism (Nguyen D. et al. 2018; Rybnicek et al. 2020; Sinha and Jha 2020) and for the potential benefits of a transnational analysis (Garvin et al. 2011), this research remedies the gap by answering the question: *How is decision rights allocation similar and different in PPP highway contracts across countries in Asia Pacific?*

3.5. Research Methodology

The research applied a similar methodology to its companion study (Chapter 2). Greenfield highway projects were selected given their important role in infrastructure and to explore the D&C phases. Asia Pacific and Australia, the Philippines, and India were selected due to their dominant shares (approximately half) in greenfield highway investment in the world and within the region, respectively (World Bank 2021b; IJ Global 2021). The similarities and differences of key characteristics of these countries facilitate a transnational analysis and finding generalization. Contemporary contracts with commercial close from 2006 were collected via the countries' official websites for Australia (all eight) and India (44 among 153) (National Highways Authority of India 2021, 2022; New South Wales state 2022; Queensland state 2022; Victoria state 2022) and formal requests to the Philippine government (five among 12). Twenty contracts were deliberately sampled (Table 15) to represent a wide range of key characteristics to explore the similarities and differences of contracts reflecting key project characteristics (Patton 2015). Key characteristics were summarized using the homepages of the PPP centers or authorities in charge of PPPs in the target countries (India PPP Center 2021; National Highways Authority of India 2021, 2022; New South Wales state 2022; Philippines PPP Center 2021; Queensland state 2022; Victoria state 2022), the World Bank PPI database (World Bank 2021b), information from the

accessible contracts, or other sources such as media (for some inaccessible contracts in India). Table 16 illustrates the general representativeness of sampled contracts in the Philippines.

Table 15. Sampled contracts

Project code (Name)	Payment & project initiation mechanisms	Commercial close	Duration (years)	Amount (USD)	
Australia					
AU1 (Airport Link M7)	Tolled Solicited	2008	45	4.8	($B)
AU2 (Peninsula Link)	Government Solicited	2010	27	0.7	($B)
AU8 (West Gate Tunnel)	Tolled Unsolicited	2017	28	6.7	($B)
AU6 (WestConnex M4-M5 Link)	Tolled Solicited	2018	42	1.3	($B)
Philippines					
PH3 (Tarlac-La Union Expressway)	Tolled Solicited	2008	35	722	($M)
PH7 (Daang Hari-SLEX Link Road)	Tolled Solicited	2012	30	46	($M)
PH9 (Cavite-Laguna Expressway)	Tolled Solicited	2015	35	736	($M)
PH10 (NLEX-SLEX Connector Road)	Tolled Unsolicited	2016	37	479	($M)
India					
ID51 (Km16 to Km96.127 (NH-75))	Government Solicited	2006	20	244	($M)
ID65 (Nagpur-Saoner-Betul (NH-69))	Government Solicited	2010	20	336	($M)
ID150 (Delhi-Meerut Package III)	Government Solicited	2016	18	137	($M)
ID111 (Delhi Meerut Package II)	Government Solicited	2017	18	184	($M)
ID142 (Salem to Ulundurpet (NH-68))	Tolled Solicited	2007	25	126	($M)
ID157 (Jaipur-Tonk-Deoli (NH-12))	Tolled Solicited	2009	25	158	($M)
ID19 (Varanasi-Aurangabad (NH-2))	Tolled Solicited	2010	30	345	($M)
ID78 (Chandikhole-Bhubaneshwar (NH-5))	Tolled Solicited	2010	26	140	($M)
ID104 (Delhi-Agra (NH-2))	Tolled Solicited	2010	26	256	($M)
ID147 (Farakka-Raiganj (NH-34))	Tolled Solicited	2010	30	141	($M)
ID117 (Jetpur-Somnath (NH-8D))	Tolled Solicited	2011	30	110	($M)
ID74 (Km510 to Km650.794 (NH-6))	Tolled Solicited	2015	19	251	($M)

Note: Project code will be referenced hereinafter. Government = government-paid projects.

Table 16. Characteristics of all projects and the sampled ones in the Philippines

Characteristics	**All projects**	**Sampled projects**
Tolled / government-paid	12 / 0	4 / 0
Solicited / Unsolicited	8 / 4	3 / 1
Commercial close	2006 to 2018	2008 to 2016
Contract duration (years)	25 to 37 (average = 32)	30 to 37 (average = 34)
Contract value ($M USD)	46 to 937 (average = 551)	46 to 736 (average = 496)

Contract content analysis started by developing a set of key contractual provisions for exploration (Table 17) by adding three provisions to the set used in Nguyen D. and Garvin (2019a). Perfect agreement with Nguyen D. and Garvin's (2019a) findings in a randomly selected contract from their study was achieved, confirming the first author's ability to interpret contracts. An analysis rubric indicating the definitions, typical locations, and related keywords to effectively search relevant provisions was established and refined during internal validation. Then, a thorough reading of all provisions was executed. Relevant contractual languages were coded using Nvivo. Assessment was based on contractual languages; terms such as "approval by", "consent of", and "absolute discretion of" the public sector indicated *owner control*, "jointly determine", "joint endeavour", and "acceptable to both parties" indicated *shared control*, while "freedom to choose or appoint" by the private sector indicated *private control*.

Finally, results were internally validated by two second raters using the same rubric. Each rater explored half of the number of contracts in each country to further enhance consistency and reliability compared with the case of only one rater. For instance, in some cases, a rater provided new insights, necessitating the need to revisit a particular allocation that had been assessed by the first author and the other rater. The first author and the raters reached agreement in almost all cases. Limited disagreements (2%) were further discussed with a supervisor (the first author's advisor) referencing contract interpretation principles (Bartholomew 2002). While unanimous agreements were generally reached after discussion, in a few cases, the supervisor made a final decision based on the contractual language.

3.6. Analysis Results

The overall results are shown in Table 18. The analysis results for each provision follow.

Table 17. Contract provisions for exploring decision rights allocation

Provisions	***Key* rationales for selection**	***Governance mechanisms***
Project management approach *over lifecycle*	• Indication of service and quality requirements • Indication of enforcement measures associated with concessionaire commitment • Auditing*/monitoring* burden could present information asymmetry issue or dispute potential	• *Monitoring* • *Reporting* • *Control*
Performance measurement	• Advantages of bundling depend on effectiveness of specification and focus on outcomes • Specification structure logically introduces controls or incentives • Auditing*/monitoring* burden could present information asymmetry issue or dispute potential • *Indication of enforcement measures associated with concessionaire commitment*	• *Incentives* • *Monitoring* • *Reputation* • *Control*
Changes by *parties*	• Dictates parties' decision-making rights • May provide levels of control over opportunism	• *Control*
Competing facilities	• Dictates governments' decision-making rights • *Dictates controls or incentives to sustain government commitment*	• *Incentives* • *Control*
Refinancing	• Dictates controls or incentives to sustain concessionaire commitment • *Dictates* controls over concessionaires to preclude activity detrimental to the project	• *Incentives* • *Control*
Transfer	• Dictates controls or incentives to sustain parties' commitment • *Dictates* controls over concessionaires to preclude activities detrimental to the project	• *Incentives* • *Control*
Handback / residual value	• Specification structure logically introduces controls or incentives • Significant, claimable residual value (or perhaps remuneration) may incentivize innovations • Auditing*/monitoring* burden could present information asymmetry issues or dispute potential	• *Incentives* • *Monitoring* • *Control*
Contracting with D&C contractors	• *Key entity significantly affecting project performance* • *Dictates controls over concessionaires to preclude activities detrimental to the project*	• *Control*
Contracting with O&M service providers	• *Key entity significantly affecting project performance* • *Dictates controls over concessionaires to preclude activities detrimental to the project*	• *Control*
Assignment of independent engineer (IE)	• *Key entity monitoring, evaluating performance, and determining conflicts between parties* • *Governments may monitor and impose control over concessionaires via having influence over IEs*	• *Trilateral governance* • *Monitor* • *Control*

Source: Adapted (in italics) from Nguyen D. and Garvin (2019a).

Table 18. Result summary

Provision	Controlled by			Additional comments
	AU (4)	PH (4)	ID (12)	
Project management approach over lifecycle	Owner (4)	Owner (4)	Shared (12)	• Submission, regular update, and compliance with project management plans involving key aspects over lifecycle were required in all contracts. • PH and ID only required D&C program and O&M manual. • These plans were subject to owner approval in AU and PH but only IE comments in ID.
Performance measurement	Owner (4)	Owner (4)	Owner (12)	• Owners periodically inspect or approve regular performance reports submitted by IEs or concessionaires in all contracts. • KPIs were linked with penalties in all contracts but not confirmed in AU6 and PH3. • Compliance with industry best practices was required in all contracts except PH3.
Changes by parties	Owner (4)	Owner (4)	Owner (12)	• While both parties can propose changes, owner approval was required in all cases. • Owner changes were restricted in AU1, AU6, PH7, and ID. • Owners in AU and ID can direct concessionaires to proceed a change pending disputes. • Savings to be returned to owners (all AU contracts) or shared (AU1, AU6) in changes proposed by owners and concessionaires, respectively.
Competing facilities	Owner (3) N/A (1)	Owner (4)	Owner (8) N/A (4)	• Not applicable in government-paid projects. • In all user-paid projects, owners can construct competing facilities, subject to compensation.
Refinancing	Owner (4)	Silent (4)	Owner (10) Shared (1) Silent (1)	• Silent in PH and ID142. Shared in ID51 where the owner would only give comments. • In all other contracts (AU, ID), owner prior consent was required. • Gains were typically shared in AU.
Transfer	Shared (3) Owner (1)	Owner (4)	Owner (12)	• Owner control projects required owner consent; some contracts only mentioned private transfer but not owner transfer; some contracts restricted private transfer during lock-up period. • Shared control projects required mutual consent for both owner transfer and private transfer.
Handback / residual value	Shared (3) Owner (1)	Owner (3) Silent (1)	Shared (12)	• Inspection procedures and monetary securities were required in all contracts except PH3. • Inspection was typically conducted by parties in AU and PH but by IEs in ID. • The extent of defective works was jointly determined by parties (AU1, AU2), IEs (AU8, ID) (thus, shared control), and owners (AU6, PH7, PH9, PH10) (thus, owner control).
Contracting with D&C contractors	Owner (4)	Owner (3) Private (1)	Owner (6) Shared (6)	• AU contracts named D&C Contractors but were silent about replacement. • PH contracts shifted toward owner control over time.

Provision	Controlled by			Additional comments
	AU (4)	PH (4)	ID (12)	
				• Six ID projects required owner approval based on national security and public interest. Six recent user-paid projects were shared control since owners only provide comments to draft D&C contracts.
Contracting with O&M service providers	Owner (4)	Owner (4)	Owner (12)	• Compared with contracting with D&C contractors, owner control was required in all contracts with relatively more detailed and stricter requirements. • Examples include numerous requirements for replacement in AU, nationality restriction or selection from enlisted entities in PH, and owner approval based on national security and public interest in almost all contracts in ID.
Assignment of IE	Shared (2) Owner (2)	Owner (3) Shared (1)	Owner (12)	• Owner control was dominant; owners either appoint or select from enlisted entities. • Shared control projects in AU named IEs; replacement requires joint agreement. • Payment was shared in most contracts but paid by concessionaires in AU6, PH3, and PH10.
All provisions	31/0/8/0/1	33/1/1/5/0	28/0/10/0/1 84/0/31/1/4	Cumulative numbers of provisions assessed as owner/private/shared/silent/not applicable per four (upper line) or 12 contracts (lower line).

Note: AU = Australia; PH = Philippines; ID = India; Silent = Silent or indeterminate; N/A = Not applicable; Numbers in parentheses = Numbers of contracts; KPIs = Key performance indicators; IE = Independent Engineer.

3.6.1. Project management approach over lifecycle

Owner control was observed in Australia (AU) and the Philippines (PH); shared control was observed in India (ID). In *Australia*, concessionaires must submit project plans (e.g., D&C Program, O&M Manual, Environment, Sustainability, Heritage, and Community and Consultation Management plans) to owners to document policies, processes, and procedures on how to comply with requirements. Concessionaires also must submit regular reports (typically monthly) stating "any proposed or likely departure" from the approved plan "together with the reasons" (e.g., AU8 Part B Clause 15). Owners can notify any non-compliance with contract requirements and concessionaires must amend and resubmit accordingly.

In the *Philippines*, unlike AU, only D&C program and O&M Manual were required. O&M Manual must detail compliance with O&M "standards, guidelines, procedures and requirements" (e.g., PH9 Definitions) and was subject to owner approval. It must be submitted four months before construction completion at the latest followed by periodical update (except PH3 which was silent). In *India*, the private sector also must submit D&C program, maintenance manual, and maintenance programme for IE comments regarding compliance with requirements but not for owner approval. Maintenance manual and maintenance programme must comply with contract requirements and good industry practices and be submitted typically 6 months before construction completion.

3.6.2. Performance measurement

This provision was owner control in all projects: performance reports revealing compliance with KPIs (not confirmed in AU6 due to data inaccessibility and silent in PH3) must be submitted regularly (monthly or quarterly) by concessionaires or IEs for owner approval. In addition, owners "shall have the right to inspect and check on the Operation and Maintenance on site" in all contracts (e.g., PH3 Clause 9). Concessionaires were required to create favorable conditions for periodical inspections and audits by IEs or owners.

In *Australia*, AU1 generally demonstrated the KPI system found in AU contracts. For instance, the benchmark for the response time to a tunnel fire was assigned as 6 minutes (AU1). Based on the actual response time, a KPI Point would be assigned from a pre-defined KPI table. These points (negative or positive, as the case may be) will be accumulated at the end of each financial year. Thus, concessionaires were monetarily *incentivized* to perform well to avoid KPI-point-linked penalties. Only in AU1, performing well in a benchmark would offset a poor performance in other benchmarks. Concessionaires had to periodically submit self-evaluated performance reports and corresponding yearly audits by an independent and reputable auditor to owners. Owners can request additional audits by a Performance Auditor, appointed and paid by owners, typically within two or three years afterward. Any inaccuracy found would result in penalties at least equivalent to such inaccuracy and payment of the costs of the Performance Auditor.

In the *Philippines*, the earliest project (PH3) requested the concessionaire to follow the submitted O&M Manual and Procedures as approved by the owner. Other projects adopted a KPI system similar to that in AU in several aspects but might require more *monitoring* efforts by owners, suggesting a stronger degree of owner control. For instance, owners might monitor and inspect on a real-time basis (not ex-post audit as in AU), i.e., "at all times the flow of traffic and level of service", to determine compliance with requirements (e.g., PH7 Clause 12) in PH7, PH9, and PH10. The relevant monitoring costs were not mentioned in PH7 but would be reimbursed, subject to a pre-agreed ceiling amount, by the concessionaire in PH9 and PH10.

In *India*, KPIs involved non-availability in the two earliest government-paid projects (i.e., ID51, ID65) and non-availability and quality non-conformances in other projects. For quality non-conformances, concessionaire performance would be measured and compared with the approved Maintenance Requirements, Maintenance Manual, or Maintenance Program, and a contractually agreed list containing technical criteria and time for remedy. In addition to owner inspection right, an IE, appointed by owners, would review concessionaires' regular performance reports and inspect the project monthly. Concessionaires had to remedy non-compliance as required by IEs (in some instances, within 15 days). If not, owners can remedy and charge the incurred costs (in some instances, plus 20% as penalties).

As such, government *oversight* rights were extensively observed as *monitoring* and *auditing* were mechanisms used to measure performance, either by owners or IEs. Monetary compensation was applied to *incentivize* concessionaires to arrange necessary resources to meet the requirements (e.g., shorten the response time to a fire in AU1).

3.6.3. Changes by parties

Owner approval was required in all contracts. In *Australia*, for *changes by owner*, restrictions were imposed differently across projects. It ranged from no restrictions (AU2, AU8), not allowing the owner to propose any change that adversely affects "the use, patronage or capacity of the Tollroad" or "the ability to levy Tolls" (AU1 Clause 22), to not obliging the concessionaire to carry out any change that will amend the Toll Calculation Schedule (AU6). Owners can notice its intended change and concessionaires would propose necessary adjustments in costs and schedule. Parties would make efforts to agree on costs and schedule. If not, parties may "refer the matter for dispute resolution" (e.g., AU1 Clause 22). Yet, owners can direct concessionaires to implement a change, "pending outcome of dispute resolution process" (e.g., AU1 Clause 22), anytime regardless of whether change procedures had been followed or not. This directive right might serve as a contingent condition for owners in cases such as emergencies concerning public safety and interest. Owners might request concessionaires to conduct a tender for the additional work or services as per its procurement principles in earlier projects (AU1, AU2); this was not found in other contracts in AU, PH, or ID. All savings must be reimbursed to owners. For *changes by*

concessionaires, concessionaires must notice a change with detailed particulars for owner approval (in its absolute discretion). A portion of savings (25% or 50%) must be reimbursed to owners in AU1 and AU6.

In the *Philippines*, for *changes by owner*, all contracts explicitly expressed the right and power of owners to request and approve changes as well as necessary procedures to follow. Restrictions and directive right were not mentioned, except PH7 where change was restricted to complying with a change in law or ensuring public safety. No description of savings or requirement for tender implementation was found. *Changes by concessionaires* were mentioned only in PH9 and PH10; change procedures and requirement for owner approval were similar to the case of changes by owners. All contracts were silent about savings.

Unlike AU and PH, contracts in *India* defined change only as additional work or services; only the earliest two projects (ID51, ID142) also included scope omission. *Changes by owner* were restricted; the private sector can "nullify" any change causing cumulative costs up to a certain percentage (typically 5% within the recent three years or cumulatively 20%) of the contract amount. Similar to AU, directive right was stipulated. No requirement for tender implementation or saving reimbursement was found. *Changes by concessionaires* can be proposed for "providing safer and improved services", subject to owner approval (in its "absolute discretion" in many instances) (e.g., ID104 Clause 16). Changes by concessionaire were not mentioned in the earliest two projects (ID51, ID142). All contracts were silent about savings.

3.6.4. Competing facilities

Not applicable in government-paid projects, this provision was owner control in all tolled projects. AU contracts explicitly expressed that the public sector could "construct new tollroads, freeways and other roads; extend, alter or upgrade existing tollroads, freeways and other roads" (e.g., AU1 Clause 21). Similarly, PH contracts only had a general clause regarding government adverse actions, which implied the right to construct competing facilities without restriction. Conversely, ID owners were restricted from constructing competing roads shorter than 120% of the project's length within a certain number of years (ranging from 8 to 22 years, averaging 13 years). This is to limit competition and thus reduce the impact on project revenue. Yet, this restriction typically shall not apply if "the average traffic … in any year exceeds 90%" of the designed capacity (e.g., ID19 Clause 6.3). Restricted or not, concessionaires would be subject to compensation in all countries should governments construct competing roads. Yet, compensation varied regarding the degree of completeness and timing of transaction costs (Nguyen D. and Garvin 2019b). For instance, in AU, parties would negotiate ex-post in good faith or calculate the compensation amount per the pre-agreed Change Compensation Schedule in the earliest project or the more recent projects, respectively. PH contracts stipulated ex-post negotiation in good faith without

describing any compensation calculation methods. In ID, a compensation amount or an extension of tolling period can be calculated as pre-agreed.

3.6.5. Refinancing

Owner control was observed in AU and almost all contracts in ID; interestingly, PH contracts were silent on this provision. In *Australia*, prior owner consent was required in all cases, regardless of whether the refinancing would affect the public sector or not. AU1, AU2, and AU6 mentioned owner judgment criteria. Typical criteria include the refinancing being on an arm's length basis and not worsening owner obligations and debt payment schedule nor downgrading the special purpose vehicle's rating. Only AU6 restricted pre-completion refinancing. Refinancing gains will be kept by the concessionaire in AU8 but shared in AU1 (50%), AU6 (50%), and AU2 (redacted). In *India*, owner consent was only required *if* such refinancing "has, or may have, the effect of imposing or increasing any financial liability or obligation on the Authority" (e.g., ID74 Clause 5) (except ID142 where the contract was silent). Yet, the determination to qualify for the case can be implied to remain in the owner's hands since no further detailed judgment criteria were provided.

3.6.6. Transfer

The provision was typically assessed as shared control in AU and owner control in PH and ID. For *change in control or ownership*, owner consent was required in all cases but not vice versa; many contracts did not even mention the case of owner change. Some contracts (e.g., PH9, PH10) restricted concessionaire change during lock-up period (typically three years after construction completion). This is understandable since owners naturally want the highway to be constructed and opened to traffic without having to deal with any major change in project structure. For *transfer of obligations or interests*, asymmetric restrictions were similarly observed since only concessionaires were required to obtain owner consent (in its absolute discretion) before assigning any rights, benefits, or obligations but not vice versa.

3.6.7. Handback / Residual value

All contracts (except PH3) required concessionaires to comply with handback conditions and provide securities via an escrow account, performance security, or handover bond; PH3 was silent on the provision. These securities would serve as a monetary *incentive* so that concessionaires would remedy defects to owner satisfaction. Otherwise, owners can "get the same repaired or rectified at the Concessionaire's risk and cost" (e.g., ID147 Clause 37) and recover the costs incurred from the relevant escrow account, bond, or security. The residual amount would be reimbursed to concessionaires after a certain period post handback (e.g., typically one year in many ID contracts). A predetermined inspection schedule before handback (e.g., typically from two or three years in AU but much shorter in ID) was specified to investigate possible defects.

Variances were found regarding who would inspect and judge compliance with handback conditions. In *Australia*, contracting parties in AU1 and AU2 would jointly inspect and "use their reasonable endeavours to agree on… the maintenance and repair work required" (e.g., AU1 Clause 43). In AU8, a Handover Reviewer, jointly appointed by and paid for, would inspect with the parties and determine the extent of remedy work. In AU6, while both parties would jointly inspect, the owner would determine the extent of remedy work. In the *Philippines*, owners would determine the extent of remedy work after joint inspections except PH3 was silent. In *India*, all contracts required inspection and determination by IEs.

3.6.8. Contracting with D&C contractors

In *Australia*, interestingly, the contracts already named D&C contractors but were silent on the procedures and right of control in case of replacement. In the *Philippines*, owner control projects (PH7, PH10) enlisted eligible entities and stated that concessionaires "may undertake Construction only through any of the entities" (e.g., PH7 Clause 10). Another owner control project (PH9) allowed the engagement of contractors outside the enlisted entities, subject to owner prior consent. Conversely, the concessionaire in the earliest project was "free to choose and appoint" (PH3 Clause 6). In *India*, six projects exhibited owner control and required concessionaires to obtain owner prior consent but provided no detailed judgment criteria except "national security and public interest", a somewhat vague expression likely giving freedom of control to owners. In shared control projects (six recent user-paid projects having commercial close from 2010), owners would only review draft D&C contracts and provide comments that are "limited to ensuring compliance" with contract requirements (e.g., ID74 Clause 5).

3.6.9. Contracting with O&M service providers

Compared with the case of D&C contractors, more asymmetric owner control was observed since concessionaires were required to achieve owner consent prior to appointment or replacement in all contracts. In *Australia*, except in AU6 where the O&M contract must be in a form acceptable to the owner and on terms specified in a contractual exhibit, O&M service providers had already been named in AU1, AU2, and AU8. In AU1 and AU2, owner judgment criteria for replacement included "sufficient expertise and ability", "sufficiently high financial and commercial standing", terms and conditions aligning with the contracts and being reasonable to owners, and no associated costs to be borne by owners (e.g., AU2 Clauses 19 and 24). In the *Philippines*, the appointment of O&M service providers was typically subject to restrictions concerning the nationality of executing officers (Filipino citizens) and selection from enlisted entities. In *India*, almost all contracts (except the earliest two projects, i.e., ID51, ID142) emphasized owners' decisions as "final, conclusive, and binding" without providing the basis of such decision except a general term of "national security and public interest" (e.g., ID117 Clause 5).

3.6.10. Assignment of Independent Engineer

All contracts mentioned the key role of IEs in inspecting and certifying compliance with contractual requirements, verifying payment claims, issuing certificates such as Performance Certificate, and determining conflicts between parties. Parties are contractually required to follow IE decisions or refer the matter to a dispute review board or arbitration in case of disagreement. IEs are theoretically independent and impartial; yet, the party that hired an IE might have influence over its decisions.

In *Australia*, two shared control projects (AU1, AU6) already named IEs in the contracts and required replacement to be mutually acceptable. Two owner control projects (AU2, AU8) required owner approval before appointment. IEs would be paid equally by parties (AU1, AU8), paid by the owner and reimbursed (a redacted portion) by the concessionaire (AU2), or paid by the concessionaire (AU6). In the *Philippines*, IEs were selected by concessionaires and subject to final approval by owners from a list provided by owners (PH3, PH7), appointed by the owner (PH9), or jointly appointed (PH10). The costs of IEs were borne by concessionaires (PH3, PH10) or equally shared (PH7, PH9). In *India*, IEs were appointed by owners. Asymmetric owner control in ID was further observed since owners could "in its discretion terminate the appointment of the Independent Engineer at any time" (e.g., ID78 Clause 23) but concessionaires could only propose to change or refer the matter to a dispute review board. The costs of IEs were paid by owners; concessionaires would reimburse half of the costs. Thus, while *project management approach over lifecycle* and *handback/residual value* were subject to IEs' comments or determination and thus were assessed as shared control in all ID contracts, one might argue that this shared control might shift toward owner control given owners' control in appointing and paying IEs. This is one of the key reasons to add *assignment of IE* to the set of provisions used in Nguyen D. and Garvin (2019a).

3.7. Discussion

The results demonstrate extensive owner monitoring and control in the countries investigated. This observation aligns with what was observed in the United States by Nguyen D. and Garvin (2019a) and suggests the influence of agency theory. From the private sector perspective, even though it plays a much more significant role in PPP projects than in traditional ones, it is still subject to a similar extent of owner control in the key provisions explored. The private sector generally can only enjoy "proposal rights" in several provisions. For instance, the private sector can propose a design or a construction method that best capitalizes on their skills and resources. The public sector retains decision rights to limit "surprises" and control the desired project performance, which is understandably driven by motivations such as accountability and legitimacy (Dewulf and Garvin 2020; Nguyen D. and Garvin 2019a). This extensive extent of government control, however, may pose considerable burdens in the public sector given the tremendous complexities and uncertainties

of a PPP transaction. Thus, the capability of public authorities and public managers is crucial even though independent engineers were typically involved to help monitor the project and resolve conflicts between parties. This might be particular concern for the private sector, especially international developers in evolving markets. Further, the extensive level of owner control does not support the argument interpreting property rights theory in PPPs that the private sector might have many decision rights given their significant role in the decades-long duration of a PPP project. Another potential way to interpret property rights theory involves public authorities' obligations to create a public asset and deliver public services for the general public and to satisfy higher authorities. They also must operate and maintain the project for several decades after handback. Thus, such obligations and "residual rights" may induce the public sector to impose owner control. While owner control can theoretically address asymmetric information and concessionaire opportunism, a question should be raised concerning how to limit government opportunism since the private sector, especially after investing in and constructing the project, might be placed in a vulnerable situation due to government-led hold-up problems (Ho et al. 2015). So, finding an optimal balance between owner control and concessionaire empowerment to capitalize on the private sector's expertise and address opportunism from both parties remains an unresolved challenge.

The results provide evidence of and support for contractual theories and governance strategies/mechanisms in PPPs. Government efforts to address the principal-agent problem were uncovered. Contracts incentivized the private sector's compliance with contractual requirements by imposing penalties as observed in the KPI regime. The KPI regime resembles regulative governance (Henisz et al. 2012; Scott 2008). Compliance with industry best practices was required in almost all contracts as evidence of reliance on norms or customs. IEs (trilateral governance) (Henisz et al. 2012; Khurana 2021; Williamson 1979) monitored performance in all contracts.

One interesting observation involves more *ex-ante* efforts or rigidity in AU contracts compared with PH and ID in numerous provisions. For instance, contracts in AU specified distinctive, rigorous, and more detailed procedures and requirements for project plans and refinancing, KPI benchmarks, pre-determined inspection schedules, and handback conditions. Further, D&C contractors, O&M service providers, and IEs in AU were typically already named in most AU contracts but would be selected after commercial close in PH and ID. This observation is contrary to the findings of Athias and Saussier (2018) that contracts tend to be more flexible in stronger institutional circumstances. AU contracts tend to be more rigid in many aspects while AU has stronger institutional strength (Table 19). While further research is necessary to uncover the reasons for the difference, potential explanations may include different research scope since Athias and Saussier (2018) only investigated toll adjustment in projects (mainly French) with commercial close from 1970 to 2005. One way to interpret the observation is that explicit contract provisions

might be more likely to be included when they are more likely to be enforced in stronger institutional circumstances (Zhou and Poppo 2010).

Table 19. Institutional strength

Index (weakest ~ strongest)	Australia	Philippines	India
Enforcing contract [(1)] (0 ~ 100)	79	46	41
Rule of law [(2)] (-2.5 ~ 2.5)	1.77	-0.45	0.00
Regulatory quality [(2)] (-2.5 ~ 2.5)	1.80	-0.09	-0.35

Note: 1) World Bank (2020a); 2) Kaufmann and Kraay (2022) (average from 2006 to 2018).

While similarities or standardization were observed in most cases within a country, some variance or contextualization was also uncovered. Yet, these variances might not constitute noticeable transnational trends regarding project characteristics. That is to say, some trends were observed particularly in a certain country but not commonly in other countries. For instance, PH contracts shifted from private control to owner control but ID tolled projects shifted from owner control to shared control over time in contracting with D&C contractors. Earlier contracts in ID applied penalties that linked to non-availability hours only; yet, recent projects in the country adopted a more rigorous regime involving more KPIs for quality. However, such trends over time were not observed in AU. It is noteworthy that the investigated AU contracts might already capture the mature period of PPP development in the country when contractual designs might have already evolved. Moreover, the numbers of owner control or shared control provisions were not significantly associated with the level of market development; while the AU is generally more developed compared to PH and ID, range of provisions under owner control was 28 to 33, with the number in AU (31) in the middle of this range. However, the number of shared control provisions differed in PH (two) and ID (10).

The research has several important pragmatic implications. For instance, silent or indeterminate provisions (i.e., refinancing in PH and ID142, handback/residual value in PH3) should be addressed to avoid conflicts or debates. Silent or not, parties can review the similarities and differences uncovered to strategically adopt and select from the practices revealed in this research to fit their contexts. For example, parties in the Philippines where *refinancing* was silent can negotiate based on and select from the practices used in contracts in Australia and India to require owner consent in all cases (Australia) or only if the refinancing would affect the public sector (India). Parties in the Philippines and India (where the following practices used in Australia were not mentioned) can (a) add criteria such as the refinancing being on an arm's length basis and not worsening owner obligations and debt payment schedule nor downgrading the special purpose vehicle's rating, (b) restrict pre-completion refinancing, and (c) decide reimbursement of refinancing gains, subject to their needs. Additionally, practitioners can consider the results as a whole against the reality of their implementation. While *project management approach over*

lifecycle and *handback/residual value* were assessed as shared in India because they were subject to IEs' comment or determination but not owner approval, further attention should be paid to *assignment of IE*. IEs in India were appointed, paid first, and terminated "in its discretion" "at any time" by the government. Thus, the government might have influence over IEs' decisions in reality so these provisions might actually shift toward owner control. Given the huge role and responsibilities of IEs (Chapter 4), this example highlights the need for revisiting the payment and assignment structure of IEs to more properly adopt trilateral governance (i.e., IEs) for the whole project's benefit.

Unsolicited contracts in ID, representing approximately 20% of the total contracts in ID, were not accessible. These unsolicited contracts, however, may not be very different from the investigated solicited contracts given the extensive adoption of the same standardized contracts in the country in different project initiation mechanisms (National Highways Authority of India 2021).

The research suggests several potential studies including investigation of the differences between the current practices and each counterparty's preferences. Another avenue is to get practitioners' insights to explore the possible reasons underlying the similarities and differences revealed. Yet, the foremost question of interest is whether, and to what extent, the current practices revealed contribute or relate to project outcomes when more and more projects reach the end of their concession periods. An in-depth investigation tracking the effectiveness of these mechanisms similar to Chung and Hensher (2015) is expected to study and confirm the efficacy of the revealed level of control and standardization. This research sets the stage for such future studies.

3.8. Conclusion

Decades-long PPP contracts face challenges such as opportunism and asymmetric information resulting from PPPs' complexity and uncertainties. The research investigated the mechanisms guiding the tension of interaction between governments and concessionaires to cope with unavoidable uncertainties in ten key provisions in a deliberately sampled data set of 20 greenfield highway PPP contracts in Australia, the Philippines, and India. While the companion study (Chapter 2) revealed that governments transfer the majority of risks to the hands of concessionaires, governments, driven by accountability and responsibilities against the public and higher authorities, do not keep much distance from regular and close project governance. Our first and striking conclusion was that even though the private sector plays a tremendously more significant role in PPPs than in traditional projects, the private sector is still subject to extensive monitoring and control by the public sector in most key issues as suggested by agency theory. Second, project-level and country-level characteristics did not relate considerably to the extent of owner control or shared control provisions revealed. Thus, the principle of maximum variation sampling suggests a more global practice (Patton 2015): the relationship between both sectors in

PPPs is still close to the traditional owner-contractor one and far from an equal “partnership”. Third, practitioners can use the findings to strategically adjust and consider their contractual design, policy design, and contract implementation toward an optimal balance between owner control and concessionaire empowerment that fits their specific context. Finally, the contractual practices investigated can be seen as a combination of various elements of contractual theories and governance strategies/mechanisms such as contractual governance and relational governance, flexibility and rigidity, and standardization and contextualization. These elements correlate and complement to limit opportunism, asymmetric information, and other challenges through monitoring (information revelation), control, incentive alignment, and other mechanisms. As such, the research is characterized by its broad scope as one of the first known efforts to conduct a transnational analysis regarding decision rights allocation and its numerous implications for both theory and practice of decision rights allocation in particular and contractual designs in general.

4. Adaptive Lifecycle Project Management Practices in Public-Private Partnership Highway Contracts in Australia, the Philippines, and India

4.1. Abstract

Public-private partnership (PPP) projects are characterized by high uncertainty due to issues such as bounded rationality, asymmetric information, and opportunism. Effectively addressing high uncertainty is of utmost concern in PPP implementation. Exploring how contracting parties interact over a PPP project's lifecycle spanning decades with inevitable, and oftentimes unanticipated, changes in circumstances and requirements and unexpected stakeholders' actions is a key area that has not been broadly addressed despite its criticality to project performance. Further, relevant literature tends to focus more on output- or measurement-based management than process-based management and on developed countries than developing countries. This paper explored the practices of lifecycle project management in 20 PPP greenfield highway contracts in Australia, the Philippines, and India. These contracts were deliberately sampled to cover the widest possible range of key project characteristics. The practices explored specify project structure, requirements, processes, and procedures that function as key elements of measurement- and process-based management throughout a contract's duration. Implementing them can trigger corresponding governance mechanisms to promote contractual and relational governance for better performance under uncertainty. Contracts in Australia tend to be more comprehensive in many areas requiring more ex ante contracting efforts such as naming contractors in contracts and ex post implementation efforts to comply with many distinctive requirements such as those concerning environment and community/user management. Meanwhile, contracts in Australia likely rely more on trust-based management versus monitoring/control-based management, having limited requirements for monitoring and safeguarding the contract. As such, the common and different practices across the three countries provide a basis to inform practitioners in key decisions such as market entry selection and strategic contractual design and policies. They also provide supporting evidence and new insights for and strengthen numerous key understandings especially in PPP governance literature.

Keywords: Public-private partnerships; Highways; Contract; Lifecycle; Management; Governance.

4.2. Introduction

Public-private partnerships (PPPs) have been increasingly adopted during the last three decades as a means to address the pressing demand for infrastructure (Yescombe and Farquharson 2018). A

PPP project typically bundles multiple project phases from design to handback and involves numerous heterogeneous stakeholders in a decades-long contract, resulting in high uncertainty due to unexpected changes in circumstances and requirements and stakeholders' actions that cannot be fully anticipated (Levitt et al. 2014; Nguyen D. et al. 2018; Yescombe and Farquharson 2018). Governments and selected private entities must design a contract ex ante to deal with such ex post uncertainty; this task is more complicated in PPPs than in other forms of conventional delivery (Athias and Saussier 2018; Iossa and Martimort 2011).

Consequently, scholars have called for greater emphasis on adaptive/relational governance and process-based management to effectively deal with uncertainty in PPPs in addition to the more conventional contractual governance and measurement-based management (Dewulf and Garvin 2020; Liu et al. 2014a; Liu et al. 2014b). While compliance with contractual requirements (contractual governance) can be measured ex post by comparing actual performance data with a contract' benchmarks (measurement-based management), parties cannot solely rely on them given key challenges in PPPs such as high uncertainty and bounded rationality (Domingues and Zlatkovic 2015). Alternatively, parties can implement and enhance relevant processes such as meetings, negotiation, and dispute resolution (process-based management) for real-time monitoring, learning, and building cooperative relationships and trust to identify issues early and to effectively negotiate solutions to unanticipated changes (adaptive/relational governance) (Dewulf and Garvin 2020; Khurana et al. 2022).

While the literature has examined how parties should govern and manage a project, a much smaller body of knowledge has reported how parties design decades-long contracts to govern and manage a PPP project under uncertainty. Contracts are the key and binding agreements that steer parties' interactions during a project's lifecycle. Exploring how contracts are designed to cope with uncertainty would provide meaningful insights to the existing literature since this area still remains relatively undeveloped (Dewulf and Garvin 2020; Liu et al. 2014a). As such, this research investigated and contrasted contractual practices to cope with uncertainty in 20 contemporary PPP greenfield highway contracts in Australia, the Philippines, and India that were deliberately sampled to cover key project characteristics. Similarities such as the adoption of trilateral governance to independently determine compliance with key performance indicators and differences such as distinctive requirements concerning environment and user management and corresponding payments in Australia were revealed. These similarities and differences can serve as a basis for practitioners' and scholars' decision-making; the former, especially in less developed PPP markets, can strategically shape policies and contractual designs for improved value for money and to enhance the open market given the context; the latter can confirm evidence of multiple literature concerning governance and management in PPPs and further examine the effectiveness of the practices revealed in different contexts.

4.3. Literature Review

4.3.1. Uncertainty in PPPs

Key challenges in PPPs include asymmetric information, incentive misalignment, opportunism, bounded rationality, and transaction costs, among others (Eisenhardt 1989; Hart 2009; Henisz et al. 2012; Khurana et al. 2022; Nguyen D. and Garvin 2019a; Scott 2008; Williamson 1979). Asymmetric information refers to the dissimilarity of information and knowledge between contracting parties (Mansor and Rashid 2016). Incentive misalignment is rooted in the differing and sometimes conflicting interests, capabilities, and perceptions between the rule-oriented public sector and the profit-oriented private sector (Hart 2009; Levitt et al. 2014; Mansor and Rashid 2016). Asymmetric information and incentive misalignment create a favorable environment for opportunism (Williamson 1996), which cannot be completely addressed due to bounded rationality and transaction costs. Contracting parties' decisions are bound by their rationality and transaction costs are expensive due to unforeseen contingencies since risks and uncertainties are impossible to comprehensively anticipate and address (Mansor and Rashid 2016; Simon 1961; Williamson 1979). Moreover, bounded rationality and transaction costs contribute to contract incompleteness (Hart 2009). These challenges are likely more significant in PPPs due to their complexity and long-term nature than in traditional delivery approaches (Soliño and Gago de Santos 2010 as cited in Dolla and Laishram 2019). They interact with each other, resulting in a high degree of environmental and behavioral uncertainties (Gao et al. 2018; Nguyen D. and Garvin 2019). Environmental uncertainties refer to changing or unanticipated circumstances or requirements in the external environment of a project that includes both the physical environment (e.g., geology) and the non-physical environment (e.g., economy, politics, and legislation) (Gao et al. 2018). Behavioral uncertainties are more associated with or derived from stakeholders' actions and include opportunism and the displaced agency hazard (Chung and Hensher 2016; Gao et al. 2018; Hart 2009; Levitt et al. 2014; Mansor and Rashid 2016). Thus, appropriate project governance and management are required to address these uncertainties.

4.3.2. Project governance in PPPs

a) Contractual governance and relational governance strategies in PPPs

Contractual governance employs formal requirements written in contract documents to govern projects; this form of governance is sanctioned by authority and ownership (Benítez-Ávila et al. 2019). Contractual governance functions through monitoring compliance with detailed requirements specified in rigid contractual provisions (Benítez-Ávila et al. 2018; Solheim-Kile and Ward 2019). Yet, contractual governance in isolation cannot comprehensively address key challenges in PPPs due to reasons such as incomplete contracts and transaction costs (Guevara et al. 2020; Khurana et al. 2022). As a result, recent studies have called for adaptive/relational

governance as an essential complement to contractual governance to deal with key PPP challenges (Benítez-Ávila et al. 2018; Dewulf and Garvin 2020; Khurana et al. 2022). Adaptive/relational governance is steered by contractual governance elements (e.g., contractual requirements). Yet, it focuses on aligning parties' actions and interactions toward better project performance by fostering trust, flexibility and adaptation, shared values, and collaborative contributions to respond to uncertainties (Benítez-Ávila et al. 2018; Brinkerhoff and Brinkerhoff 2011; Guevara et al. 2020). For instance, contracts can require regular meetings and communication between parties; this is a chance to build and enhance relationships, trust, and an environment of fair process between parties over a project's lifecycle so that they can effectively address issues or negotiate reasonable resolutions when uncertainties unfold (Khurana et al. 2022). Yet, relational governance also has limitations that can be mitigated by contractual governance (Khurana et al. 2022). For instance, excessive reliance on relational governance might result in blind trust where parties do not strictly enforce contracts; yet, contract provisions set a boundary to curb parties' actions from derailing too far ex post from what was agreed ex ante (Peng et al. 2022). Adaptive/relational governance is comparable with agile project management, which is used in many industries such as software development in dealing with dynamic project contexts (Levitt 2011). Essentially, more compliance-oriented contractual governance and more trust-oriented adaptive/relational governance are expected to address each other's limitations to trigger cooperative efforts for better performance and value for money (Benítez-Ávila et al. 2018; Levitt et al. 2014; Henisz et al. 2012).

b) Governance mechanisms in PPPs

The literature has identified several governance mechanisms for better project governance and improved project outcomes (Dewulf and Garvin 2020; Henisz et al. 2012; Khurana et al. 2022). They are underpinned by the three institutional pillars, namely, regulative, normative, and cognitive (Henisz et al. 2012; Scott 2008). Simply put, regulative institutions include the enforcement of written requirements such as laws, regulations, and contracts, whereas normative and cognitive institutions involve socially acceptable behavior as well as the creation of shared identities and values (Henisz et al. 2012). Some key mechanisms follow.

First, *incentive alignment* or *shared ownership* may improve allocating/sharing risks, monitoring performance, and adopting performance-linked payments and other measures; the goal is to incentivize the private sector to perform as desired by the public sector (Cheung et al. 2018; Garvin 2009; Henisz et al. 2012; Khurana et al. 2022; Solheim-Kile and Wald 2019). Moreover, the structure of PPPs requiring the private sector to be responsible for financing, operations, and maintenance is expected to better incentivize the private sector than traditional delivery approaches (Robinson and Scott 2010). Second, *shadow of the future* or *reputational capital* also aligns incentives by rewards beyond the boundary of the current project since future business opportunities and reputation of a contracting party (both public and private) are at stake (Henisz

et al. 2012). Third, *trilateral governance* involves an independent and impartial third party to monitor performance by both parties, make decisions or determinations, and resolve conflicts and disputes (Khurana et al. 2022; Williamson 1979; Williamson 1985 as cited in Winch 2001). The typical organizational structure of trilateral governance includes audit, independent engineer, dispute review board, expert determination, and arbitration. Trilateral governance can reduce parties' efforts to seek a comprehensive and rigid set of contractual requirements that is either impossible or very costly to achieve (Henisz et al. 2012). Fourth, *procedural justice* can constrain opportunism via exchanging information on the activities including contributions and rewards, sharing rights to raise concerns about activities, contributions, and rewards, and sharing perceptions of fairness of stakeholder behaviors (Henisz et al. 2012). Fifth, *flexibility* can be introduced in contractual designs via some risk sharing mechanisms, negotiation, or renegotiation to cope with the unavoidable incompleteness of contracts, or in other words, to respond to future changes (Athias and Saussier 2018; Chung and Hensher 2015; Nguyen D. and Garvin 2019b). Sixth, *trust* refers to confidence in the counterparty's capabilities and willingness to perform; trust builds cooperative relationships between parties and contributes to project success (Cheung et al. 2018; Meng 2015). Trust can be built via regular interactions through project activities including good communication and regular meetings (Chan and Suen 2005). Seventh, *monitoring/control* is a common mechanism (Nguyen D. and Garvin 2019a). The monitoring mechanism enables information revelation mainly as a contractual obligation via reports or inspections (Ho et al. 2015; Nguyen D. and Garvin 2019a; Schieg 2008). Control mechanism specifies and enforces the public sector's "authority system" to achieve hierarchical effects, providing incentives to motivate the private sector (Stinchcombe 1990). In extremis, monitoring/control comes into play due to a lack of adequate trust; there is an inverse association between them (Meng et al. 2015). Monitoring/control can address issues such as asymmetric information or opportunism (Ceric 2012; Hart 2003; Ho et al. 2015; Nguyen D. and Garvin 2019a; Schieg 2008). Monitoring/control is extensively used in key contractual provisions such as project management plans, performance measurement, changes, and handback/residual value (Nguyen D. and Garvin 2019a; Chapter 3). Eighth, *involvement of societal stakeholders* such as users or project-affected communities, groups, or individuals may reinforce monitoring, foster procedural justice, and provide inputs to and measure project performance for enhanced quality of service delivery (Delhi et al. 2012; Henisz et al. 2012). This involvement also triggers incentives when payments or reputation are associated or at stake. Thus, stakeholder-oriented performance measurement is suggested (Liu et al. 2014a; Liu et al. 2018).

Overall, these mechanisms interact and generally contain elements of both governance strategies. *Incentive alignment*, *monitoring/control*, *trilateral governance*, *involvement of societal stakeholders*, and *shadow of the future* function more as regulative mechanisms and contractual governance elements, whereas *flexibility*, *trust*, and *procedural justice* function more as normative

and cognitive mechanisms and relational governance elements. These mechanisms can be strategically enabled to promote project governance through practices embedded in contracts (Khurana et al. 2022).

4.3.3. Project management in PPPs

Measurement-based management has been widely used to incentivize or control the private sector by measuring compliance with performance benchmarks such as construction completion milestones and key performance indicators (KPIs) and linking the measured performance with penalties or sometimes rewards (Garvin et al. 2011; Liu et al. 2014a; Liu et al. 2014b). While it is a key and indispensable element of project management, it typically measures the outputs or outcomes of relevant activities or processes *after*, for instance, construction completion and operation commencement, when a remedy can be very costly or time-consuming (Haponava and Al-Jibouri 2012; Robinson and Scott 2009). However, parties cannot design a perfect contractual framework with all necessary benchmarks that can completely capture all uncertainties (Hart 2009). Further, many *processes* that do not necessarily directly produce any output or outcome are very influential in determining and enhancing project performance and success especially given the complexity and uncertainty of PPPs (Liu et al. 2014a; Liu et al. 2015; Garvin et al. 2011). For instance, stakeholder engagement, transparency, and good faith negotiation can promote trust among project counterparties and thus improve project performance (Khurana et al. 2022; Meng 2015). Trilateral governance involves an impartial third party such as an independent engineer or a dispute review board that impartially monitors activities, measures contractual compliance, and mediates conflicts and disputes between parties (Khurana et al. 2022; Henisz et al. 2012). This third party can help address the unavoidable incompleteness of contracts to limit opportunism and transaction costs (Henisz 2012; Khurana et al. 2022). Thus, some recent studies have emphasized the need to appropriately design, manage, and improve relevant processes to address issues early and effectively in PPPs (Liu et al. 2014b; Liu et al. 2015).

In this regard, such literature suggests a shift of attention and calls for the adoption of lifecycle project management methods (Liu et al. 2014b; Liu et al. 2016). Foremost, lifecycle project management adds process-based management into the more conventional measurement-based management to enable real-time monitoring, decision-making, and improvement (Liu et al. 2014b; Liu et al. 2016). Thus, measurement-based management and process-based management are expected to complement each other to provide the necessary information, tools, and opportunities for both sectors to effectively and timely identify issues and improve key areas such as quality and schedule control. For instance, the lack of flexibility of monitoring and control mechanisms that measure compliance with pre-defined benchmarks under uncertainty along with the realities of contract incompleteness and bounded rationality can be “compensated for” by harmonious and cooperative relationships between contract counterparties functioning under mutual trust for better

project management and outcomes (Meng 2015). In many respects, measurement-based management elements such as performance measurement and corresponding payments and process-based management elements such as regular meetings and a fair process of communication to promote trust and good faith negotiations pave the way for contractual governance and adaptive/relational governance, respectively (Athias and Saussier 2018; Benítez-Ávila et al. 2018; Chan 2010; Chung and Hensher 2015; Domingues and Zlatkovic 2015). Effective lifecycle project management for contracts is a critical success factor (Liu et al. 2015).

4.3.4. Contracts' key role in PPPs

Contracts are the central and main instrument in PPP implementation (Khurana et al. 2022; Nguyen D. et al. 2018) for several reasons. Contracts prescribe the rights and obligations of contracting parties to limit opportunism (Gao et al. 2018; Stinchcombe 1990). The requirements, procedures, or principles written in contracts steer parties' actions and interactions to confirm performance, solve disputes, negotiate and deal with future events when uncertainties materialize, and promote trust and cooperative behaviors (Benítez-Ávila et al. 2018; Gao et al. 2018; Khurana et al. 2022; Stinchcombe 1990). Practitioners can strategically design and implement governance practices in contracts to trigger desired governance mechanisms and strategies (Khurana et al. 2022). Parties can choose to rely on ex ante transactions or decisions and design more rigid contractual provisions that monitor and control parties' actions by assigning risks and requiring compliance with measurable benchmarks; this measurement-based management triggers and provide momentum for contractual governance (Athias and Saussier 2018; Benítez-Ávila et al. 2018; Chan 2010; Chung and Hensher 2015; Domingues and Zlatkovic 2015). Yet, many PPP contracts are too rigid and restrictive, failing to account for needed changes (Dewulf and Garvin 2020; Domingues and Zlatkovic 2015). Hence, parties can also rely on ex post transactions or decisions by incorporating more flexible provisions that encourage relevant processes to adapt and respond to uncertainties with a focus on mutual trust and cooperative relationships (adaptive/relational governance and process-based management) (Athias and Saussier 2018; Chan 2010; Chung and Hensher 2015; Domingues and Zlatkovic 2015). Parties strategically make their choice between the two opposing contractual designs by weighing the level of uncertainty (Dewulf and Garvin 2020). Regardless of the parties' efforts, contracts are unavoidably incomplete (Hart 2009). Thus, it is critical to balance rigid and flexible contract provisions (Athias and Saussier 2018; Domingues and Zlatkovic 2015), contractual and adaptive/relational governance, and measurement-based and process-based management, given the project's context.

4.4. Point of Departure

Exploring how contracting parties interact over a project's lifecycle is an important area that has not been broadly addressed despite such interactions' criticality to project performance (Dewulf

and Garvin 2020; Liu et al. 2015). As previously discussed, most of the literature focuses on providing theoretical and normative governance and management frameworks that emphasize what parties ought to do. Despite the centrality of contracts in PPP implementation, the literature revealing the relevant contractual practices is limited, focusing more on the earlier stages of PPP implementation through the early 2000s and on developed countries. For instance, Garvin et al. (2011) revealed contractual practices in eight projects with commercial close through 2009 in the United States, the United Kingdom, Canada, New Zealand, and Australia. Formal requirements such as KPIs, corresponding payments, and relevant safeguards were designed ex ante to give authority to the public sector to contractually measure compliance and enforce contracts via *incentives alignment* and *monitoring/control*. The contracts also detailed procedures and processes such as regular meetings and communication, independent engineer, and dispute resolution to build trust and cooperative relationships for effective ex post efforts in response to uncertainty via *procedural justice*, *trust*, *flexibility*, and *trilateral governance*. Khurana (2021) revealed relational practices in more recent highway contracts in the United States that were designed flexibly to create collaborative relationships and project structure for effectively addressing uncertainties. This study enriches the literature by investigating and comparing how parties design lifecycle project management to cope with uncertainties and how such contractual practices align with the normative literature in promoting lifecycle project management and employing governance mechanisms in both developed and developing countries in recent contracts.

4.5. Research Methodology

The research applied a similar methodology to its companion studies (Chapter 2; Chapter 3). First, investigation scope was identified. Greenfield highway was selected given the sector's importance in infrastructure delivery and the possibility to investigate lifecycle project management from design to handback. Asia Pacific and Australia, the Philippines, and India in particular were selected due to their dominant shares (approximately half) in greenfield highway investment in the world and within the region, respectively (World Bank 2021; IJ Global 2021). Further, the similarities and differences of key characteristics of these countries likely enable a transnational analysis and generalization of findings within the region and beyond (Chapter 2; Chapter 3).

Second, contracts were collected and deliberately sampled. Contemporary contracts with commercial close from 2006 were collected via the countries' official websites for Australia (all eight) and India (44 among 153) (New South Wales state 2022; National Highways Authority of India 2021, 2022; Queensland state 2022; Victoria state 2022) and formal requests to the government for the Philippines (five among 12). Key characteristics were summarized using the homepages of the PPP centers or authorities in charge of PPPs in the target countries (India PPP Center 2021; National Highways Authority of India 2021, 2022; New South Wales state 2022; Philippines PPP Center 2021; Queensland state 2022; Victoria state 2022), the World Bank PPI

database (World Bank 2021b), information from the accessible contracts, or other sources such as media (for some inaccessible contracts in India). Key characteristics of all projects include payment mechanisms (user-paid or government-paid), project initiation mechanisms (solicited or unsolicited), commercial close (from 2006 to 2018), duration (14 to 45 years), and contract amount ($46M to $6.7B). Twenty contracts were sampled deliberately to cover the widest possible range of key characteristics to facilitate parametric analysis (Table 20) (Patton 2015).

Table 21 depicts the characteristics of the sampled contracts for the Philippines to illustrate its general representativeness. Unsolicited contracts in India, representing approximately 20% of the total, were not accessible.

Table 20. Sampled contracts with key characteristics

Project Code (Name)	Payment & project initiation mechanism	Commercial close	Duration (years)	Amount	
Australia					
AU1 (Airport Link M7)	Tolled Solicited	2008	45	4.8	($B)
AU2 (Peninsula Link)	Government Solicited	2010	27	0.7	($B)
AU8 (West Gate Tunnel)	Tolled Unsolicited	2017	28	6.7	($B)
AU6 (WestConnex M4-M5 Link)	Tolled Solicited	2018	42	1.3	($B)
Philippines					
PH3 (Tarlac-La Union Expressway)	Tolled Solicited	2008	35	722	($M)
PH7 (Daang Hari-SLEX Link Road)	Tolled Solicited	2012	30	46	($M)
PH9 (Cavite-Laguna Expressway)	Tolled Solicited	2015	35	736	($M)
PH10 (NLEX-SLEX Connector Road)	Tolled Unsolicited	2016	37	479	($M)
India					
ID51 (Km16 to Km96.127 (NH-75))	Government Solicited	2006	20	244	($M)
ID65 (Nagpur-Saoner-Betul (NH-69))	Government Solicited	2010	20	336	($M)
ID150 (Delhi-Meerut (Package III))	Government Solicited	2016	18	137	($M)
ID111 (Delhi Meerut (Package II))	Government Solicited	2017	18	184	($M)
ID142 (Salem to Ulundurpet (NH-68))	Toll Solicited	2007	25	126	($M)
ID157 (Jaipur-Tonk-Deoli (NH-12))	Toll Solicited	2009	25	158	($M)
ID19 (Varanasi-Aurangabad (NH-2))	Toll Solicited	2010	30	345	($M)
ID78 (Chandikhole-Bhubaneshwar (NH-5))	Toll Solicited	2010	26	140	($M)
ID104 (Delhi-Agra (NH-2))	Toll Solicited	2010	26	256	($M)
ID147 (Farakka-Raiganj (NH-34))	Toll Solicited	2010	30	141	($M)
ID117 (Jetpur - Somnath (NH-8D))	Toll Solicited	2011	30	110	($M)
ID74 (Km510 to Km650.794 (NH-6))	Toll Solicited	2015	19	251	($M)

Note: Project code will be referenced hereinafter. Government = government-paid.

Table 21. Characteristics of the sampled projects and all projects in the Philippines

Characteristics	All projects	Sampled projects
User-paid / government-paid	12 / 0	4 / 0
Solicited / Unsolicited	8 / 4	3 / 1
Commercial close	2006 to 2018	2008 to 2016
Contract duration (years)	25 to 37 (average = 32)	30 to 37 (average = 34)
Contract value ($M)	46 to 937 (average = 551)	46 to 736 (average = 496)

Third, contract content analysis was executed, starting by developing a set of key practices categories to be explored by reviewing relevant studies that indicated a linkage between a category and a particular governance mechanism (Table 22) (Khurana et al. 2022). For instance, Memon et al. (2021, p. 6) stated "In this relationship, collaborative intentions, which can be manifested by team building activities, informal dialogues and meetings, and facilitated workshops, can improve trust due to the continuous interactions." This suggests that the category specifying communication protocols and meetings can promote *trust*. These categories, in whole or in part, were also assessed as key and thus explored in recent studies examining contractual practices regarding contractual governance and relational governance (Garvin et al. 2011; Nguyen D. and Garvin 2019a, b; Khurana et al. 2022; Chapter 2; Chapter 3). The categories were grouped as contractual governance (measurement-based management) and adaptive/relational governance (process-based management). It is noted that in some cases, the boundary between them is not crystal clear. For instance, in category 1.2, contracts might require a concessionaire to comply with KPIs (contractual governance) that may be subject to regular review and updated upon negotiation and mutual agreement in response to changing circumstances and requirements (adaptive/relational governance). Next, the table of contents and relevant keywords were used to effectively identify relevant contract clauses. For instance, "completion", "delay", "damage", "KPIs", "performance", "test", and "payment" were among the keywords used to search for the category of "Performance Measurement and Corresponding Payment". A thorough reading of all provisions of the contracts was executed. The identified languages were coded using Nvivo. Studies exploring contractual practices concerning some key categories (Garvin et al. 2011; Khurana et al. 2022; Nguyen D. and Garvin 2019a; Nguyen D. and Garvin 2019b; Nguyen D. et al. 2018; Chapter 2; Chapter 3) were referenced to capture key practices for each category. Explored information was tabulated with necessary notes for further comparative analysis. The uncovered information for AU1 substantially aligned with Garvin et al. (2011).

Table 22. Key practices categories for exploration and their linkages with governance mechanisms

Categories	Key references	Related governance mechanisms	Description
1) Contractual governance / Measurement-based management	Benítez-Ávila et al. (2018); Cao and Lumineau (2015); Guevara et al. (2020)		More reliant on ex ante transactions to address uncertainties, more rigid, requires compliance with requirements as defined in contracts, otherwise subject to penalties and obligations to remedy, more linked with outputs and control.
1.1) Performance requirements and monitoring structure	Nguyen D. and Garvin (2019a); Schieg (2008); Stinchcombe (1990); Chapter 3	Monitoring/control; Incentive alignment	Requirements (quality, schedule, safety, etc.), management plans to achieve requirements, and structure of monitoring achievement (tests, audits, etc.)
1.2) Performance measurement and corresponding payments	Henisz et al. (2012); Liu et al. (2014a, 2016, 2017); Nguyen D. and Garvin (2019a); Robinson and Scott (2009); Stinchcombe (1990); Chapter 3	Monitoring/control; Incentive alignment; Societal stakeholder involvement; Shadow of the future	Benchmarks and indicators are used to measure performance against requirements. Measured performance is linked with payment.
1.3) Remedies/Safeguards for poor performance	Schieg (2008); Solheim-Kile and Wald (2019); Stinchcombe (1990)	Incentive alignment; Monitoring/control; Shadow of the future	Noncompliance with requirements is subject to remedy obligations enforced by safeguards (e.g., bond, escrow account).
1.4) Handback	Garvin (2009); Nguyen D. and Garvin (2019a); Nguyen D. et al. (2018); Chapter 3	Monitoring/control; Incentive alignment	Handback conditions must be met to ensure residual value as required.
2) Adaptive and Relational governance / Process-based management	Benítez-Ávila et al. (2018); Dewulf and Garvin (2020); Dewulf et al. (2016); Khurana et al. (2022)		More reliant on ex post transactions, more flexible, adaptive, and responsive to uncertainties such as changing circumstances and requirements, more linked with processes and trust.
2.1) Communication and meetings	Chan and Suen (2005); Delhi et al. (2012); Henisz et al. (2012); Khalfan et al. (2007); Memon et al. (2021)	Procedural justice; Trust; Societal stakeholder involvement	Examples include regular meetings between owners and concessionaires and regular communication to obtain and resolve feedback from other stakeholders including users and project-affected communities.
2.2) Dispute resolution structure and process	Chan and Suen (2005); Delhi et al. (2012); Henisz et al. (2012); Ling and Ng (2006); Osei-Kyei et al. (2019); Stinchcombe (1990); Williamson 1979; Winch (2001)	Trilateral governance Flexibility; Shadow of the future; Procedural justice; Trust	Structure and process to resolve disputes including negotiation, dispute review board, expert determination, and arbitration.

Categories	Key references	Related governance mechanisms	Description
2.3) Independent engineer	Ling and Ng (2006); Osei-Kyei et al. (2019); Winch (2001); Henisz et al. (2012); Stinchcombe (1990); Williamson (1979)	Trilateral governance Flexibility	Roles and responsibilities of Independent Engineer in monitoring and evaluating project performance and determining disputes.
2.4) Executing changes	Chung and Hensher (2015); Nguyen D. and Garvin (2019a); Stinchcombe (1990); Chapter 3	Monitoring/control; Flexibility	Procedures and processes to respond to uncertainties such as changing circumstances and requirements.
2.5) Risk sharing mechanisms	Athias and Saussier (2018); Dewulf and Garvin (2020); Nguyen D. and Garvin (2019b); Chapter 2	Flexibility; Incentive alignment	Risk sharing might rely more on ex post transactions (Nguyen D. and Garvin 2019b). How risks are shared incentivizes concessionaires. Shared risks were revealed in a companion study (Chapter 2).

4.6. Analysis Results

Key practices of each categories concerning contractual governance (measurement-based management) and adaptive/relational governance (process-based management) are summarized in Table 23 and Table 24, respectively. Analysis results for each practices categories follow.

4.6.1. Contractual governance (measurement-based management)

a) Performance requirements and monitoring structure

Both Design and Construction (D&C) and Operations and Maintenance (O&M)

Overall, all contracts required compliance with performance standards and completion milestones (Table 23, a). Further, the relevant provisions in all contracts (except PH3) stipulated that compliance was subject to best or good industry practices. For instance, ID74 indicated operational practices must be those "which are generally and reasonably expected from a reasonably skilled and experienced operator engaged in the same type of undertaking" (ID74 Clause 48). Two contracts in Australia (AU1, AU6) contemplated the evolution of these requirements by explicitly requiring compliance with best industry practices from time to time.

All contracts required concessionaires to demonstrate how to implement the project and ensure compliance with requirements by submitting, regularly (and upon request) updating, and following lifecycle project management plans except PH3. These plans took the form of D&C Program and O&M Manual/Program. Contracts in Australia additionally required specific plans such as Environment, Communication and Community, Cultural Heritage, Quality, Safety, and Sustainability management plans. It is noted, however, that requirements of some plans such as Quality and Safety plans can be found in the standardized standards, of which compliance was required in the contract, as in India. All contracts required regular submission of performance reports by concessionaires and regular progress meetings between parties.

All contracts adopted trilateral governance in the form of Independent Engineer (IE) to independently verify compliance with requirements. Some contracts in Australia involved a Proof Engineer/Construction Verifier (a third party hired and paid by concessionaires and accepted by owners to provide information, assistance, and documentation concerning performance to IEs) and an Environmental Representative (a third party jointly appointed to oversee the implementation of all environmental management plans and monitoring programs). Further, most contracts in India stated that owners would procure a Safety Consultant to audit compliance with safety requirements.

Table 23. Key practices concerning contractual governance (measurement-based management)

Practices	AU	PH	ID
a) Performance requirements and monitoring structure			
Both D&C and O&M			
Compliance with standards, criteria, milestones	4	4	12
Compliance with best practices / from time to time	4/2	3/-	12/-
Lifecycle project management plans	4	4	12
Submit, regularly and upon request update, and comply	4	3	12
D&C program, O&M manual/program	4	4	12
Environmental management plan	4	-	1
Communication and community engagement plan	2	-	-
Other plans*	1~3	-	-
Regular performance reports and progress meetings	4	4	12
O&M			
Audit of financial books and records	4	4	12
Regular audits procured by concessionaires	4	3	12
Additional audits procured by owners	4	1	10
KPIs	3	3	12
Complaint resolutions	4	-	12
Actual traffic/revenue confirmed by owners	-	-	8
b) Performance measurement and corresponding payments			
D&C			
Liquidated damages due to delayed completion	1	4	12
Bonus due to early completion	-	-	4
O&M			
KPI-linked penalties	3	3	12
Involving environment and customer complaints	3	-	-
Performance reports			
Self-evaluated regular submission	3	-	-
Regular audits procured by concessionaires	3	-	-
Additional audits procured by owners	3	-	-
KPI regular review & update	2	1	-

Practices	AU	PH	ID
c) Remedies/safeguards for poor performance			
D&C and O&M			
Non-conformance report by concessionaires	2	-	-
Request to remedy by owners/IEs	3/3	3/4	-/12
Shadow of the future	1	-	-
Escrow account	-	-	12
D&C			
Bond submitted before D&C by concessionaires	1	4	12
Bond submitted upon delays by concessionaires	1	-	-
Construction bond by contractors to concessionaires	2	-	-
Retaining payments to concessionaires	1	-	-
O&M			
Bond submitted before O&M	-	3	-
Bond submitted upon failure to remedy	3	-	-
d) Requirements and safeguards for handback			
Requirements	4	3	12
Remaining residual life as required	4	-	-
No defects or no repair work required	3	-	12
Transfer titles of plant and equipment for O&M	3	3	12
Deliver all manuals, records, plans (D&C, O&M)	3	3	-
No material replacement for the next five years	2	-	-
Handover reviewer	1	-	-
Inspection before and at handback			
Inspection schedule	4	3	12
Inspection by parties/IEs or reviewers	3/1	3/-	-/12
Determination by parties/IEs or reviewers/owners	2/1/1	-/-/3	-/12/-
Bond/escrow after remedy work determination	4/3	-	-
Bond/escrow before remedy work determination	-	3/-	11/12
Training for owner personnel	3	3	-
Short-term consultation with owner post handback	1	-	1
Remedy defects found after handback	-	3	10

Note: Number = contracts confirmed (explored) (hereinafter). "-" = 0 (hereinafter). Other plans* include Heritage, Traffic, Health, Incident, Sustainability, Quality, and Safety management plans. Escrow = escrow account.

Table 24. Key practices concerning adaptive/relational governance (process-based management)

Practices	AU	PH	ID
a) Communication and meetings			
Senior project group	4	-	-
Regular meetings	4	4	-
Communication & community plans	4	-	-
Information disclosure to the public	4	-	12
Visitor center / public relations office	1	-	12
Record, resolve, and submit complaints register	4	-	12
Owner approval before media correspondence	4	-	-
b) Dispute resolution structure and process			
Senior project group	4	-	-
Regular meetings	4	4	-
Mediation by IEs	-	-	12
Negotiation	4	4	12
Expert determination	4	-	-
Expert determination (for termination payment)	-	3	-
Dispute review board	-	4	-
Arbitration	4	4	12

Practices	AU	PH	ID
d) Organizational structure for executing changes			
Definition including addition/omission of work	4/4	4/4	12/2
Changes initiated by owners	4	4	12
Procedures	4	3	12
Restriction of owner changes	2	1	12
Concessionaires required to conduct tenders	2	-	-
Pending disputes, owners can direct to proceed	4	-	12
A portion of savings to return to owners	4	-	-
Changes initiated by concessionaires	4	3	10
Procedures	4	2	10
Savings to return to owners	2	-	-
Pre-agreed changes	4	-	-
Involvement of IEs	-	4	12

D&C

For design, all contracts demanded concessionaires to submit all design products for owner review/approval and IE verification of contractual compliance. Only in *Australia*, concessionaires must submit concessionaire certificates confirming contractual compliance (AU1, AU2, AU6).

For construction, in *Australia*, interestingly, no detailed list of tests was found. Instead, most contracts mentioned that the IE would undertake "general overview and reasonable checking" (AU1, AU2 Clause 18, AU8). Thus, questions remain about how best industry practices would come into play. Conversely, contracts in the *Philippines* and *India* had stricter requirements for tests and inspections. In the *Philippines*, concessionaires must conduct tests as required in the Minimum Performance Standards and Specifications for Construction and be subject to monitoring and witnessing by IEs and/or owners. IEs must regularly inspect the work. In *India*, IEs would regularly (daily, weekly, or monthly) supervise the work. In addition to the tests at completion already detailed in contracts such as a "riding quality test", IEs can also require concessionaires to carry out tests as necessary in accordance with Good Industry Practice but up to 10% of the required frequency undertaken by owners through their contractors in public procurement projects.

O&M

All contracts required audits of financial books and records and performance measurement and payments based on KPIs (Table 23, a). KPIs were not confirmed in AU6 (perhaps due to inaccessibility of the relevant appendix) and PH3. Contracts in *Australia* and *India* required to resolve complaints by customers or non-customers proactively and reasonably. Contracts in *India* allowed traffic sampling by owners to confirm actual traffic volume.

b) Performance measurement and corresponding payments

D&C

Concessionaires must pay liquidated damages in one project in Australia and all projects in the Philippines and India but could only receive a bonus due to early completion in Indian government-paid projects (Table 23, b). In *Australia*, most contracts did not mention liquidated damages except AU6. The concessionaire in AU6 must pay liquidated damages only when delays in overall completion cause delays in an adjacent project but to the extent that can be recovered from the contractor or relevant insurance proceeds, subject to a pre-agreed maximum amount. In the *Philippines*, all contracts required payment of liquidated damages, either 0.1% of the costs of the remaining work per day with a ceiling amount (PH3, PH7) or a fixed daily rate (PH9, PH10), in case of delays in overall completion. Most contracts allowed owners to declare concessionaires in default, forfeit relevant performance bonds, and terminate contracts if the pre-agreed maximum delays (three or six months) were exceeded (PH7, PH9, PH10). While not linked with payments,

negative schedule slippage was subject to acceleration via "catch-up" programs (5% to 15% slippage) submitted by concessionaires (PH9, PH10) or contract termination (20% slippage) (PH3). In *India*, all contracts required payment of liquidated damages for delays in both overall completion and intermediate milestones (typically 0.1% of performance bond amount per day). If delays exceed 270 days, owners can terminate contracts in tolled projects. Government-paid contracts stated that the daily bonus due to early completion was 1/180 of each annuity payment (ID51, ID65) or 0.01% of the project amount (ID150, ID111) with a pre-agreed maximum amount.

O&M

All contracts required compliance with KPIs and corresponding penalties in case of poor performance (no bonus mentioned) except AU6 (perhaps due to data inaccessibility) and PH3 (Table 23, b). Only limited contracts in Australia (AU1, AU8) and the Philippines (PH7) mentioned review of KPIs. In *Australia*, KPIs generally involved multiple indicators concerning a range of activities: reporting, incident response, compliance with O&M plans, quality, availability, customer service and complaints, and environment management. Only in AU1, good performance in one indicator might offset poor performance in other indicators. Concessionaires must record all performance failures and periodically submit self-evaluated performance reports and corresponding yearly independent audit reports to owners. Any inaccuracy favoring a concessionaire found in additional audits procured by owners would result in penalties at least equivalent to such inaccuracy and additional auditor costs. KPIs would be mutually reviewed following the 5th anniversary of tolling system completion in AU1 and AU8. In the *Philippines*, concessionaires must pay KPI-linked penalties as determined by owners or IEs, pending disputes. Detailed indicators were inaccessible. No requirements concerning self-evaluated performance reports and audits were found. In *India*, KPIs involved availability and quality conformances. For instance, failure to repair defects within allowable periods would be subject to payment of damages per day of either 0.5% of the average daily annuity/fee or 0.1% of the relevant costs as estimated by IEs (e.g., ID19). Indicators concerning environment or customer complaints and requirements regarding self-evaluated performance reports and audits or review of KPIs were not found.

c) Remedies/Safeguards for poor performance

All contracts required concessionaires to submit safeguards for remedy obligations of non-conformances but differently in Australia (upon failure to remedy in most contracts) versus the Philippines and India (before D&C or O&M) (Table 23, c). In *Australia*, all contracts stated that non-conformances must be promptly reported by concessionaires to owners and IEs with proposed remedy plans or can be noticed by owners and IEs. Concessionaires must consult with owners in good faith to agree on how such non-conformances would be rectified and "expeditiously and diligently progress the rectification" (e.g., AU8 Clause 25). All contracts required bonds to be in

the form specified in contracts so that owners can make a demand at any time without concessionaires taking any steps to injunct or otherwise restrain such demand. For D&C, while AU1 required bond submission before D&C, AU8 required bond submission upon delayed achievement of close-out with an amount of 120% of the costs for completing the remaining work. In AU8 and AU6, interestingly, concessionaires must call on any construction bond submitted by contractors within 10 business days of receipt of owner demand. For O&M, most contracts (except AU2) required submission of O&M bonds only upon failure to remedy non-conformances with an amount as decided by owners up to a pre-agreed maximum amount. Other forms of securities include shadow of the future (AU6) and retaining payments to the concessionaire (AU2, government-paid project) as determined by the IE.

In the *Philippines* and *India*, non-conformances can be noticed to concessionaires by owners or IEs. Concessionaires can request IEs to verify the nature and extent of the non-conformances informed by owners. Concessionaires must submit bonds *before* D&C and O&M. O&M bonds were not required in Indian contracts perhaps due to the application of an escrow account.

d) Handback

All contracts (except PH3) required compliance with handback requirements and inspection schedule (Table 23, d). All contracts (except PH3) required safeguards after or before remedy work determination in Australia versus in the Philippines and India, respectively. In *Australia*, all contracts required achievement of the required residual life for each project asset such as five years of residual life for pavement in AU8. All contracts (except AU8) had other detailed requirements such as no defects, transfer of plant and equipment, and delivery of manuals, records, and plans. No material item replacement for the next five years was required in AU1 and AU2. In contrast with other contracts, AU8 only required compliance with "the condition that the [Project] should be in if [the concessionaire] had complied with all of its obligations" (AU8 Clause 28) with no further details. Perhaps this is one of the reasons why this project involved a handover reviewer, appointed by the owner, a year before handback to independently determine requirements and the extent of remedy work.

All contracts required inspection by parties typically from three to five years prior to handback at the interval of six months. The extent of remedy work (including remedy plans/programs and estimation of the costs required) was determined differently: joint agreement (AU1, AU2), handover reviewer judgment (AU8), and owner determination (AU6). All contracts required monetary securities such as a bond or an escrow account for the amount at least equal to 120% of the estimated costs *after* remedy work determination. Other requirements included training owner personnel in the final months (typically three) regarding all aspects of O&M to the level of competency deemed necessary by concessionaires in all contracts except AU8 and arranging experienced personnel for consultation with the owner for 12 months after handback in AU6.

In the *Philippines*, most contracts required concessionaires to transfer rights and titles of plant and equipment required for O&M and deliver all manuals, records, and plans concerning D&C and O&M; handback requirements were not found in PH3. Joint inspections by owners and concessionaires would be done two times starting two years before handback. Concessionaires must submit a bond before handback with an amount equivalent to the higher of the remedy costs, determined by owners, and 5% of toll fees collected in the previous year (PH7) or 5% of toll fees collected in the previous year (PH9, PH10). Interestingly, concessionaires must remedy defects found within one year after handback, hence the enforceable period of the bond. Concessionaires had to train owner personnel for O&M.

In *India*, handback conditions were similarly specified in all contracts. Concessionaires must satisfy Maintenance Requirements, hand back the project free of defects or repair work, and transfer all rights and titles of plant and equipment required for O&M. Compliance with requirements was inspected by IEs three months before handback. Concessionaires typically must deposit money equivalent to 15% of annuity payment or 5% of annual toll revenue into an escrow account or provide a bond with the same face value two years before handback. Concessionaires must remedy defects found within 120 days after handback in all but the two earliest contracts (ID51, ID142).

4.6.2. Adaptive/Relational governance (process-based management)

a) Communication and meetings

In *Australia*, all contracts required establishing a senior project group (Table 24, a). The group consisted of representatives from both parties at project level and more senior level as well as other persons/entities as necessary. While having no legal responsibilities or powers, the group would meet monthly before and upon request after construction completion to monitor the overall progress, review progress reports by concessionaires, and resolve any matters referred to the group. All contracts required submission of and compliance with communication and community engagement and management plans. Concessionaires must "manage and participate in all community relations and involvement programs and activities" as required in contracts or reasonably required by owners from time to time to build and maintain effective relationships with local communities and users (e.g., AU6 Clause 9, AU8 Part F1). One contract required establishing a visitor center (AU8). Some contracts measured relevant performance and linked to payments. Examples include the accuracy and availability of information provided regarding tolls, fees, and customer terms via a project website and a call center, weekly and monthly submission of a report containing details of all community liaison, communication, community inquiries, response times to calls, complaint registers, issues arising from stakeholder meetings, and corrective actions

(AU1). All contracts required owner prior approval before concessionaire response to media requests and prompt submission of reports afterward.

In the *Philippines*, all contracts required holding regular progress meetings between owners, concessionaires, and IEs; further requirements were not found. In *India*, all contracts required disclosure of "Concession Agreement, the Maintenance Manual, the Maintenance Programme and the Maintenance Requirements" and "all Documents and data relating to safety" "at the Toll Plazas and [the] Concessionaire's Registered Office" for inspection by any person (e.g., ID74 Clause 45). Concessionaires must maintain a public relations office at each toll plaza where complaint registers must always be publicly accessible. Complaint registers must include information such as date, name, and address of the complainant, substance of the complaint, and actions taken. Owners could review a copy of the register, submitted monthly by concessionaires, and direct further actions.

b) Dispute resolution structure and process

All contracts mentioned the structure and process for dispute resolution somewhat differently across the countries (Table 24, b). In *Australia*, a senior project group or regular meetings would be the first structure for dispute resolution before a party's notice to the other party for negotiation. Then, the chief executive officers or their nominees must meet and reasonably negotiate in good faith to resolve the dispute within 10 business days. Otherwise, a party should give another notice requesting expert selection within 30 business days. Within 7 business days, parties must exchange written lists of three qualified persons in order of preference. One person with higher preference order appearing on both lists would be selected; otherwise, the noticing party must procure a nomination by the Australian Centre for International Commercial Arbitration. Parties must agree with the selected or nominated expert on the terms specified in the contract or other reasonable terms as the expert may require. Determination rules were specified. Costs concerning expert determination shall be equally borne. Within 10 business days after expert determination, a party can notice its dissatisfaction and intention to refer the matter to arbitration. A single arbitrator shall be mutually agreed upon; otherwise, the Secretary General of the Australian Centre for International Commercial Arbitration would appoint one. Arbitration rules were specified. The laws of the state where the project locates would be applied.

In the *Philippines*, all contracts required regular meetings and negotiation as the first attempt to resolve disputes. The next steps were somewhat different in PH3 versus in more recent projects. Disputes shall be referred to a dispute review board immediately in PH3 but only after attempts to settle by parties within 30 days by amicable means in more recent projects (PH7, PH9, PH10). The board consists of three members: each party would choose one member; these two members would choose the third. Board members and terms would be mutually agreed upon within 30 days from contract signing. Relevant costs would be equally shared (PH3) or subject to a mutual agreement

within 30 days from contract signing (PH7, PH9, PH10). The board shall promptly solve disputes within 10 or 30 days unless mutually extended. In case of disagreement, parties would proceed next steps, depending upon the nature of the matter. For matters concerning termination payment, parties must refer to an Independent Expert, procured by owners, for its decision in all contracts except PH3. For other matters, parties can refer to arbitration following the procedures of the Construction Industry Arbitration Commission Arbitration Rules with the place of arbitration in Metro Manila (all disputes in PH3, construction disputes in PH7, PH9, PH10) or the Rules of Arbitration of the International Chamber of Commerce with the place of arbitration in Singapore (non-construction disputes in PH7, PH9, PH10). Applicable laws would be the laws of the Philippines.

In *India*, all contracts had similar requirements starting from mediation and assistance by IEs and negotiation by the Chairmans of both parties (within 15 days) to achieve an amicable settlement. In case of failure to do so, the dispute would be escalated to arbitrators with no involvement of an independent expert or a dispute review board. There shall be a board of three arbitrators, of whom each party selects one. The third arbitrator shall be appointed by the Rules of Arbitration of the Indian Council of Arbitration. Arbitration shall be held in Delhi applying the laws of India.

c) Independent Engineer

All contracts stated that IEs would independently and impartially verify compliance with contract requirements from D&C (all three countries) to O&M and handback (Australia, India). IEs reviewed management plans as well as compliance with those plans by monitoring tests and inspecting and reviewing performance reports submitted by concessionaires. IEs could notify owners and concessionaires of non-conformances such as defects or delays; concessionaires were required to remedy accordingly to satisfy IEs. IEs could determine key issues such as payments, excusable delays, completion of key activities, and issues certificates such as construction completion certificate. Some differences across the countries follow.

In *Australia*, all contracts (except AU6) stated that the work would be subject to "general overview and reasonable checking" by IEs with no further detailed requirements regarding tests or inspections found. IEs were either already named with replacement being acceptable to both parties (AU1, AU6) or would be appointed and replaced by owners (AU2, AU8). Its costs would be borne equally by parties (AU1, AU8), paid first by the owner and reimbursed by the concessionaire up to a threshold amount and a portion of the exceeding amount or corresponding to the proportionate responsibility for the costs as determined by the IE (AU2), or paid by the concessionaire (AU6). In the *Philippines*, all contracts required IEs to monitor tests and inspect in a more detailed manner compared with contracts in Australia. For instance, most contracts required regular (PH3, PH7) or daily (PH9, PH10) inspections by IEs. The most recent contract required

the IE to attend all tests (PH10). Interestingly, IEs were limited to D&C; no stipulations regarding similar entities for O&M were found. IEs would be selected by the concessionaire from a list provided by owners (PH3, PH7), appointed by the owner (PH9), or jointly appointed (PH10). The costs of IEs would be borne by concessionaires (PH3, PH10) or equally shared (PH7, PH9). In *India*, all contracts required IEs to monitor tests and regularly inspect daily, weekly, or monthly to verify compliance with requirements. IEs were appointed and paid first by owners with one-half of the relevant costs being reimbursed by concessionaires.

d) Executing changes

Table 24 (d) shows procedures and processes for executing changes. In *Australia*, changes include any addition to or omission of the original work. For changes *initiated by owner*, two contracts restricted changes adversely affecting the "capacity of the Tollroad" or the "ability to levy Tolls" (AU1 Clause 22) or changes amending the Toll Calculation Schedule (AU6); other contracts had no restrictions (AU2, AU8). Two earlier contracts allowed owners to request concessionaires to conduct tenders for the change following owner procurement policies (AU1, AU2). All contracts specified similar procedures. Within 20 business days from receiving owner proposal with relevant details, concessionaires must provide detailed particulars of estimated costs, funding schedule, implementation schedule, and effects to the project including safety and handback requirements. Parties would reasonably consult in good faith to reach agreement. The absence of an agreement after 10 business days of consultation might trigger dispute resolution procedure. Owners can also direct concessionaires to implement a change by issuing a "Modification Order" at any time during concession period. Then, while owners must reasonably determine all related issues and fund related costs, concessionaires must implement as directed pending disputes. All savings must be returned to owners. For changes *initiated by concessionaires*, all contracts required owner prior approval. Concessionaires must propose a change with detailed particulars such as reasons, implementation schedule, and effects on the project including safety and handover requirements, and, upon owner request, written statements confirming no adverse effect to the functional integrity of the project, the quality standards, nor other obligations. Owners can reject any proposal in its absolute discretion. Some contracts required concessionaires to pay 25% or 50% of savings to owners (AU6, AU1). In addition, all contracts allowed owners to request concessionaires to implement *pre-agreed changes* until a pre-agreed date. Concessionaires must do so with an entitlement to pre-agreed payments but not extension of time.

In the *Philippines*, contracts did not specify some key provisions concerning changes initiated by owners as observed in Australia: restrictions (except PH7), right to require concessionaires to conduct tenders, right to direct concessionaires to proceed pending disputes, and savings. Other provisions changed over time. The earliest contract (PH3) only mentioned some change principles such as parties can initiate a change during the concession period and just compensation must be

paid to the concessionaire without specifying change procedures or a calculation method for compensation. Yet, PH7 restricted changes to those complying with a change in law or ensuring the safety of the public or the project. The owner might initiate a change by sending a notice to the IE. Upon certifying compliance with the required standards and initial design, the IE would request the concessionaire to submit a proposal with detailed particulars regarding estimated costs and other details within 15 days. Parties can request the IE to verify the costs. No clauses mentioning changes initiated by concessionaires were found. PH9 and PH10 specified similar change procedures with PH7 for changes initiated by either party.

In *India*, all contracts had similar provisions, except the earliest two projects included work omission as a change and they did not mention changes initiated by concessionaires. Changes *initiated by owners* were typically restricted; the private sector could nullify any change that caused cumulative costs up to a certain percentage (typically 5% within the recent three years or cumulatively 20%) of the contract amount. Concessionaires must implement a change directed by owners, pending disputes. For any change *initiated by either party*, concessionaires must provide documents detailing schedule and costs with supporting particulars. Parties would make good faith efforts to agree on time and costs with the assistance of IEs.

e) Risk sharing mechanisms

Fourteen risk sharing mechanisms, excluding cost adjustment, were confirmed and grouped following Nguyen D. and Garvin (2019b) (Table 25). Some mechanisms such as insurance were more complete, stipulating insurance premium, target assets, deductible amount, and maximum coverage and requiring lower ex post efforts. Some other mechanisms such as negotiation were less complete with little to no effort spent ex ante; they relied more on ex post efforts such as good faith negotiation. The remaining mechanisms such as extension required both ex ante and ex post efforts but to a lesser degree. Across all three countries, mechanisms with a higher level of ex post efforts appeared far more frequently than those with a lower level of ex post efforts (251 appearances versus 126), suggesting more reliance on ex post efforts to flexibly cope with uncertainties. This observation aligns with what was observed in the United States (Nguyen D. and Garvin 2019b).

The vast majority of shared risks used multiple mechanisms: on average, 2.9, 4.6, and 6.0 mechanisms were used for each shared risk in Australia, the Philippines, and India, respectively. Examples include the collective use of relief event, compensation event, negotiation, extension, and insurance to share force majeure risk. Very limited risks used one mechanism in some contracts such as further interpretation for permits and transfer in Australia (AU1, AU2, AU6), delay event for permits and environmental permits (construction-related) in the Philippines (PH3, PH7), and further interpretation for permits (ID51, ID65) and external reference for interest rates

(ID150, ID111) in India. The most frequent tandem used was deductible and compensation event with 59 appearances. External reference was not used in tandem with any other mechanisms.

Table 25. Sharing mechanisms

Level of ex post efforts	Sharing mechanisms (Risks addressed most often)	Appearances			
		AU	PH	ID	All
Lower	Deductible (socio-political opposition, change in law, force majeure)	4	9	58	71
	Insurance (socio-political opposition, force majeure)	6	6	24	36
	Maximum reimbursement (usage/demand, revenue)	2	3	14	19
Subtotal	-	12	18	96	126
Medium	Extension (socio-political opposition, force majeure)	8	15	45	68
	Further interpretation (change in law, socio-political opposition, force majeure)	12	6	49	67
	Proration (change in law, force majeure)	3	8	39	50
	External reference (interest rates)	0	0	2	2
	Extra work and delay costs (latent defects)	0	1	0	1
Subtotal	-	23	30	135	188
Higher	Compensation event (change in law, force majeure)	19	16	47	82
	Delay event (socio-political opposition, force majeure)	2	17	27	46
	Relief event (private) (socio-political opposition, force majeure)	6	15	24	45
	Relief event (public) (socio-political opposition, force majeure)	3	6	22	31
	Negotiation (change in law)	8	8	13	29
	Force majeure (Socio-political opposition)	2	4	12	18
Subtotal	-	40	66	145	251
Total	-	75	114	376	565

Note: Shared risks were revealed in Chapter 2. AU: Australia; PH: Philippines; ID: India.

4.7. Discussion

Across the three countries, the results first reveal that contracts embedded numerous practices that can trigger multiple mechanisms for implementing contractual governance such as KPIs (monitoring/control mechanism) and adaptive/relational governance such as IEs (trilateral governance mechanism) and meetings (trust and procedural justice mechanisms). These practices also pave the way for measurement-based management (KPIs) and process-based management (IEs, meetings). Contracts had both rigid and flexible provisions requiring more ex ante efforts such as detailed tests and ex post efforts such as negotiation, respectively. In this regard, this result aligns with and supports the literature exploring the tension of these pairs of connected but opposing notions (e.g., Athias and Saussier 2018; Dewulf and Garvin 2020; Khurana et al. 2022; Liu et al. 2014a; Liu et al. 2014b). Additionally, with the shadow of the future and incentives (such as a bonus) being applied in only a few cases in Australia and India, respectively, disincentives or

penalties were much more common. This extensive use of penalties aligns with but occurs to a greater extent than Garvin et al.'s (2011) findings in earlier projects in some developed countries. More importantly, the study revealed a valuable set of key practices that practitioners can reference to strategically design contracts and shape policy.

Contracts in Australia differed from contracts in the Philippines and India in two aspects. First, contracts in Australia tend to be more comprehensive with more ex ante contracting efforts and corresponding ex post implementation efforts required in many areas. For instance, contracts in Australia specified more detailed procedures and requirements for project management plans including distinctive areas such as environment and communication and community management. Most contracts in Australia also embedded more rigorous KPIs concerning such distinctive areas. Perhaps governments in the Philippines and India might consider adopting and implementing these practices for better service provision. Pre-agreed changes were found only in Australia. Contracts in Australia typically named D&C contractors, O&M service providers, and IEs. The tendency to design contracts more comprehensively in Australia has mixed associations with uncertainty avoidance. The Uncertainty Avoidance index is higher in Australia (4.39) versus the Philippines (3.89) (Table 26), which may explain that practitioners in Australia tend not to tolerate ambiguity and thus likely prefer ex ante decisions. Yet, the index is higher in India (4.15) versus the Philippines (3.89), which hardly explains the similar level of comprehensiveness found in the two countries. Other rationales such as potential associations with market maturity and past lessons, the involvement of experienced international developers and advisors, or the requirements of relevant laws and regulations are subject to further study.

Table 26. Cultural indexes

Index (weakest ~ strongest)	Australia	Philippines	India
Uncertainty Avoidance (1 ~ 7)	4.39	3.89	4.15
Power Distance (1 ~ 7)	4.74	5.44	5.47

Source: House et al. (2004) (practice scores).

Second, contracts in Australia tend to have acknowledged the motivation of the private sector to create better assets and deliver better long-term services for their own profits in PPPs more than those in the Philippines and India. Many examples illustrating this tendency were found. The private sector did not have to pay liquidated damages (or only pay the amount recoverable from contractors or insurance proceeds) in Australia but must do so in the Philippines and India. Monetary securities (D&C, O&M, handback) were typically required only when the required performance or remedy obligations had not been met in Australia but before the beginning of each phase regardless of subsequent performance in the Philippines and India. The monitoring level by IEs was typically limited to general overview and reasonable checking in Australia but was much more extensive including daily inspection and attendance to all tests in most cases in the

Philippines and India. Responsibilities to remedy defects found during a certain period after handback were only required in the Philippines and India. As such, management in Australia likely functions more via trust while management in the Philippines and India is closer to that in traditional contracts with more emphasis on monitoring/control in many aspects. This acknowledgment of concessionaire motivation in Australia signals a more balanced "partnership" and warrants more relational governance. This may be because, in countries with less power distance such as Australia (smaller index) (Table 26), partners are more likely to be treated as equal and contracts are less likely to function as a control instrument (Cao and Lumineau 2015). Governments in the Philippines and India might want to consider adopting more trust-based management practices so that their contracts would better attract and incentivize international developers.

The research sets a stage for several avenues of future research. Among these, expert input would provide valuable insights to strengthen and reinforce the research's findings, especially in exploring the "why" question in addition to the "how" question, the effectiveness of the practices investigated, and the alignment with parties' preferences. Further, addressing the research's data limitation (inaccessibility of unsolicited contracts in India) or extending the research's scope to other sectors or other regions might further seek more general or unique patterns and generalize findings. It might be argued that unsolicited contracts in India may not be very different from the solicited contracts explored given the prevalent adoption of the same standardized contracts in the country in different project initiation mechanisms (National Highways Authority of India 2021).

4.8. Conclusion

Long-term and complex PPP transactions must effectively deal with high uncertainty for better value for money. Twenty contemporary PPP highway contracts in Australia, the Philippines, and India incorporated numerous practices via a lifecycle project management approach including both measurement- and process-based management; these practices can trigger governance mechanisms to promote contractual and relational governance for better project performance under uncertainty. Practitioners can reference the revealed practices for strategic contractual designs and implementation. Contracts in Australia were more comprehensive in forming project structure and demanding numerous distinctive requirements but also more reliant on trust-based management and relational governance in monitoring and safeguarding requirements. Governments in evolving markets might want to consider adopting these practices to better provide services and attract and incentivize international developers. Together, the findings provide insights to better understand how contracts are designed to address uncertainties in PPP highways or other large scale infrastructure projects in general, regardless of project delivery method, where uncertainties are

likewise inherent; the similarities and differences revealed would serve as a basis to better govern projects and strategically design contracts or policies.

5. Summary, Contributions, and Future Research

Three studies were conducted to comprehensively capture contractual practices concerning three key issues that are also critical success factors (risk allocation, decision rights allocation, and lifecycle project management) in 20 contracts in three large PPP markets (Australia, the Philippines, and India) in Asia Pacific, an active region of PPP implementation. This research was warranted given the scarcity of the relevant literature in the target countries, the region, and global developing countries. Twenty contracts were deliberately sampled to capture the widest possible range of key project characteristics (commercial close, project initiation mechanism, payment mechanism, contract duration, contract amount). Since Study 1 and Study 2 assessed risk allocation and decision rights allocation, they employed validation to enhance the results' consistency and reliability (internal and external for Study 1; internal for Study 2). All three studies (i) developed comprehensive sets of key risks, provisions, and practices categories for exploration based on the sets used in previous relevant studies (e.g., Nguyen D. and Garvin 2019a; Nguyen D and Garvin 2019b; Nguyen D. et al. 2018; Garvin et al. 2011) and reviewing the relevant literature in the target countries and the region, (ii) confirmed my ability to interpret contracts by analyzing a contract and comparing the results with those of previous relevant studies, (iii) established effective analysis rubrics referencing previous relevant studies and confirmed the rubrics via pilot studies involving the contracts in point (ii) and three contracts in this research that represent typical characteristics of contracts in each country, and (iv) conducted contract content analysis followed by transnational, comparative, and parametric analysis.

5.1. Summary of Findings

Study 1 presents the allocation of a comprehensive list of 35 key risks and reveals several major findings. First, risks were similarly allocated across Australia, the Philippines, and India. This similarity is somewhat surprising given the huge differences between these countries. For instance, risk allocation ratios were similar and most risks were allocated the same or predominantly the same across the countries. Specifically, all exogenous risks had either the same allocation or the same predominant allocation in all contracts across the three countries. Second, while generally limited to some endogenous risks, variances in risk allocation should be paid attention to for informed decision-making about market entry, project selection, contractual designs, and policy shaping. Third, the vast majority of risks from design, construction, operation, and maintenance were either allocated to the private sector or shared, confirming the risk transfer tenet of PPPs. Fourth, some shift of responsibilities to the private sector was observed in tolled projects (typically longer contract duration) compared with government-paid ones (typically shorter). Fifth, exogenous risks were shared more than endogenous risks. This reinforces the "control" criterion in risk allocation because exogenous risks are typically beyond parties' control and thus should be

shared. Exogenous risks had more consistent risk allocation than endogenous risks, confirming the principle of risk allocation regarding sources of risks. Sixth, the practices of risk allocation generally align with the preferred risk allocation in Australia and the Philippines. Seventh, some limited trends over time such as less silent or indeterminate provisions and more public risks in the Philippines and India, respectively, were observed.

While the first study revealed that governments transfer the majority of risks to the hands of concessionaires, **Study 2** demonstrates extensive owner monitoring and control in all three countries in 10 key areas of contractual provisions: project management approach over lifecycle, performance measurement, changes by owners or concessionaires, competing facilities or proximate work, refinancing, transfer, handback/residual value, contracting with D&C contractors, contracting with O&M service providers, and assignment of independent engineer. Even though the private sector plays a much more significant role in PPP projects than in traditional ones, the partnership between both sectors is still far from balanced. The public sector retains decision rights in the majority of important activities or decisions, trying to ensure that no issues arise or unexpected uncertainties materialize. This extensive level of monitoring and control was observed in all three countries regardless of development level and the substantial number of risks transferred to the private sector. No notable transnational trends or variances were observed.

Study 3 presents contractual practices to manage a project over its lifecycle in the following key practices categories: performance requirements and monitoring structure, performance measurement and corresponding payments, remedies/safeguards for poor performance, handback, communication and meetings, dispute resolution structure and process, independent engineer, executing changes, and risk sharing mechanisms. Based on the linkages with governance mechanisms synthesized from the relevant literature, these practices can trigger multiple governance mechanisms for implementing contractual governance such as KPIs (monitoring/control mechanism) and adaptive/relational governance such as IEs (trilateral governance mechanism) and meetings (trust and procedural justice mechanisms). These practices also pave the way for measurement-based management (e.g., KPIs) and process-based management (e.g., IEs, meetings). Contracts had both rigid and flexible provisions requiring more ex ante efforts such as detailed tests and ex post efforts such as negotiation, respectively. Contracts in Australia tend to be more comprehensive in many areas requiring more ex ante contracting efforts such as naming contractors in contracts and ex post implementation efforts to comply with many distinctive requirements such as those concerning environment and community/user management. Meanwhile, contracts in Australia likely rely more on trust-based management versus monitoring/control-based management, having limited requirements for monitoring and safeguarding the contract.

5.2. Contributions and Implications

The three studies comprehensively present the current practices of the three key issues that are also critical success factors, i.e., risk allocation, decision rights allocation, and lifecycle project management (Chou and Pramudawardhani 2015; Dewulf and Garvin 2020; Kim and Thuc 2019; Liu et al. 2015; Nguyen D. et al. 2018; Nguyen D. and Garvin 2019a; Tariq and Zhang 2021), investigated in a deliberately sampled set of 20 highway contracts in Australia, the Philippines, and India. Together, these three studies provide insights to better understand how contracts are designed to address uncertainties. These insights contribute to better shaping policies and contractual designs for enhanced value for money and improved PPP implementation. Unique contributions and implications of each study are followed by common and overall contributions and implications of all three studies.

5.2.1. Unique contributions and implications of each study

Study 1 revealed a broadly consistent risk allocation in the three different countries, suggesting other influential factors in parties' contractual choices besides country or project characteristics such as risk preferences, expectations of future revenue, or availability of risk mitigating/hedging measures. The similarities revealed might suggest more regional practices thanks to the principle of maximum variation sampling (Patton 2015). Practitioners can reference the similarities and variances revealed for more informed decision-making about market entry, project selection, contractual designs, and policy shaping. Key areas that practitioners should carefully consider to mitigate potential conflicts involve silent or indeterminate provisions and all-risks or disclaimer clauses. The results also provide contractual evidence supporting and reinforcing multiple literature: the risk transfer tenet of PPPs, the materialization of well-known risk allocation criteria in PPPs, the allocation principle according to sources of risks, and the standardization and contextualization in PPP contracts.

Study 2's results provide evidence of and support for contractual theories in PPPs. Governments address the principal-agent problem by extensively monitoring concessionaires' compliance with contract requirements (agency theory). Contracts incentivized the private sector's compliance with contractual requirements by imposing penalties as observed in the KPI regime (agency theory). Decision rights were generally retained by governments to cope with contract incompleteness (incomplete contract theory, property rights theory) due to governments' accountability and responsibilities as regulators (Dewulf and Garvin 2020; Nguyen D. and Garvin 2019a). This extensive level of owner control might pose considerable burdens to governments and warrants governments' relevant capabilities. The private sector generally can only enjoy "proposal rights" in several provisions. For instance, the private sector can propose a design or a construction method that best capitalizes on their skills and resources. A question should be raised concerning how to

limit government opportunism, especially in weaker institutional environments, since the private sector, especially after investing in and constructing the project, might be placed in a vulnerable situation due to government-led hold-up problems (Ho et al. 2015). Ideally, owner control and concessionaire empowerment should be optimal to maximize private innovations and mitigate opportunism from both parties for better project outcomes.

Study 3 integrated the rich but fragmented literature to develop a comprehensive set of linkages between contractual practices categories and governance mechanisms. The practices explored specify project structure, requirements, processes, and procedures that function as key elements of measurement- and process-based management during a project's lifecycle. Implementing them can trigger corresponding governance mechanisms to promote contractual and relational governance for better performance under uncertainty. The linkages developed can be used as a starting point in further research such as those exploring contractual practices and governance mechanisms in other countries. More comprehensive contractual designs in many areas in Australia have mixed associations with country-level factors. More reliance on trust-based management in Australia signals a more balanced partnership and warrants more relational governance that associates with the lower power distance index in the country. Trust-based management acknowledges the private sector's motivation to, for instance, achieve early completion and deliver good services since their huge investment is at stake. A proper level of trust-based management can create room for innovations by the private sector for better project performance. Governments in the Philippines and India might want to consider adopting more trust-based management practices to better attract and incentivize international developers who might favor or be more familiar with the trust-based management practices in Australian contracts. Governments in the Philippines and India might also want to consider adopting and implementing some distinctive requirements found in Australian contracts such as those concerning community/user and environment management for better service provision.

5.2.2. Overall contributions and implications of all three studies

a) Contributions to the current body of knowledge

Together, the findings provide contractual evidence to reinforce the literature by demonstrating how parties design contracts ex ante to deal with ex post uncertainties as selectively demonstrated in Fig. 13. For instance, agency theory was adopted via transferring most risks to the private sector (Study 1) and using extensive owner monitoring/control (Study 2, Study 3) to align incentives, mitigate opportunism, and limit asymmetric information. This is to address incomplete contracts as suggested by incomplete contract theory. Moreover, the similarities and differences revealed reinforce the recent discussion in the literature regarding the tension of standardization and contextualization. Study 1 and Study 2 show that similarities or standardization in contracts are

more prevalent within a country and across the countries regarding risk allocation and decision rights allocation. This is perhaps due to (i) governments' motivations to apply standardized contracts or relevant national guidelines to fulfill their accountability, legitimacy, and transparency responsibilities and to reduce transaction costs and (ii) the adoption of agency theory. Further influential factors concerning risk allocation (Study 1) are subject to future research. Study 3 shows a relatively lower level of similarities across the countries with Australian contracts being more rigid and requiring more non-asset (service) requirements but relying more on trust-based management practices in many areas. These differences associate with and likely highlight the relatively stronger influence of factors including institutional strength, PPP enabling environment and market maturity, and culture. Further, practices such as review/update of KPIs, adoption of industry best practices, negotiations, and meetings introduce flexibility and rely more on ex post efforts to address incomplete contracts. They involve elements of process-based management and can trigger certain normative and cognitive mechanisms that promote adaptive/relational governance to respond to uncertainties. Similarly, practices such as KPIs with corresponding penalties demonstrate contract rigidity and rely more on ex ante efforts. They involve elements of performance-measurement management and can trigger certain regulative mechanisms that promote contractual governance. All these related but in some senses different or even opposing mechanisms and strategies were employed in a complementary way to address each other's limitations. For instance, extreme reliance on relational governance might result in blind trust where parties do not strictly enforce contracts; yet, KPIs with corresponding penalties or other contractual requirements were designed to set a boundary to curb parties' actions from derailing too far ex post from what was agreed ex ante.

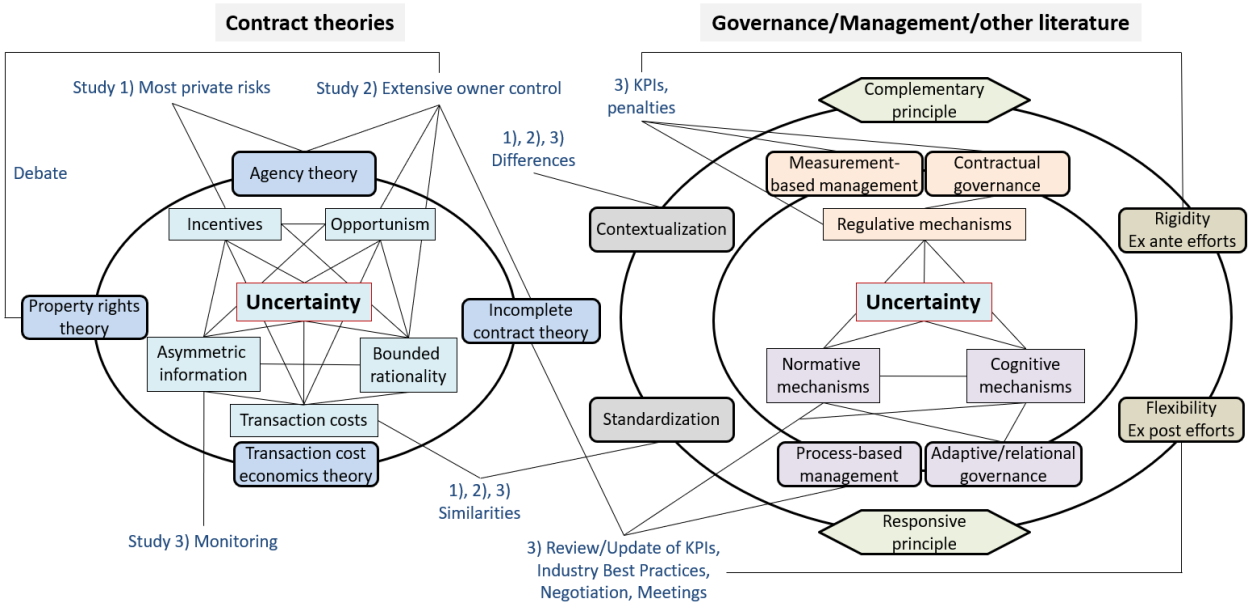


Fig. 13. Contractual evidence reinforcing the literature

(Compiled from Athias and Saussier 2018; Coarse 1937; Chung and Hensher 2015; Dewulf and Garvin 2020; Dewulf et al. 2016; Eisenhardt 1989; Hart 2009; Henisz et al. 2012; Khurana 2021; Khurana et al. 2022; Liu et al. 2014a, b, 2015, 2018; Nguyen D. and Garvin 2019; Sappington 1997; Scott 2008; Williamson 1979)

Note: Numbers indicate study numbers.

b) Pragmatic implications

In addition to its important academic contributions, the research also has valuable pragmatic implications: policymakers and practitioners can use the similarities and differences uncovered for more informed decision making such as strategically adjusting and better designing contracts and policies to fit specific contexts for enhanced PPP implementation. Some key examples follow. First, policymakers in evolving markets such as the Philippines and India might consider reshaping their policy and contracts toward involving trust-based management practices as in Australia to better attract and incentivize international developers who might favor or be more familiar with contracts having more trust-based management practices versus the current practices relying more on monitoring and control in the Philippines and India. Second, the different allocation in key risks can inform developers and governments for market entry, policy shaping, and contractual design decisions. Take *revenue risk* as an example; the risk is typically shared in India but borne by the private sector in the Philippines. Thus, international developers considering market entry between the Philippines and India might choose India over the Philippines if they want to share the risk with the government. Otherwise, they can choose the Philippines over India if they want to take the risk, expecting the risk's positive side (opportunity). Market entry decision can be very costly and time-consuming since international developers must study the laws and regulations in the target market, establish and operate a representative office, and establish good relationships with and reputation among local contractors, subcontractors, government authorities, and other key stakeholders. Third, practitioners can consider the results as a whole together with the reality of their implementation. For instance, assessment based on the contractual languages indicated that *project management approach over lifecycle* and *handback/residual value* were shared in India because they were subject to IEs' comment or determination but not owner approval. Further attention should be paid to *assignment of IE*: IEs in India were appointed, paid first, and terminated "in its discretion" "at any time" by the government. Thus, the government might have influence over IEs' decisions in reality so these provisions might actually shift toward owner control. Given the huge role and responsibilities of IEs (Chapter 4), this example highlights the need for revisiting the payment and assignment structure of IEs to more properly adopt trilateral governance (i.e., IEs) for the whole project's benefit. Fourth, practitioners can also negotiate reasonable ways to address the silent or indeterminate provisions identified to mitigate lengthy and costly contractual conflicts or debates in both ongoing and future projects by strategically adopting the practices,

mechanisms, strategies, and principles revealed or demonstrated in this research. For example, parties in the Philippines where *refinancing* was silent can negotiate based on and select from the practices used in contracts in Australia and India to require owner consent in all cases (Australia) or only if the refinancing would affect the public sector (India). Parties in the Philippines and India (where the following practices used in Australia were not mentioned) can (a) add criteria such as the refinancing being on an arm's length basis and not worsening owner obligations and debt payment schedule nor downgrading the special purpose vehicle's rating, (b) restrict pre-completion refinancing, and (c) decide reimbursement of refinancing gains, subject to their needs. Fifth, the high similarity of the structure and actual language of contracts within a country in the Philippines and India (especially within the same payment category) might have set precedents that the governments might be reluctant to change given their accountability and legitimacy responsibilities. Thus, developers considering involvement (market entry and project selection) or currently involved in these countries might face difficulties in negotiating and requesting changes from the current and prevalently used provisions. Sixth, overall, parties might reference the practices uncovered to strategically design contracts. For instance, parties can share *change in law* by selecting some mechanisms from the 14 mechanisms uncovered, considering the timing and level of effort needed and parties' preferences. Parties can use the further interpretation mechanism to share the risk by sources of changes (e.g., general or project-specific, environmental or non-environmental). Parties can also use the deductible and proration mechanisms to share the risk proportionally after the private sector's incurred costs exceed a pre-agreed threshold. Further, parties can mitigate potential conflicts by explicitly indicating the applicable timing of industry best practices or standards. Additionally, parties can enhance trust to promote relational governance by designing and implementing regular meetings and communication. Seventh, parties, especially those new to complex PPP contracts, should carefully review their ongoing or prospective contracts for generic and complex clauses such as definitions, representations and warranties, force majeure, termination and default, government material adverse action, payment adjustment, all-risks, and disclaimer since these clauses affect the contractual interpretation of many key issues. For instance, a few sentences of an all-risks or disclaimer clause push all responsibilities to the private sector except those expressly mentioned otherwise and significantly limit concessionaire claims, respectively. Overlooking these few sentences might result in huge and unexpected losses. Thus, given the overall complexity of a contract, contracting parties might use the analysis rubric developed for and the sets of provisions identified in this research (e.g., risk allocation matrix) to effectively and thoroughly explore contracts and compare their own contractual interpretation (e.g., risk allocation). Such a comparison might increase transparency, limit opportunism, and mitigate misunderstandings while ultimately avoiding lengthy and costly future contractual issues in PPPs and beyond.

5.2.3. Conclusion

The research comprehensively revealed and thoroughly validated the current practices of three key issues (risk allocation, decision rights allocation, and lifecycle project management) via exploring comprehensive sets of provisions in not only a developed country (Australia) but also two developing countries (the Philippines and India). The uncovered similarities and differences across countries and projects of not only the high-level information such as the allocation of risks or decision rights but also the in-depth information including contractual languages, mechanisms, and strategies, provide a rich database of relevant practices to better understand how contracts are designed to address uncertainties and a valuable reference point for better shaping policies and contractual designs for enhanced value for money and improved PPP implementation. This enriches and addresses the scarcity of the relevant literature in the target countries, the region, and global developing countries.

As such, this research is unique in many aspects. Foremost, it has both significant academic and pragmatic contributions and implications as previously discussed. It provides contractual evidence to reinforce the literature by demonstrating how parties design contracts ex ante to deal with ex post uncertainties. Policymakers and practitioners can use the similarities and differences uncovered for more informed decision making such as strategically adjusting and better designing contracts and policies to fit specific contexts for enhanced PPP implementation. Moreover, it is also both broad, covering three countries, and comprehensive, exploring comprehensive sets of provisions in a large data set of 20 contracts, which especially includes one third or a half of total contracts in the Philippines and Australia, respectively. Further, the research is one of the first known transnational analyses in PPPs using contracts. The research situates itself as part of and contributes to the limited transnational PPP literature (Tallaki and Bracci 2021). It enriches the current PPP literature relying more on interviews, surveys, and case studies since contracts are a valuable data source; the data set proves valuable given the difficulties in accessing contracts especially in developing countries. Overall, the research is characterized by its broad scope having explored comprehensive sets of key provisions in 20 contracts spanning three countries and its numerous implications for both theory and practice of PPP contractual design and implementation.

5.3. Future Research

The results suggest several potential avenues for future research. First, confirming some claims in the literature that were not supported by some results - such as contracts tend to be more flexible in dealing with future uncertainties in stronger institutional environments (Athias and Saussier 2018) - might help better understand factors affecting parties' contractual choices. Second, scholars can use the rubrics and sets of provisions developed in this research to effectively explore contracts in other regions and low-income countries to seek a general pattern of contractual

practices in the world. Alternatively, scholars can consider developing a program based on natural language processing that can automatically (or semi-automatically) and effectively read, code, and assess contracts before experts' final confirmation. In doing so, scholars can reference the semi-automated natural language processing method employed in Khurana (2021). Third, scholars are encouraged to get more insights from practitioners to explore the possible reasons underlying the similarities and differences revealed. Such knowledge would deepen our understanding of the factors, including country-level ones, that contribute to such similarities and differences. Fourth, investigating the alignment between the current practices revealed and each counterparty's preferences is helpful for informed decision making such as market entry and policy making. Lastly, an in-depth investigation similar to Chung and Hensher (2015) in a contemporary context can track the effectiveness of the practices revealed. The research sets the stage for such future research.

References

ADB (Asian Development Bank). (2019). "Public-Private Partnership Monitor." Retrieved Sep 15, 2021, from https://www.adb.org/publications/public-private-partnership-monitor.

Aghion, P., and Holden, R. (2011). "Incomplete Contracts and the Theory of the Firm: What Have We Learned over the Past 25 years?" *Journal of Economic Perspectives,* 25(2), 181-197.

Ahmed, M., and Garvin, M., J. (2022). "Review of Critical Success Factors and Key Performance Indicators in Performance Assessment of P3 Transportation Projects." *J. Manage. Eng.,* 38(5): 04022045.

Athias, L., and Saussier, S. (2018). "Are public private partnerships that rigid? And why? Evidence from price provisions in French toll road concession contracts." *Transp. Res. Part A Policy Pract.,* 111 (May): 174–186. https://doi.org/10.1016/j.tra.2018.02.011.

Bao, F., Chan, A., P., C., Chen, C., and Darko, A. (2016). "Review of Public-Private Partnership Literature from a Project Lifecycle Perspective." *J. Infrastruct. Syst.,* 24(3): 04018008.

Bartholomew, S., H. (2002). "Construction contracting: business and legal principles." 2nd Ed., Prentice Hall.

Benítez-Ávila, C., Hartmann, A., Dewulf, G., and Henseler, J. (2018). "Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution." *International Journal of Project Management*, 36(2018), 429-443.

Benítez-Ávila, C., Hartmann, A., and Dewulf, G. (2019). "Contractual and Relational Governance as Positioned-Practices in Ongoing Public-Private Partnership Projects." *Project Management Journal*, 50(6), 716-733.

Brinkerhoff, D., W., and Brinkerhoff, J., M. (2011). "Public-private partnerships: Perspectives on purposes, publicness, and good governance." *Public Administration and Development*, 31, 2-14.

Caniëls, M., C., J., Gelderman, C., J., and Vermeulen, N., P. (2012). "The interplay of governance mechanisms in complex procurement projects." *J. Purch. Supply Manage,* 18 (2): 113–121. https://doi.org/10.1016/j.pursup.2012.04.007.

Cao, Z., and Lumineau, F. (2015). "Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation." *Journal of Operations Management,* 33-34(2015), 15-42.

Carbonara, N., Constantino, N., and Gunnigan, L. (2015). "Risk Management in Motorway PPP Projects: Empirical-based Guidelines." *Transport Reviews: A Transnational Transdisciplinary Journal*, DOI: 10.1080/01441647.2015.1012696.

Castelblanco, G., and Guevara, J. (2020). "Risk Allocation in PPP Unsolicited and Solicited Proposals in Latin America: Pilot Study in Colombia." *Construction Research Congress 2020*.

Castelblanco, G., Guevara, J., Mesa, H., and Flores, D. (2020). "Risk Allocation in Unsolicited and Solicited Road Public-Private Partnerships: Sustainability and Management Implications." *Sustainability*, 2020, 12, 4478; doi:10.3390/su12114478.

Ceric, A. (2012). "Strategies for minimizing information asymmetries in construction projects: Project managers' perceptions." *Journal of Business Economics and Management*, 15(3), 424-440.

Chan, A., P., C., Lam, P., T., I., Chan, D., W., M., Cheung, E., and Ke, Y. (2009). "Drivers for Adopting Public Private Partnerships – Empirical Comparison between China and Hong Kong Special Administrative Region." *J. Constr. Eng. Manage.*, 135(11): 1115-1124.

Chan, A., P., C., Yeung, J., F., Y., Yu, C., C., P., Wang, S., Q., and Ke, Y. (2011). "Empirical study of risk assessment and allocation of public-private partnership projects in China*." J. Manage. Eng.*, 10.1061/(ASCE)ME.1943-5479.0000049, 136–148.

Chan, C., H, F. (2010). "To talk or to fight? Collective Effects of Strategic, Cultural, and Institutional Factors on Investors' Renegotiation Approach in Public-Private Concessions." *Stanford University Ph.D. Dissertation*.

Chan, E., and Suen, H. (2005). "Dispute resolution management for international construction projects in China." *Manage. Decis.*, 43 (4): 589–602. https://doi.org/10.1108/00251740510593576

Cherkos, F., D., Jha, K., N., and Singh, A. (2020). Framework to select PPP modalities. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 2020, 12(4): 04520034

Cheung, E., Chang, A., P., C., and Kajewski, S. (2009). "Reasons for implementing public private partnership projects: Perspectives from Hong Kong, Australian and British practitioners." *Journal of Property Investment & Finance*, 27(1), 81-95.

Cheung, E., Chang, A., P., C., and Kajewski, S. (2010). "Suitability of procuring large public works by PPP in Hong Kong." *Engineering, Construction and Architectural Management*, 17(3), 292-308.

Cheung, S. O., Zhu, L., and K., W., Lee. (2018). “Incentivization and interdependency in construction contracting.” *J. Manage. Eng.*, 34 (3): 04018010. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000601.

Chou, J., and Pramudawardhani, D. (2015). “Cross-country comparisons of key drivers, critical success factors and risk allocation for public-private partnership projects.” *International Journal of Project Management*, 33(2015), 1136-1150.

Chou, J.-S., Ping Tserng, H., Lin, C., and Yeh, C.-P. (2012). “Critical factors and risk allocation for PPP policy: Comparison between HSR and general infrastructure projects.” *Transport Policy 22*, 36–48.

Chung, D., and Hensher, D., A. (2015). “Risk management in public–private partnerships.” *Aust. Account.*, Rev. 25 (1): 13–27. https://doi.org/10.1111/auar.12062.

Chung, D., and Hensher, D., A. (2016). “Risk-sharing in public–private partnerships: A contractual economics perspective.” *Handbook on transport and urban planning in the developed world*, edited by M. C. J.

Chung, D., Hensher, D., and Rose, M., J. (2010). “Toward the Betterment of Risk Allocation: Investigating Risk Perceptions of Australian Stakeholder Groups to Public-Private-Partnership Tollroad Projects.” *Research in Transportation Economics*, DOI: 10.1016/j.retrec.2010.10.007.

Cohen, J. (1960). “A coefficient of agreement of nominal scales.” *Educ. Psychol. Meas.*, 20(1), 37–46.

Dolla, T., and Laishram, B. (2019). “Bundling in public-private partnership projects – a conceptual framework.” *International Journal of Productivity and Performance Management*. DOI: 10.1108/IJPPM-02-2019-0086.

Delhi, V. S. K., Mahalingam, A., and Palukuri, S. (2012). “Governance issues in BOT based PPP infrastructure projects in India.” *Built Environ. Project Asset Manage*, 2 (2): 234–249. DOI: https://doi.org/10.1108/20441241211280864.

Dewatripont, M., and P. Legros. (2005). “Public-private partnerships: Contract design and risk transfer.” *EIB Pap.*, 10 (1): 120–145.

Dewulf, G., and Garvin, M., J. (2020). “Responsive governance in PPP projects to manage uncertainty.” *Construction Management and Economics*, 38(4), 383-397.

Dewulf, G., Garvin, M., J., and Duffield, C. (2016). “Multinational comparison of the tension between standards and context in PPP.” *Public Private Partnerships in Transport: Trends and theory*, ed. By Roumboutsos, A, Routledge Studies in Transport Analysis.

Domingues, S., and Zlatkkovic, D. (2015). “Renegotiating PPP Contracts: Reinforcing the ‘P’ in Partnership.” *Transport Review,* 35(2), 204-225.

Eisenhardt, K., M. (1989). “Agency theory: An assessment and review.” *Academy of Management Review,* 14 (1): 57–74.

Economist Intelligence Unit. (2014). “Evaluating the environment for public-private partnerships in Asia-Pacific.” Retrieved Sep 15, 2021, from https://infrascope.eiu.com/

Economist Intelligence Unit. (2019). “Measuring the enabling environment for public-private partnerships in infrastructure.” Retrieved Sep 15, 2021, from https://infrascope.eiu.com/

Foster, R. (2013). “Comparative study of variation clauses in public private partnership contracts.” *Innovation in Public Finance Vol. 1: Proc. of the 2013 IPF Conf., Politencnico di Milano,* 17–19 June 2013, edited by B. Monda and M. Giorgino. London: PoliFinance.

Gao, N., Chen, Y., Wang, W., and Wang, Y. (2018). “Addressing Project Complexity: The Role of Contractual Functions.” *J. Manage. Eng.,* 34(3): 01018011.

Garvin, M., J., and Bosso, D. (2008). “Assessing the Effectiveness of Infrastructure Public-Private Partnership Programs and Projects.” *Public Works Management & Policy, 13*(2), 162-178.

Garvin, M., Molenaar, K., Navarro, D., and Proctor, G. (2011). “Key Performance Indicators in Public-Private Partnerships: A State-of-the-Practice Report.” Retrieved Oct 1, 2022, from https://international.fhwa.dot.gov/pubs/pl10029/pl10029.pdf.

Garvin, M., J. (2009). “Governance of PPP projects through contract provisions.” In *Proc., 4th Specialty Conf. of Leadership and Management of Construction*, edited by P. S., Chinowsky and R. E. Levitt. South Lake Tahoe, CA: CD-ROM.

Gopalkrishna, N., and Karnam, G. (2015). “Performance Analysis of National Highways Public Private Partnerships in India.” *Public Works Management and Policy*, 20(3), 264-285.

Grimsey, D., and Lewis, M., K. (2002). “Evaluating the risks of public private partnerships for infrastructure projects.” *Int. J. Project Manage.,* 20(2), 107–118.

Grout, P, A., and Stevens, M. (2003). “Financing and Managing Public Services: An Assessment.” *CMPO Working Paper Series* No. 03/076.

Guasch, J., L. (2004). “Granting and Renegotiating Infrastructure Concessions: Avoiding the Pitfalls.” *World Bank Publications*, 2004.

Guasch, J., L., Benitez, D., Portables, I., and Lincoln, F. (2014). “The renegotiation of PPP contracts: An overview of its recent evolution in Latin America.” *International Transport Forum*, Discussion Paper No. 2014-18.

Guevara, J., Garvin, M., J., and Ghaffarzadegan, N. (2020). “The Forest and the Trees: A Systems Map of Governance Interdependencies in the Shaping Phase of Road Public-Private Partnerships.” *J. Manage. Eng*, 36(1): 04019031.

Oxford Economics. (2017). “Global Infrastructure Outlook.” Retrieved Dec 8, 2020, from https://outlook.gihub.org/

Haponava, T., and Al-Jibouri, S. (2012). “Proposed System for Measuring Project Performance Using Process-Based Key Performance Indicators.” *Journal of Management in Engineering*, 28(2): 140-149.

Hart, O. (1995). Firms, contracts, and financial structure. *Oxford, UK: Oxford Univ. Press*.

Hart, O. (1988). “Incomplete contracts and the theory of the firm.” *J. Law Econ.*, Organ. 4 (1): 119–139.

Hart, O. (2003). “Incomplete contracts and public ownership: Remarks, and an application to public-private partnerships.” *Econ. J.*, 113 (486): C69–C76. https://doi.org/10.1111/1468-0297.00119.

Hart, O. (2009). “Hold-up, asset ownership, and reference points.” *Q. J. Econ.*, 124 (1): 267–300. https://doi.org/10.1162/qjec.2009.124.1.267.

Henisz, W., J., Levitt, R., E., and Scott, W., R. (2012). “Toward a unified theory of project governance: Economic, sociological and psychological supports for relational contracting.” *Engrg. Project Organ. J.*, 2:1–2, 37–55.

Ho, S. P., R. Levitt, C.-W. Tsui, and Y. Hsu. (2015). “Opportunism-focused transaction cost analysis of public-private partnerships.” *J. Manage. Eng.*, 31 (6): 04015007. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000361.

Holmström, B. (1979). “Moral hazard and observability.” *Bell J. Econ.*, 10 (1): 74–91. https://doi.org/10.2307/3003320.

House, R., Hanges, J., and Paul, J. (2004). “Culture, leadership, and organizations: The GLOBE study of 62 societies.” *SAGE Publications, Inc*.

Hwang, B.-G., Zhao, X. and Gay, M., J., S. (2013). “Public-Private Partnership projects in Singapore: Factors, critical risks and preferred risk allocation from the perspective of contractors.” *International Journal of Project Management*, 31(3), 424–433.

IJ Global. (2021). “Transaction Data.” Retrieved Sep 15, 2021, from https://ijglobal.com/data/search-transactions.

India PPP center. (2021). “List of all PPP projects.” Retrieved October 15, 2021, from https://www.pppinindia.gov.in/list-of-all-ppp-projects.

Institutional Investor. (2016). “Country credit ratings.” Retrieved Sep 5, 2021, from https://www.institutionalinvestor.com/research/6150/Global-Rankings.

Iossa, E., and Martimort, D. (2011). “Risk Allocation and the Costs and Benefits of Public-Private Partnerships.” *The RAND Journal of Economics,* 42(1), 1-13. DOI: 10.2307/41723338.

Iossa, E., and Martimort, D. (2015). “The Simple Microeconomics of Public-Private Partnerships.” *Journal of Public Economic Theory,* 17(1), 4-48.

ISO (International Organization for Standardization). (2018). “ISO 31000: Risk management – Guidelines.” Retrieved Sep 26, 2021, from https://www.iso.org/obp/ui/#iso:std:iso:31000:ed-2:v1:en.

Ismail, S. (2013). “Factors Attracting the Use of Public Private Partnership in Malaysia.” *Journal of Construction in Developing Countries,* 18(1), 95-108.

Ismail, S., and Haris, F., A. (2014). “Constraints in implementing Public Private Partnership (PPP) in Malaysia.” *Built Environment Project and Asset Management,* 4(3), 238-250.

Kakati, M., and Baruah, P. (2016). “Optimal risk allocation in Public-private partnership (PPP) projects in India.” *WEI International Academic Conference Proceedings*.

Kaplan, R., S., and Norton, D., P. (1992). “The Balanced Scorecard: Measures That Drive Performance.” *Harvard Business Review,* 172-180.

Kaufmann, D., and Kraay, A. (2022). “Worldwide Governance Indicators.” Retrieved Apr 29, 2022, from http://info.worldbank.org/governance/wgi/

Ke, Y., Wang, S., and Chan, A. P. C. (2010). “Risk allocation in public private partnership infrastructure projects: Comparative study.” *J. Infrastruct. Syst.,* 10.1061/(ASCE)IS.1943-555X.0000030, 343–351.

Keep, M. (2021). “Infrastructure policies and investment.” *UK House of Commons Library Research Briefing* Number 6594. Retrieved Oct 30, 2021, from https://commonslibrary.parliament.uk/research-briefings/sn06594/

Khalfan, M., M., McDermott, P., and Swan, W. (2007). “Building trust in construction projects.” *Supply Chain Manage,* 12 (6): 385–391. https://doi.org/10.1108/13598540710826308.

Khurana, M. (2021). “Investigation of Contractual Specification and Implementation of Relational Approaches in Public Private Partnership (PPP) Projects.” *Virginia Polytechnic Institute and State University Ph.D. Dissertation*.

Khurana, M., Garvin, M., J., and Mahalingam, A. (2022). “Synthesis of Relational Practices for PPP Contracts and Their Linkage with Governance Mechanisms.” *J. Constr. Eng. Manage.*, 148(12): 04022131.

La, A., T. (2016). “Principal Factors for Public-Private Partnership (PPP) Implementation in Vietnam: A Mixed Methods Study.” *University of Technology Sydney Ph.D. dissertation*.

Lam, K., C., Wang, D., Patricia, T., K., L., and Tsang, Y., T. (2007). “Modelling risk allocation decision in construction contracts.” *International Journal of Project Management*, 25(5), 485-493.

Landis, J. R., and Koch, G. G. (1977). “The measurement of observer agreement for categorical data.” *Biometrics*, 33(1), 159–174.

Le, P., T., Kirytopoulos, K., Chileshe, N., and Rameezdeen, R. (2019). “Taxonomy of risks in PPP transportation projects: a systematic literature review”. *International Journal of Construction Management*, DOI: 10.1080/15623599.2019.1615756

Le, P., T., Chileshe, N., Kirytopoulos, K., and Rameezdeen, R. (2020). “Investigating the significance of risks in BOT transportation projects in Vietnam.” *Engineering, Construction and Architectural Management*, 27(6), 1401-1425.

Levitt, R., E., (2011). “Toward project management 2.0.” *Engineering project organization journal*, 1(3), 197–210.

Levitt, R., E., Garvin, M., J., Scott, W., R., Dewulf, G., Monk, A., and South, A. (2014). “Toward an Integrated Lifecycle Governance Framework for Delivering Civil Infrastructure Projects through Public-Private Partnerships (P3s).” *Engineering Project Organization Conference*, 1-24.

Li, B., Akintoye, A., Edwards, P. J., and Hardcastle, C. (2005). “The allocation of risk in PPP/PFI construction projects in the UK.” *Int. J. Project Manage.*, 23(1), 25–35.

Likhitruangsilp, V., Do., S., T., and Onishi, M. (2017). “A Comparative Study on the Risk Perceptions of the Public and Private Sectors in Public-Private Partnership (PPP) Transportation Projects in Vietnam.” *Engineering Journal*, 21(7).

Liu, H., J., Love, P., E., D., Davis, P., R., Smith, J., and Regan, M. (2014a). “Conceptual Framework for the Performance Measurement of Public-Private Partnerships.” *J. Infrastruct. Syst.*, 21(1): 04014023.

Liu, H., J., Love, P., E., D., Smith, J., Regan, M., and Sutrisna, M. (2014b). “Public-Private Partnerships: a review of theory and practice of performance measurement.” *International Journal of Productivity and Performance Management*, 63(4), 499-512.

Liu, H., J., Love, P., E., D., Smith, J., Regan, M., Davis, P., R. (2015). "Life Cycle Critical Success Factors for Public-Private Partnership Infrastructure Projects." *J. Manage. Eng.*, 31(5): 04014073.

Liu, H., J., Love, P., E., D., Smith, J., Mathews, J., and Sing, C. (2016). "Praxis of Performance Measurement in Public-Private Partnerships: Moving beyond the Iron Triangle." *J. Manage. Eng.*, 32(4): 04016004.

Liu, H., J., Love, P., E., D., Smith, J., Irani, Z., Hajli, N., and Sing, M., C., P. (2018). "From design to operations: a process management life-cycle performance measurement system for Public-Private Partnerships." *Production Planning & Control*, 29:1, 68-83, DOI: 10.1080/09537287.2017.1382740

Liu, T., and Wilkinson, S. (2011). "Adopting innovative procurement techniques: Obstacles and drivers for adopting public private partnerships in New Zealand." *Construction Innovation*, 11(4), 452-469.

Macneil, I. R. (1974). "The Many Futures of Contracts." *Southern California Law Review*, 47(688): 691-816.

Mansor, N., S., and Rashid, K., A. (2016). "Incomplete Contract in Private Finance Initiative (PFI) contracts: causes, implications and strategies." *Procedia Social and Behavioral Sciences*, 222 (2016), 93-102.

Meng, X., (2015). "The role of trust in relationship development and performance improvement." *Journal of Civil Engineering and Management*, 21(7), 845-853.

Memon, S., A., Rowlinson, S., Sunindijo, R., Y., and Zahoor, H. (2021). "Collaborative behavior in relational contracting projects in Hong Kong - A contractor's perspective." *Sustainability*, 13 (10): 5375. https://doi.org/10.3390/su13105375.

National Highways Authority of India. (2021). "Resource center." Retrieved October 15, 2021, from https://nhai.gov.in/#/agr-memo-of-underst.

National Highways Authority of India. (2022). "Old website." Retrieved February 15, 2022, from https://nhai.org/

Neely, A., Adams, C., and Crowe, P. (2001). "The Performance Prism in Practice." *Measuring Business Excellence*, 5(2), 6-12.

New South Wales state. (2017). "PPP Guidelines." Retrieved Oct 26, 2021, from https://www.treasury.nsw.gov.au/sites/default/files/2021-06/TPP17-07%20NSW%20Public%20Private%20Partnerships%20Guidelines%202017-1.pdf

New South Wales state. (2021). "Awarded Projects." Retrieved January 15, 2021, from https://www.treasury.nsw.gov.au/projects-initiatives/public-private-partnerships/awarded-projects.

Nguyen, C., A. and Garvin, M., J. (2023). "Risk Allocation in Public-Private Partnerships Highway Contracts: A Transnational Analysis." *J. Constr. Eng. Manage.*, under preparation.

Nguyen, C., A., and Garvin, M., J. (2022). "Synthesis of Challenges for Public-Private Partnerships (PPPs) in Transportation Infrastructure in Southeast Asia." *CI & CRC Joint Conference 2022*.

Nguyen, D., A., Garvin, M., J., and Gonzalez, E., E. (2018). "Risk allocation in US public-private partnership highway project contracts." *J. Constr. Eng. Manage.*, 144 (5): 04018017. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001465.

Nguyen, D., A. and Garvin, M., J. (2019). "Life-cycle contract management strategies in US highway public private partnerships: public control or concessionaire empowerment." *Journal of Management in Engineering*, Vol. 35 No. 4, pp. 04019011.

Nguyen, D., A., and Garvin, M., J. (2019b). "Contractual Risk Sharing Mechanisms in US Highway PPP Projects." In Lavitt, R., E., Scott, W., R, and Garvin, M., J (Eds.), *Public-Private Partnerships for Infrastructure Development: Finance, Stakeholder Alignment, Governance* (121~141). Edward Elgar

Parker, D., and Dressel, U. (2019). "Agency theory perspective on public-private-partnerships: international development project." *International Journal of Productivity and Performance Management*, 67(2), 239-259.

Patel, T., D., Haupt, T., C., and Bhatt, T. (2019). "Fuzzy probabilistic approach for risk assessment of BOT toll roads in Indian context." *Journal of Engineering, Design and Technology*, 18(1), 252-269.

Patton, M., Q. (2015). "Qualitative Research & Evaluation Methods." 4th Ed., Sage.

Peng, X., Hou, W., and Wang, L. (2022). "The influence of contractual and relational governance on the sustainable performance of public-private partnership projects: Findings from PLS-SEM." *Advances in Economics and Management Research*, ICMSMI 1(3), 314-27.

Philippines PPP Center. (2016). "Generic Preferred Risk Allocation Matrix." Retrieved Sep 15, 2022, from https://ppp.gov.ph/press_releases/generic-preferred-risks-allocation-matrix-gpram/

Philippines PPP Center. (2021). “Projects Database.” Retrieved Sep 15, 2021, from https://ppp.gov.ph/project-database/

Pinz, A., Roudyani, N., and Thaler, J. (2018). “Public–private partnerships as instruments to achieve sustainability-related objectives: The state of the art and a research agenda.” *Public Management Review*, 20(1), 1–22. https://doi.org/10.1080/14719037.2017.1293143

PMI (Project Management Institute). (2017). “A Guide to the Project management body of knowledge.” 6th ed. Newtown Square, PA: Project Management Institute.

Queensland state. (2022). “Transport sectors.” Retrieved January 15, 2022, from https://www.tmr.qld.gov.au/business-industry/Transport-sectors.

Qin, W., Tariq, S., and Zayed, T. (2021). “Evaluation of the Suitability of Public-Private Partnership for Kowloon East Smart City Development Project in Hong Kong.” *International Journal of Sustainable Construction Engineering and Technology*, 12(2), 15-23.

Raisbeck, P., Duffield, C., and Xu, M. (2010). “Comparative performance of PPPs and traditional procurement in Australia.” *Construction Management and Economics*, 28:4, 345-359, DOI: 10.1080/01446190903582731

Roy, D., Kalidindi, S., and Soundararajan, A. (2014). “Risk Allocation in Concession Agreements for PPP Road Projects in India.” *Urbanization in Asia: Governance, Infrastructure and the Environment*.

Robinson, H., S., and Scott, J. (2009). “Service delivery and performance monitoring in PFI/PPP projects.” *Construction Management and Economics*, 27, 181-197.

Rybnicek, R., Plakolm, J., and Baumgartner, L. (2020). “Risks in Public–Private Partnerships: A Systematic Literature Review of Risk Factors, Their Impact and Risk Mitigation Strategies.” *Public Performance & Management Review*, DOI:10.1080/15309576.2020.1741406

Sappington, D. E. M. (1991). “Incentives in principal-agent relationships.” *J. Econ. Perspect.,* 5 (2): 45–66. https://doi.org/10.1257/jep.5.2.45.

Sarvari, H., Valipour, A., Yahaya, N., and Md Noor, N. (2014). “Risk Identification and Assessment in Malaysian Public Private Partnership Projects.” *Vulnerability, Uncertainty, and Risk*, 2014, 436-445

Saunders, M., Lewis, P., and Thornhill, A. (2007). “Research Methods for Business Students.” 4th ed., Pearson Education.

Schieg, M. (2008). “Strategies for avoiding asymmetric information in construction project management.” *Journal of Business Economics and Management*, 9(1), 47-51.

Scott, R., W. (2008). “Institutions and Organizations: Ideas and Interests.” *3rd edition. Sage Publications, Thousand Oaks, CA*.

Shrestha, A., Tamošaitiene, J, Martek, I., Hosseini, M., R., and Edwards, D., J. (2019). “A Principal-Agent Theory Perspective on PPP Risk Allocation.” *Sustainability*, 11, 6455; doi:10.3390/su11226455

Simon, H., A. (1961). “Administrative Behavior.” *2nd ed. New York: Macmillan*.

Sinha, A., K., and Jha, K., N. (2020). “Dispute Resolution and Litigation in PPP Road Projects: Evidence from Select Cases.” *J. Leg. Aff. Dispute Resolut. Eng. Constr.*, 12(10: 05019007.

Solheim-Kile, E., and Wald, A. (2019). “Extending the transactional view on public–private partnership projects: Role of relational and motivational aspects in goal alignment.” *J. Constr. Eng. Manage.,* 145 (5): 04019030. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001643

Soomro, M., A., and Zhang, X. (2016). “Evaluation of the Functions of Public Sector Partners in Transportation Public-Private Partnerships Failures.” *J. Manage. Eng.*, 2016, 32(1): 04015027.

Stinchcombe, A., L. (1990). “Organizing Information Outside the Firm: Contracts as Hierarchical Documents.” *Information and Organizations*, University of California Press.

Tallaki, M., and Bracci, E. (2021). “Risk allocation, transfer and management in public–private partnership and private finance initiatives: a systematic literature review.” *International Journal of Public Sector Management*. DOI 10.1108/IJPSM-06-2020-0161

Tariq, S., and Zhang, X. (2021). “Critical Failure Drivers in International Water PPP Projects.” *J. Infrastruct. Syst.*, 26(4): 04020038.

Thomas, A. V., Kalidindi, S. N., and Ananthanarayanan, K. (2003). “Risk perception analysis of BOT road project participants in India.” *Constr. Manage. Econ.*, 21(4), 393–407.

Valero, V. (2014). “Government opportunism in public-private partnerships.” *J. Public Econ. Theory*, 17 (1): 111–135. https://doi.org/10.1111/jpet.12105.

Victoria state. (2016). “Partnerships Victoria Requirements”. Retrieved Oct 26, 2021, from https://www.dtf.vic.gov.au/sites/default/files/2018-05/Partnerships-Victoria-Requirements-November-2016.pdf

Victoria state. (2022). “Partnerships Victoria PPP Projects.” Retrieved January 15, 2022, from https://www.dtf.vic.gov.au/public-private-partnerships/partnerships-victoria-ppp-projects.

Wang, H., Liu, Y., Xiong, W., and Song, J. (2018). “The moderating role of governance environment on the relationship between risk allocation and private investment in PPP markets: Evidence from developing countries.” *International Journal of Project Management*, DOI: 10.1016/j.ijproman.2018.10.008

Williamson, O., E. (1979). “Transaction-Cost Economics: The Governance of Contractual Relations.” *Journal of Law & Economics,* 22(2), 233-261.

Williamson, O., E. (1985). “The Economic Institutions of Capitalism”. The Free Press, New York.

Williamson, O., E. (1996). “The mechanisms of governance.” New York: Oxford University Press.

Winch, G., M. 2001. “Governing the project process: A conceptual framework.” *Construct. Man age. Econ*. 19 (8): 799–808. https://doi.org/10.1080/01446190110074264.

World Bank. (2020a). “Ease of Doing Business Database.” Retrieved Dec 20, 2020, from https://www.doingbusiness.org/en/data/doing-business-score

World Bank. (2020b). “Benchmarking Infrastructure Development 2020.” Retrieved Oct 1, 2021, from https://bpp.worldbank.org/

World Bank. (2021a). “World Bank Open Data.” Retrieved Sep 22, 2021, from https://data.worldbank.org/

World Bank. (2021b). “World Bank Private Participation in Infrastructure (PPI) Database.” Retri eved Sep 22, 2021, from https://ppi.worldbank.org/en/

World Economic Forum. (2019). “The Global Competitiveness Report 2019.” Retrieved Nov 24, 2020, from http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport201 9.pdf

Yescombe, E., R., and Farquharson, E. (2018). “Public-Private Partnerships for Infrastructure Principles of Policy and Finance.” *Butterworth-Heinemann*, an imprint of Elsevier.

Yu, Y., Chan, A., P., C., and Chen, C. (2017). “Critical Risk Factors of Transnational Public-Private Partnership Projects: Literature Review.” *Journal of Infrastructure System*, 24(1): 04017042.

Zhou, K., Z., and Poppo, L. (2010). “Exchange hazards, relational reliability, and contracts in China: The contingent role of legal enforceability.” *Journal of International Business Studies*, (2010) 41, 861-881.

Zou, P. X. W., Wang, S., and Fang, D. (2008). “A life-cycle risk management framework for PPP infrastructure projects.” *J. Financial Manage. Prop. Constr.*, 13(2), 123–142.

Appendices

Appendix A. PPP Enabling Environment scores

Table 27. PPP enabling environment scores

Rank	Country	Score
1	Thailand	80
2	Chile	79
3	China	78
4	Colombia	77
5	Peru	76
=6	India	75
=6	Philippines	75
=8	Gujarat state	73
=8	Jamaica	73
=10	Brazil	71
=10	Costa Rica	71
=12	Côte d'Ivoire	69
=12	Guatemala	69
=12	Honduras	69
=12	Uruguay	69
16	El Salvador	68
17	Sindh province	67
18	Bangladesh	66
=19	Mexico	65
=19	Senegal	65
21	Vietnam	64
=22	Kosovo	63
=22	Kyrgyz Republic	63
=22	Slovakia	63
=25	Jordan	61
=25	Niger	61
=25	Pakistan	61
28	Serbia	60
=29	Benin	59
=29	Ecuador	59
=29	Indonesia	59
=29	Kazakhstan	59
=29	Nepal	59
=29	Nicaragua	59
=29	Turkey	59
=29	Zambia	59
37	Panama	58
38	Tunisia	57
=39	Ethiopia	56
=39	Ghana	56
=39	Morocco	56
42	Egypt	55
=43	Burkina Faso	53
=43	Trinidad and Tobago	53
=45	Mongolia	52
=45	Paraguay	52
47	Bahamas	51
=48	Dominican Republic	50
=48	Ukraine	50
=50	Argentina	49
=50	The Gambia	49
=52	Albania	48
=52	Romania	48
54	Belarus	47
55	Timor-Leste	46
=56	Georgia	45
=56	Sri Lanka	45
=58	Bulgaria	44
=58	Tajikistan	44
60	Armenia	43
61	Malawi	42
=62	Liberia	41
=62	Sierra Leone	41
64	Barbados	37
=65	Lesotho	35
=65	Togo	35
=67	Papua New Guinea	30
=67	Solomon Islands	30
69	Venezuela	8

Note: "=" before a rank indicates a tie. Score: 0 to 100; 100 = best; average = 59.
Source: Economist Intelligence Unit (2019).

Appendix B. List of PPPs' benefits

Benefits	UK	Hong Kong	Australia	New Zealand	Singapore	Malaysia	China	Taiwan	Indonesia	India
Source*	1	2, 7	2	3	4	5	7	8	9	10
Solve the problem of public sector budget restraint	✓	✓	✓			✓	✓	✓	✓	✓
Provide an integrated solution (for public infrastructure/services)	✓	✓	✓			✓	✓	✓	✓	✓
Reduce public money tied up in capital investment	✓	✓	✓			✓	✓	✓	✓	✓
Cap the final service costs	✓	✓	✓				✓	✓	✓	✓
Facilitate creative and innovative approaches	✓	✓	✓		✓	✓	✓	✓	✓	✓
Reduce the total project cost	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Save time in delivering the project	✓	✓	✓	✓		✓	✓	✓	✓	✓
Transfer risk to the private partner	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reduce public sector administration costs	✓	✓	✓			✓	✓	✓	✓	✓
Benefit to local economic development	✓	✓	✓	✓		✓	✓	✓	✓	✓
Improve buildability	✓	✓	✓			✓	✓	✓	✓	✓
Improve maintainability	✓	✓	✓			✓	✓	✓	✓	✓
Technology transfer to local enterprise	✓	✓	✓				✓	✓	✓	✓
No recourse or limited recourse to public funding	✓	✓	✓			✓	✓	✓	✓	✓
Accelerate project development	✓	✓	✓			✓	✓	✓	✓	✓

Benefits	UK	Hong Kong	Australia	New Zealand	Singapore	Malaysia	China	Taiwan	Indonesia	India
Source*	1	2, 7	2	3	4	5	7	8	9	10
Private sector possess better resource mobility					✓					
Better value for money					✓					
Improved quality of service				✓	✓					
Likely to access additional revenue sources				✓						
Improved project scrutiny				✓						
Legitimacy requirements set by the government										✓

※Source: 1 = Li et al. (2005); 2 = Cheung et al. (2010); 3 = Liu and Wilkinson (2011); 4 = Hwang et al. (2013) (as cited in La 2016); 5 = Ismail (2013); 6 = Ismail and Harris (2014); 7 = Chan et al. (2009); 8 = Chou et al. (2012) (as cited in La 2016); 9 = Chou and Pramudawardhani (2015); 10 = Dolla and Laishram (2019).

Appendix C. All and sampled contracts in Australia

Table 28. All and sampled contracts in Australia

Project code and name	Tolled?	Solicited?	State	Commercial close	Duration (years)	Contract Value ($B)	Access to contract
AU1) Airport Link M7	**Tolled**	**Solicited**	**QLD**	**2008**	**45**	**4.8**	**yes**
AU2) Peninsula Link	**AP**	**Solicited**	**VIC**	**2010**	**27**	**0.7**	**yes**
AU3) NorthConnex	Tolled	Unsolicited	NSW	2015	33	2.9	yes
AU4) WestConnex M4	Tolled	Solicited	NSW	2015	45	3.9	yes
AU5) WestConnex M5	Tolled	Solicited	NSW	2015	45		yes
AU6) WestConnex M4-M5 Link	**Tolled**	**Solicited**	**NSW**	**2018**	**42**		**yes**
AU7) OSAR – Western Package	AP	Solicited	VIC	2017	20	1.3	yes
AU8) West Gate Tunnel	**Tolled**	**Unsolicited**	**VIC**	**2017**	**28**	**6.7**	**yes**

Note: QLD = Queensland; VIC = Victoria; NSW = New South Wales; AP = Availability payment; Bold = selected projects; Duration = contract duration.

Source: Queensland state (2022); Victoria state (2022); New South Wales state (2022).

Table 29. Characteristics of all and sampled projects in Australia

Characteristics	All projects	Sampled projects
Tolled / Availability payment	6 / 2	3 / 1
Solicited / Unsolicited	6 / 2	3 / 1
QLD / VIC/ NSW	1 / 3 / 4	1 / 2 / 1
Commercial close	2008 to 2018	2008 to 2018
Contract duration (years)	20 to 45	20 to 45
Contract value ($ billion)	0.7 to 6.7 (average = 2.5)	0.7 to 6.7 (average = 3.4)

Note: QLD = Queensland; VIC = Victoria; NSW = New South Wales.

Appendix D. All and sampled contracts in the Philippines

Table 30. All and sampled contracts in the Philippines

Project code and name	Tolled?	Solicited?	Commercial close	Duration (year)	Amount ($M)	Access to contract
PH1) South Luzon Expressway (SLEX) Toll Road 4 (TR-4)	Tolled	Unsolicited	2006	30	270.4	no
PH2) South Luzon Tollway Extension (SLEX)	Tolled	Unsolicited	2008	30	478.0	no
PH3) Tarlac-Pangasinan-La Union Expressway (TPLEX)	**Tolled**	**Solicited**	**2008**	**35**	**722.3**	**yes**
PH4) Subic-Clark-Tarlac Expressway	Tolled	Solicited	2008	35	703.8	no
PH5) NLEX Harbor Link (Segments 8.1, 8.2, 9, and 10)	Tolled	Unsolicited	2010	25	537.0	no
PH6) Metro Manila Skyway (MMS) Stage 3	Toll	Solicited	2012	30	772.5	no
PH7) Daang Hari-SLEX Link Road	**Tolled**	**Solicited**	**2012**	**30**	**46.0**	**yes**
PH8) NAIA Expressway Project (Phase II)	Tolled	Solicited	2013	30	370.0	yes
PH9) Cavite-Laguna Expressway (CALAX)	**Tolled**	**Solicited**	**2015**	**35**	**736.4**	**yes**
PH10) NLEX-SLEX Connector Road	**Tolled**	**Unsolicited**	**2016**	**37**	**478.8**	**yes**
PH11) Cebu-Cordova Link Expressway (CCLEX)	Tolled	Solicited	2017	35	557.2	no
PH12) Southeast Metro Manila Expressway (SEMME)	Tolled	Solicited	2018	30	936.8	no
Total					6,609.2	

Note: Bold = selected projects; Duration = contract duration.

Source: Philippines PPP Center (2021); Philippines DPWH (2021).

Table 31. Characteristics of all and sampled projects in the Philippines

Characteristics	All projects	Sampled projects
Tolled / Availability payment	12 / 0	4 / 0
Solicited / Unsolicited	8 / 4	3 / 1
Commercial close	2006 to 2018	2008 to 2016
Contract duration (years)	25 to 37 (average = 32)	30 to 37 (average = 34)
Contract value ($M)	46 to 937 (551)	46 to 736 (496)

Appendix E. All and sampled contracts in India

Table 32. All and sampled contracts in India

No.	Code	Tolled? Solicited?	Year	Duration (years)	Value ($M)	Access to contracts	Select
1	**ID51**	**Annuity Solicited**	**2006**	**20**	**244**	**Yes**	**Select**
2		Annuity Solicited	2007	20	?	Yes	
3		Annuity Solicited	2007	20	151	Yes	
4		Annuity Solicited	2009	18	141	Yes	
5	**ID65**	**Annuity Solicited**	**2010**	**20**	**336**	**Yes**	**Select**
6		Annuity Solicited	2010	20	155	Yes	
7		Annuity Solicited	2010	20	242	Yes	
8		Annuity Solicited	2010	20	281	Yes	
9		Annuity Solicited	2010	15	107	Yes	
10		Annuity Solicited	2010	20	265		
11		Annuity Solicited	*2010*	*25*	120		
12		Annuity Solicited	*2011*	22	243		
13		Annuity Solicited	*2012*	*23*	110		
14		Annuity Solicited	*2013*	*25*	154		
15		Annuity Solicited	*2014*	30	108		
16		Annuity Solicited	2015	*20*	129		
17		Annuity Solicited	2015	*21*	131		
18		Annuity Solicited	*2016*	*28*	113		
19		Annuity Solicited	2018	22	1212		
20		Annuity Unsolicited	2010	25	198		
21		Annuity Unsolicited	2010	25	107		
22		Annuity Unsolicited	2010	25	134		
23		Annuity Unsolicited	2010	30	209		
24		Annuity Unsolicited	2011	15	197		
25		Annuity Unsolicited	2011	17	118		
26		Annuity Unsolicited	2011	17	198		
27		Annuity Unsolicited	2015	*25*	125		
28		Hybrid Solicited	2006	24	150		
29		Hybrid Solicited	*2011*	18	218		
30		Hybrid Solicited	*2012*	24	170		
31	**ID150**	**Hybrid Solicited**	**2016**	**14**	**136**	**Yes**	**Select**
32		Hybrid Solicited	2016	24	127		
33		Hybrid Solicited	2016	15	135		
34		Hybrid Solicited	2016	28	170		

No.	Code	Tolled? Solicited?	Year	Duration (years)	Value ($M)	Access to contracts	Select
35		Hybrid Solicited	2016	15	102		
36		Hybrid Solicited	2016	30	102		
37		Hybrid Solicited	2016	33	133		
38		Hybrid Solicited	2016	26	204		
39		Hybrid Solicited	2016	15	122		
40		Hybrid Solicited	2016	15	125		
41		Hybrid Solicited	2016	15	126		
42		Hybrid Solicited	2016	15	152		
43		Hybrid Solicited	2016	18	156		
44		Hybrid Solicited	*2016*	30	253		
45		Hybrid Solicited	2016	*20*	155		
46	**ID111**	**Hybrid Solicited**	**2017**	**15**	**184**	**Yes**	**Select**
47		Hybrid Solicited	2017	15	314		
48		Hybrid Solicited	2017	15	167		
49		Hybrid Solicited	2017	15	226		
50		Hybrid Solicited	2017	15	158		
51		Hybrid Unsolicited	2016	*15*	718		
52		Hybrid Unsolicited	2017	15	132		
53		Hybrid Unsolicited	2017	15	139		
54		Hybrid Unsolicited	2017	15	104		
55		Hybrid Unsolicited	2017	15	108		
56		Hybrid Unsolicited	2017	15	110		
57		Hybrid Unsolicited	2017	15	112		
58		Hybrid Unsolicited	2017	15	115		
59		Hybrid Unsolicited	2017	15	137		
60		Hybrid Unsolicited	2017	10	347		
61	**ID142**	**Tolled Solicited**	**2007**	**25**	**125**	**Yes**	**Select**
62		Tolled Solicited	2008	12	187	Yes	
63		Tolled Solicited	2008	12	223	Yes	
64		Tolled Solicited	2008	15	305	Yes	
65	**ID157**	**Tolled Solicited**	**2009**	**25**	**158**	**Yes**	**Select**
66		Tolled Solicited	2009	19	201	Yes	
67		Tolled Solicited	2009	20	100	Yes	
68		Tolled Solicited	2009	19	111	*Yes*	
69		Tolled Solicited	2009	27	151	Yes	
70		Tolled Solicited	2009	25	129	Yes	
71	**ID19**	**Tolled Solicited**	**2010**	**30**	**345**	**Yes**	**Select**

No.	Code	Tolled? Solicited?	Year	Duration (years)	Value ($M)	Access to contracts	Select
72	**ID78**	**Tolled Solicited**	**2010**	**26**	**140**	**Yes**	**Select**
73	**ID104**	**Tolled Solicited**	**2010**	**26**	**256**	**Yes**	**Select**
74	**ID147**	**Tolled Solicited**	**2010**	**30**	**141**	**Yes**	**Select**
75		Tolled Solicited	2010	25	114	Yes	
76		Tolled Solicited	2010	19	134	Yes	
77		Tolled Solicited	2010	*25*	164	Yes	
78		Tolled Solicited	2010	25	173	Yes	
79		Tolled Solicited	2010	24	230	Yes	
80		Tolled Solicited	2010	30	121	Yes	
81		Tolled Solicited	2010	20	139	Yes	
82		Tolled Solicited	2010	24	107	Yes	
83		Tolled Solicited	2010	19	126	Yes	
84		Tolled Solicited	2010	26	112	Yes	
85		Tolled Solicited	2010	30	107	Yes	
86		Tolled Solicited	2010	30	199	Yes	
87		Tolled Solicited	2010	25	108	Yes	
88		Tolled Solicited	2010	27	114	Yes	
89		Tolled Solicited	2010	25	137		
90		Tolled Solicited	2010	24	177		
91		Tolled Solicited	2010	17	117		
92		Tolled Solicited	*2010*	*25*	277		
93		Tolled Solicited	2010	30	211		
94	**ID117**	**Tolled Solicited**	**2011**	**30**	**110**	**Yes**	**Select**
95		Tolled Solicited	2011	25	283	Yes	
96		Tolled Solicited	2011	21	126	Yes	
97		Tolled Solicited	2011	24	188		
98		Tolled Solicited	2011	23	318		
99		Tolled Solicited	*2011*	*25*	167		
100		Tolled Solicited	2011	25	186		
101		Tolled Solicited	2012	27	126		
102		Tolled Solicited	2012	28	164		
103		Tolled Solicited	*2012*	29	227		
104		Tolled Solicited	2012	25	170		
105		Tolled Solicited	2012	28	242		
106		Tolled Solicited	2012	30	225		
107		Tolled Solicited	2012	29	141		
108		Tolled Solicited	2012	*25*	154		

No.	Code	Tolled? Solicited?	Year	Duration (years)	Value ($M)	Access to contracts	Select
109		Tolled Solicited	*2013*	30	135		
110		Tolled Solicited	2013	28	221		
111		Tolled Solicited	2013	20	229		
112		Tolled Solicited	2013	20	180		
113		Tolled Solicited	2013	20	357		
114		Tolled Solicited	2013	22	128		
115		Tolled Solicited	2014	26	110		
116		Tolled Solicited	*2014*	30	260		
117		Tolled Solicited	2014	27	186		
118		Tolled Solicited	2014	26	250		
119		Tolled Solicited	2014	29	130		
120	**ID74**	**Tolled Solicited**	**2015**	**19**	**251**	**Yes**	**Select**
121		Tolled Solicited	2015	19	305		
122		Tolled Solicited	*2015*	20	237		
123		Tolled Solicited	2015	17	284		
124		Tolled Solicited	2015	26	135		
125		Tolled Solicited	2015	27	211		
126		Tolled Solicited	2015	30	108		
127		Tolled Solicited	*2015*	30	331		
128		Tolled Solicited	*2016*	*25*	216		
129		Tolled Solicited	2016	27	172		
130		Tolled Solicited	2016	*25*	121		
131		Tolled Solicited	2016	20	138		
132		Tolled Solicited	2016	20	165		
133		Tolled Solicited	2016	*25*	147		
134		Tolled Solicited	2016	20	105		
135		Tolled Solicited	*2016*	18	207		
136		Tolled Solicited	*2016*	25	599		
137		Tolled Solicited	2016	30	117		
138		Tolled Solicited	*2016*	*25*	375		
139		Tolled Solicited	*2017*	20	145		
140		Tolled Solicited	*2018*	*25*	160		
141		Tolled Solicited	*2019*	*25*	271		
142		Tolled Unsolicited	2009	15	179		
143		Tolled Unsolicited	2010	30	205		
144		Tolled Unsolicited	*2011*	*25*	111		
145		Tolled Unsolicited	2012	16	210		

No.	Code	Tolled? Solicited?	Year	Duration (years)	Value ($M)	Access to contracts	Select
146		Tolled Unsolicited	2012	25	123		
147		Tolled Unsolicited	2012	17	160		
148		Tolled Unsolicited	2012	18	165		
149		Tolled Unsolicited	2015	25	185		
150		Tolled Unsolicited	2015	24	220		
151		Tolled Unsolicited	*2015*	24	261		
152		Tolled Unsolicited	2015	22	184		
153		Tolled Unsolicited	*2015*	*25*	254		

Note: 1) No. = Number of projects more than 100 million USD in ascending order of commercial close as per each category of payment mechanism and project initiation mechanism; 2) Italic = information from non-governmental sources such as newspaper websites; Non-italic = information from governmental sources, i.e., India PPP Center (2021) and National Highways Authority of India (2021, 2022). 3) Bold and red = Selected contracts. 3) Year = commercial close year; 4) Duration = Contract duration; 5) Annuity model = the private sector finances all construction costs and receives a semi-annual fixed payment from the government (Cherkos et al. 2020); 6) Hybrid annuity model = the private sector finances the majority of construction costs and receives a semi-annual fixed payment from the government (Cherkos et al. 2020).

Table 33. Characteristics of all, sampled, and accessible projects in India

Characteristics	All projects	Sampled projects (*available contracts*)
Annuity solicited	19	2 (*9*)
Annuity unsolicited	8	0 (*0*)
Hybrid solicited	23	2 (*2*)
Hybrid unsolicited	10	0 (*0*)
Toll solicited	81	8 (*32*)
Toll unsolicited	12	0 (*0*)
Commercial close	2006 to 2019	2006 to 2017 (*2006 to 2019*)
Contract duration (years)	10 to 33 (average = 22)	14 to 30 (average = 23) *12 to 30 (average = 22)*
Contract value ($ million)	100 to 1,212 (average = 193)	110 to 345 (average = 202) *100 to 345 (average = 173)*

Note: Italic = characteristics in available contracts.

Table 34. Project code and project name in India

No.	Code	Project Name
1	**ID51**	**Km 16.00 to KM 96.127 on NH-75 in Uttar Pradesh and Madhya Pradesh**
2		455.4 to 491.62 Amritsar- NH1
3		Design, Construction, Development, Finance, Operation and Maintenance of km 175.000 to km 230.000 on NH-7 in the State of Andhra Pradesh under North South Corridor (NHDP Phase II) on Build, operate and Transfer (Annuity) Basis
4		Four laning of Hazaribagh – Ranchi section of NH33 from Km40.5 to Km114.0
5	**ID65**	**Four laning of Nagpur-Saoner-Betul, Section of NH-69 Maharashtra and Madhya Pradesh on DBFOT (Annuity) basis**
6		Srinagar-banihal section of NH1A from 187-189.35km, km 220.7-286.11km and 187 to 220.7 on DBFOT (Annuity) in Jammu and Kashmir
7		Rehabilitation strengthening and 4 laning of Jammu-Udhampur sec of NH 1A from 15-67km on BOT basis on DBFO pattern
8		4 laning of Chenani-Nashri section of NH 1A including 9 km long tunnel with parallel escape tunnel on BOT (Annuity) basis
9		4 laning of Trichy Karaikkudi section of NH-210 (10-94 km) and Trichy Bypass (ch 109.558-ch 135.39) in Tamil Nadu on BOT basis.
10		4 laning of Qazigund-Banihal Section of NH 1A from 189.35-204.7km including 2 tunnels of 0.69 & 8.45 km length in J&K
11		Bridges (Arunachal Pradesh) Project
12		6/8 laning of JNPT Port Road Project at NH 4B (A1 - E section), NH-4B (D-G section), SH-54 and on Amra Marg
13		Four Laning of Trivandrum, Kerala/ Tamil Nadu border including Trivandrum by-pass (Package I)
14		Four laning of Kuttipuram-Edapally section of NH17 in the state of Kerala
15		2 laning from 0 to km7.95 (Katni Bypass) & 4.6 to 245km of Katni-Shahdol-Anooppur to MP/CG Border section on NH-78
16		Rehabilitation, strengthening and Four laning of Udhampur to Ramban section of NH 1A from km 67 to km 89 & km 130 to km 151
17		Rehabilitation, strengthening and 4 laning of Ramban to Banihal section of NH 1A in Jammu and Kashmir
18		Four Laning of Kerala/ Tamil Nadu border, Kanyakumari section of NH 47 (Package II)
19		Two laning of Zojila Tunnel of 14.083 km length on NH - 1D in the State of Jammu & Kashmir on BOT annuity basis
20		Four/Six laning of Moradabad-Bareilly section of NH 24 from km 1+C28348 to km 262 in Utar Pradesh on DBFOT basis under NHDP III
21		Four laning of Muzaffarnagar-Haridwar section of NH 58 from km 131 to 211 of NH 58 in the state of UP and Uttarakhand
22		Four laning of Baharampur-Farakka section of NH 34 from km 193 to km 295.700 in West Bengal on DBFOT basis under NHDP III

No.	Code	Project Name
23		Four laning of Cuddapah-Kurnool section (Km 167.750 to km 356.030) of NH 18 Under NHDP Phase III on BOT Basis
24		Four laning of Ranchi Jamshedpur section of NH33 in the State of Bihar on BoT (Annuity) under NHDP Phase III
25		Four laning of Barasat-Krishnagar section of NH 34 in West Bengal under NHDP Phase III on BOT (Annuity) basis
26		Two laning Nechipu to Hoj via Seppa, Saggali in length of 311 km
27		Parwanoo-Solan section of NH 22 in the State of Himachal Pradesh on BOT (Annuity) under NHDP Phase III
28		Four-laning a section between Yadgiri-Warangal section of NH 202 from km 54.000 to km 150.000 in AP on BOT (Toll) basis
29		Four Laning of Lucknow Sultanpur Section of NH-56 on Hybrid Annuity Mode
30		4 laning of Chandikhole-Dubari-Talchar Secton of NH 200, 301.89-428.03km including km 8.5- km 15.75 in Orissa
31	**ID150**	**Delhi-Meerut Expressway Project [Package-III]**
32		Four laning of BRT Tiger Reserve Boundary-Bengaluru section in 174.1 Km in Bengaluru district
33		Four laning of Binjhabahal-Telebani section in length of 78.3 km in Keonjhar district
34		Four laning of Lucknow-Sultanpur Section of NH 56 from KM 11.5 to KM 135 under NHDP IV
35		Four Laning of Mahuva to Kagavadar section in 39.8 Km under NHDP-IV
36		Four laning of Una-Kodinar road in length of 41.1 Km in Junagadh district
37		Four laning of Bhavnagar-Talaja road in length of 46.5 km in Bhavnagar under NHDP-IV
38		Two /Four laning with PSS of Gadu to Dwaraka section on NH 8E from km 263.000 to km 473.000 inGujarat on DBFOT pattern
39		Four laning of Kalmath-Zarap section in length of 44.2 km in Sindhudurg district
40		Four laning of Tarsod-Fagne section of NH-6 in length of 87.3 Km in Jalgaon district
41		Four laning of Chikhali-Tarsod section in length of 62.7 km in Buldana
42		Four Laning of Stand Alone Ring Road/Bypass for Nagpur City
43		Four laning of Phagwara-Rupnagar of NH-344A in Punjab on Hybrid Annuity Mode (total 80.82 KM)
44		Four laning with PSS of Amritsar to Bathinda section of NH - 15 from km 103 to km 287.5 in Punjab under NHDP - IV
45		Two Laning of proposed Shimla Bypass (Kaithalighat to Shimla Section) of NH-22 under NHDP Phase III on Hybrid Annuity Mode
46	**ID111**	**8/6 Laning of Delhi Meerut Expressway from Km. 8.36- Km. 27.74 (UP Border to Dasna) on NH-24 on HAM(Package II)**
47		Six Laning of Handia Varanasi Section of NH-2 from KM 713.146 to KM 785.544 in Uttar Pradesh on Hybrid Annuity Mode
48		Six laning of NH-8 in length of 93.2 km of Shamlaji-Chiloda section

No.	Code	Project Name
49		Two laning with paved shoulders of Jhansi-Khajuraho section of NH 75 in UP and MP
50		Six laning of Ranastalam-Anandpuram section in length of 47 km
51		Six laning of Kishangarh -Udaipur- Ahmedabad section of NH 79A, NH79, NH 76 and NH 8 under NHDP Phase V, length 555.50 km
52		Six laning of Chitradurga-Davanagere section in length of 72.7 km
53		Four laning of Singhara-Bhinjhabal Section of NH6 from KM 310.806 to KM 414.982 under NHDP IV
54		Six laning of Udaipur bypass in length of 23.9 km under NHDP-V
55		Four laning of Waranga-Mahagaon section in length of 66.9 km
56		Four laning of Yavatmal-Wardha section in length of 64.9 km under NHDP-IV
57		Four laning of Tuljapur-Ausa road in length of 67 km under NHDP-IV
58		Four laning of Mahagaon-Yavatmal section in length of 80 km under NHDP-IV
59		Four laning of Wardha-Butibori section in length of 59.2 km
60		Four laning of Pandoh bypass to Takoli section in length of 20.7 km
61	**ID142**	**Four Laning from Junction of NH-68 with NH-7 near Salem to Junction of NH-68 with NH-45 near Ulundurpet in Tamil Nadu on BOT**
62		Six Laning of Surat-Dahisar Section of NH-8 (239 Km) in Gujarat and Maharashtra
63		Six Laning of Gurgaon-Kotputli-Jaipur Section of NH-8 in Haryana/Rajasthan on BOT (Toll) basis following by DBFO pattern.
64		Six Laning of Panipat - Jalandhar Section of NH-1 (291 Km) in Haryana and Punjab.
65	**ID157**	**Four/Six Laning of Jaipur-Tonk-Deoli section of NH 12 from km 18.7 to km 165 (length 148.77 kms) in Rajasthan on BOT (Toll) basis**
66		Four/Six Laning of Gujarat/Maharashtra Border-Surat-Hazira Port Section of NH 6 under NHDP Phase III
67		Six Laning of Pimpalgaon-Nashik-Gonde section of NH-3 in the State of Maharashtra under NHDP Phase IIIA on BOT basis.
68		Four laning of Pune-Solapur NH-9 road in length of 110 km under NHDP-IIIB (Pkg-I)
69		Four laning of MP/Maharashtra border-Nagpur section of NH7 including Kamptee-Kahnan and Nagpur bypass in Maharashtra
70		Development of Hyderabad-Vijayawada section and additional 2 Laning/future 6 Laning of NH 9 in Andhra Pradesh (km 40 to km 160)
71	**ID19**	**Six laning of Varanasi-Aurangabad section of NH 2 from Km 786.00 to km 978.40 in the State of UP/Bihar under NHDP V on BOT basis**
72	**ID78**	**Six laning of Chandikhole -Jagatpur- Bhubaneshwar section of NH 5 from Km 413 to 418 and Km 0 to Km 62 in Orissa on BOT basis**
73	**ID104**	**Six laning of Delhi-Agra section of NH 2 from Km 20.500 to Km 199.600 in the States of Haryana/UP under NHDP V on BOT basis**
74	**ID147**	**Four laning of Farakka-Raiganj section of NH 34 from km 295 to km 398 in West Bengal on DBFOT basis under NHDP III**
75		Four laning of Godhara to Gujarat/MP border section of NH 59 in the State of Gujarat under NHDP Phase III on DBFOT pattern

No.	Code	Project Name
76		Four laning of Ahmedabad to Godhra section of NH 59 in the State of Gujarat under NHDP Phase III on DBFOT pattern
77		Design, Engineering, Finance, Construction, Operation and Maintenance of 4 laning of Bijapur-Hungund section of NH13 on DBFOT
78		Four laning of Indore-Jhabua-Gujarat/MP border section of NH 59 in Madhya Pradesh on BOT (Toll) basis under NHDP III
79		Six laning of Pune-Satara section of NH 4 from km 725 to km 865.35 in Maharashtra on BOT (Toll) basis on DBFO pattern
80		Four laning of Sambalpur Baragarh of Orissa/Chhatisgarh border section of NH 6 from Km 0 to Km 88 in Orissa
81		Four laning of Bareilly-Sitapur section of NH 24 in the State of Uttar Pradesh on BOT basis under NHDP III
82		Six laning of Samakhiali-Gandhidham section of NH 8A from km 306 to km 362.16 in Gujarat on BOT (Toll) basis on DBFO pattern
83		4-Laning of Hungund - Hospet Section of NH-13 Karnataka on("DBFOT") basis under NHDP III
84		Six laning of NH 4 from Tumkur to Chitradurga in Karnataka under NHDP Phase V on BOT (Toll) on DBFO pattern
85		4 laning of Tirupati-Tiruthani-Chennai section of NH 205 from 274.8-341.6 km in AP and km 0 to 59.60 in Tamil Nadu on BOT Basis
86		Six laning of Krishnagiri-Walahjpet section of NH 46 from Km 0 to km 148.30 in the State of Tamil Nadu under NHDP V on BOT basis
87		Four laning of Rohtak to Panipat section of NH 71A from km 0 to km 80.858 in the state of Haryana on BOT basis under NHDP III
88		6-Laning (Chengapalli &4-Laning on end of TNKerala Border Sec.of NH47 Tamil Nadu under NHDP-11 on DBFOT(Toll)basi
89		Four/Six laning of Gandhidham-Mundra Port section of NH8A in Gujarat under NHDP Phase III on DBFOT pattern*
90		Four/Six laning of Ghaziabad-Aligarh section of NH 91under NHDP Phase III on BOT Basis.
91		Construction of Dhola-Sadia Ghats bridges in length of 9.15 km
92		4/6 laning of Maharashtra/Goa Border to Panaji-Goa/Karnataka Border to be executed as BOT(Toll) on DBFO pattern*
93		Four laning of YSR-Kurnool section in length of 188.3 km on NH-18 under NHDP-III
94	**ID117**	**Four laning of Jetpur - Somnath Section of NH 8D in the State of Gujarat**
95		6 laning of Ahmedabad Vadodara Section of NH 8 and improvement of Ahmedabad Vadodara Expressway in Gujarat under NHDP Phase V
96		Four/Six laning of Panvel Indapur section of NH 17 in the State of Maharashtra
97		Four Laning of Panikoili-Rimuli Section of NH 215 under NHDP Phase III, length 163 km
98		Four laning of Beawar Pali Pindwara Section of NH 14 from km 0 to km 244.12 in Rajasthan on BOT(Toll) basis

No.	Code	Project Name
99		Four laning of Muzzafarnagar-Nepali farm section of NH 58 in Uttar Pradesh and Uttrakhand from Nepali to ISBT Dehradun
100		Six laning of Dhankuni-Kharagpur section in length of 111.4 km on NH-6 under NHDP-V
101		Four laning of Gomti-Chauraha - Udaipur Section of NH - 8, km 177.000 to km 260. 10 under NHDP - IV A on BOT (Toll) Basis
102		Four laning of Orissa/Chhattisgarh Border - Aurang of NH-6 in length of 150.4 Km under NHDP-IV
103		Four laning of Khagaria-Bhaktiarpur section of NH31 in the state of Bihar*
104		Four Laning of Maharashtra/Karnataka Border-Sangareddy Section from 348.0 km to 423.8 km on BOT (Toll)
105		Four-laning Kiratpur- Ner Chowk Section from Km 73.20 to Km 186.50 of NH-21 in Himachal Pradesh on BOT (Toll) basis
106		Six-laning of Vijayawada-Gundugolanu section of NH-5 section from km 1076.48 to km 1022.48 on BOT (Toll) basis
107		Four laning of Gwalior - Shivpuri section of NH 3 from km 15.600 to NH 75 to km 236 inMadhya Pradesh on BOT (Toll) basis.
108		Two/ four laning of Obedullaganj -Shahganj Junction, Budhni- Betul Section of NH 69 under NHDP-IV, length 121.36 km
109		Chandikole - Paradeep Section, km 0.000 to 76.618 of NH - 5A under NHDP V on BOT (Toll)*
110		Four laning of Goa/Karnataka Border-Kundapur road in length of 189.6 km under NHDP-IV
111		Six laning of Barwa-Adda-Panagarh section of NH 2 in Jharkhand and West Bengal under NHDP PhaseV on BOT (Toll) basis
112		Four-laning a section between Khed-Sinnar section of NH 50 from km 42 to km 177 in Maharashtra on BOT (Toll) basis.
113		Two laning Z-Morh Tunnel section of NH-I on BOT (Annuity) in Sonamarg, Srinagar, Jammu and Kashmir
114		Four-laning of Rohtak - Hisar Section of NH-10 connecting to NH-71, in Haryana under NHDP-III on BOT (Toll) basis
115		Widening and Strengthening of Bikaner - Phalodi section of NH - 15 to 4 lane and two lane with paved shoulder on BOT (Toll) mode
116		Four/Two-laning of Baharagora to Sambalpur Section from km 200.00 to 566.000 Section of NH-6 in Orissa on BOT (Toll) basis
117		Four laning with PSS of Kaithal to Rajasthan Border section of NH 152/65 from km 33.250 to km 243.58 under NHDP IV
118		Four laning with PSS of Aurangabad to Yedshi section on NH 211 from km 100 to km 290.2 in Maharashtra on DBFOT pattern
119		Four laning with PSS of Solapur to Yedshi section on NH 211 from km 0 to km 100 in Maharashtra on DBFOT pattern
120	**ID74**	**Four laning of Fagne to Gujarat-Maharashtra Border section of NH 6 from Km 510 to Km 650.79 in Maharashtra under NHDP Phase IV**

No.	Code	Project Name
121		Four laning of Amravati to Chikhli Section of NH-6 from Km 166.00 to Km 360.00 in the state of Maharashtra under NHDP Phase IV
122		Four laning of Sultanpur-Varanasi Section of NH-56 from km 134.700 to km 271.300 in Uttar Pradesh on DBFOT (Toll) basis.
123		Eight laning of Mukarba Chowk to Panipat of NH 1 (DEL-HRY)
124		Four laning of Guna to Biaora section of NH 3 from Km 332.100 to Km 426.100 in the state of Madhya Pradesh under NHDP phase IV
125		Four laning of Biora - Dewas section of NH-3 from Km 426.100 to Km 566.450 in the state of Madhya Pradesh under NHDP phase IV
126		2 laning with paved shoulder of Jabalpur-Mandala-Chilpi section from 3.4 to 192.4 km under NHDP - IV
127		Four-laning with PSS of Jabalpur-Bhopal section of NH-12 from km 10.400 to km 301.800 under NHDP Phase III on BOT (Toll) basis
128		Four laning of Patna-Buxar section of NH 30 in the state of Bihar
129		Four-laning of a section under NHDP-IV, between Hubli - Hospet section of NH 63 on BOT (Toll) basis.
130		Four-Laning of Hospet, Bellary Section of NH-63 under NHDP Phase IV, length 95.44 km
131		Six laning of Kishangarh-Gulabpura section in length of 90.0 Km NHDP-V
132		Six laning from 90.0 km to 214.9 km of Kishangarh-Udaipur-Ahmedabad section under NHDP Phase-V
133		Six laning of Chittorgarh - Udaipur section of NH-76 PKG-III
134		Four laning of Rampur-Kathgodam section of NH-87 from km 0 to km 88 in UP and Uttarakhand on BoT (Toll) basis
135		Four/six laning of Raipur-Bilaspur section of NH 200 from km 0.000 to km 127.650 in Chhattisgarh on BoT (Toll) basis
136		Eastern Peripheral Expressway (NH No. NE-II)
137		Four laning of Ambala - Kaithal section of NH-65 including Ambala Bypass inHaryana on BOT (Toll) project on DBFOT (Toll) basis
138		Four laning of Shivpuri - Dewas section of NH3 from km 15.623 to km 566.45 in Madhya Pradesh on BOT (Toll) basis.
139		2/4 laning of Vikravandi-Meensuruti Section of NH-45C and 2 laning with PSS from Meensuruti 93.5km to Thanjavur 164.614km
140		Four laning of Baihata Chariali to Tejpur Section of NH-52 (Km 0.00 to km 130.00) inAssam under NHDP Phase III on BOT basis.
141		Six laning of Dankuni - Baleshwar section of NH 6 in West Bengal
142		Four laning elevated road from Chennai Port gate No. 10 to Maduravoyal (NH 4) in the state of Tamilnadu
143		Six laning of Chilkaluripet-Nellore section of NH 5 from km 1182.802 to km 1366.547 in AP on BOT (Toll) project on DBFO pattern
144		Four laning of Pune-Sholapur section of NH 9 under NHDP Phase III, length 110.05 km Package II

No.	Code	Project Name
145		Six laning of Etawah Chakeri (Kanpur) section of NH 2 under NHDP Phase V, length 160.21 km
146		Four Laning of Solapur-Maharashtra/Karnataka border section in length of 99.8 km in Solapur under NHDP-III
147		Six laning of Poonamallee-Walajapet section of NH 4 under NHDP V on BOT(Toll) basis
148		Four -laning of Orrisa border to Aurang section of NH-6 from km 88 to km 239 in Chattisgarh on DBFOT (Toll) basis
149		Four laning of Hospet-Chitradurga section of NH-13 from km 299 to km 418.6 in Karnataka on BoT (Toll) basis
150		Six laning of Agra-Etawah Section of NH 2 from Km 199/660 to km 323.525 on BoT (Toll) in Uttar Pradesh under NHDP Phase V.
151		4 laning of Ghaghar Bridge (Indo Nepal Border) to Varanasi section from Km 121.8 to Km 298.45 of NH 233 in UP on BOT (Toll) basis
152		Four laning of Solapur-Bijapur section of NH 13 under NHDP Phase III from 0 110.542km in Maharashtra and Karnataka
153		Four-laning of Jabalpur- Kanti- Rewa Section of NH-7 from km 242.30 to km 465.50 in MP on BOT (Toll)

Note: Bold and red = selected projects. Project code is referenced in the research.

Source: India PPP Center (2021) and National Highways Authority of India (2021, 2022).