ENHANCING THE SUSTAINABILITY OF CHINESE PRODUCTION

**GOING BEYOND INDIVIDUAL FIRMS BY GREEN SUPPLY
CHAIN AND ECO-INDUSTRIAL PARKS**

DISSERTATION

to obtain
the degree of doctor at the University of Twente,
on the authority of the rector magnificus,
Prof.dr. T.T.M. Palstra,
on account of the decision of the graduation committee,
to be publicly defended
on Thursday, the 1st of October 2020 at 16:45 hours

by

Qiansong Zhang
born on the 21st of January 1991
in Xi'an, China

This dissertation has been approved by

Supervisors: Prof. dr. M.A. Heldeweg

Prof. dr. J.T.A. Bressers

Co-Supervisor: Dr. M.L. Franco-García

The research reported in this thesis has been carried out within the frame work of the MEMORANDUM OF AGREEMENT FOR A DOUBLE DOCTORATE DEGREE BETWEEN NORTHWESTERN POLYTECHNICAL UNIVERSITY, PEOPLE'S REPUBLIC OF CHINA AND THE UNIVERSITY OF TWENTE, THE NETHERLANDS.

Members of the Graduation Committee:

Chair and secretary

Prof. dr. T.A.J. Toonen	University of Twente
-------------------------	----------------------

Supervisors

Prof. dr. M.A. Heldeweg	University of Twente
-------------------------	----------------------

Prof. dr. J.T.A. Bressers	University of Twente
---------------------------	----------------------

Co-supervisors

Dr. M.L. Franco-García	University of Twente
------------------------	----------------------

Committee Members:

Prof. dr. T. Filatova	University of Twente
-----------------------	----------------------

Prof. dr. M.E. Iacob	University of Twente
----------------------	----------------------

Dr. Hongwei Shi	Xidian University
-----------------	-------------------

Prof. dr. Jieyi Pan	Northwestern Polytechnical University
---------------------	---------------------------------------

The work described in this thesis was performed at the School of Management, Northwestern Polytechnical University, 710129, Xi'an, Shaanxi, P.R. China, and the Department of Governance and Technology for Sustainability, Faculty of Behavioural, Management and Social sciences, University of Twente, P.O. Box 217, 7500 AE, Enschede, The Netherlands.

Colophon

Cover image: Qiansong Zhang

Printed by: Ipskamp printing, Enschede, The Netherlands

Copyright © 2020, Qiansong Zhang, University of Twente, BMS-CSTM.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the author.

ISBN: 978-90-365-5061-1

DOI: 10.3990/1.9789036550611

UNIVERSITY OF TWENTE.

Faculty of Behavioural, Management and Social sciences (BMS)

Department of Governance and Technology for Sustainability (CSTM)

Enschede, The Netherlands

NORTHWESTERN POLYTECHNICAL UNIVERSITY.

School of Management

Xi'an, Shaanxi, P.R. China

Acknowledgments

It was September 2016 when I started my PhD. This book was formed by countless revisions and improvements, as well as the cooperation, encouragement and help received from many people. Looking back at the four years of my doctoral study, I feel my doctoral experience is like a tortuous and long journey. Fortunately, I was not alone in such struggle, as I have received encouragement and support from many people. I would like to take this opportunity to offer my sincerely gratitude to all those who have contributed to this achievement in various ways.

I am deeply grateful to my family for their support and understanding of my PhD study, and for being able to accompany me through both good situations and bad situations. Their selfless dedication and firm support have made me who I am today.

I am sincerely grateful to my supervisor Professor Jieyi Pan at Northwestern Polytechnical University, for giving me the opportunity to become a PhD candidate. Your extensive professional knowledge and valuable academic insights deeply inspired and influenced me. Professor Pan's attention to details and grasp of language use, more than I could learn from the books, benefited me a lot. You have also strongly supported me to participate in various important academic conferences, and to study at the University of Twente to enrich my academic experience and expand my horizons. Due to the special circumstances of this year, you always cared about my safety and health while abroad, and gave me a lot of care and advice.

My other Chinese supervisor and corresponding author, Professor Taiwen Feng at Harbin Institute of Technology (Weihai) consistently provided me constructive opinions and academical feedback at critical points. You have cultivated my way of thinking about scientific issues and asking questions, arousing my interest in undertaking a PhD research. At the first time I wrote an English paper, you have also patiently revised the text and pointed out

problems for me many times, which greatly improved my academic writing ability. It is your contribution that has allowed me to publish three high-level papers, overcoming the hardship. I feel very lucky to study and carry out research under the supervision of these two.

My sincere thanks also go to Professor Hans Bressers, my supervisor, as well as Dr. Laura Franco-García, my co-supervisor at the University of Twente for accepting me at the Department of Government and Technology for Sustainability (CSTM) in the first place. When I first arrived in the Netherlands where I was unfamiliar, it was you both who made me feel warmly welcome and helped me to quickly adapt. In terms of academic research, the case study approach is a new field for me making me need more guidance. You always encouraged me and gave me the confidence to keep improving. In each discussion meeting, you were always patiently hearing what I wanted to express and what my thoughts were, and also gave many enlightening suggestions. After our repeated discussions, I learned a lot and quickly found a research direction. Professor Hans Bressers, you are really a great mentor, always pointed me out the direction. I was very impressed by attending the Sustainability and Policy course in Leeuwarden. Whether in class or on the train, you had enough patience to describe the course content in detail and answer my questions. I learned a lot from you about techniques for responding to reviewers' comments and writing skills. In addition to your profound professional knowledge and rigorous scientific spirit, many of your noble qualities, such as kindness, had a great influence on me. Dr. Laura Franco-García is not only my co-supervisor, but also a friend of mine. No matter what time or anything I am looking for, you will reply to me quickly and try your best to help me. You care about me and keep asking me to see a doctor when I fell in August, making me feel the warmth of home.

I want to express my deep gratitude for the persistence of both of you that I should have the opportunity to study here and obtain a PhD degree at the University of Twente. I am also very grateful to Professor Michiel Heldeweg

for finally agreeing to get my PhD.

My sincere thanks also go to my graduation committee from the University of Twente: Professor Tatiana Filatova and Professor Iacob. I feel honored to have you both as part of my PhD graduation committee. Thank you very much for your professional feedback on my book. I extend my sincere gratitude to the external committee members: Professor Jieyi Pan and Dr. Hongwei Shi. Thank you for taking the time to read my book and give comments, and become members of my committee.

I am thankful to Barbera for helping me with my daily affairs. It is also my pleasure to acknowledge my PhD colleagues at CSTM for the great times of communication and for helping me a lot: Alessandro, Brayton, Dewi, Franziska, Juli, Karen, Kenia, Cristina. Due to these friends I got to know Enschede making my life in the Netherlands very pleasant.

This book ends my journey as a PhD researcher at the University of Twente, but I will continue to conduct research on sustainability. This can be my new starting point.

Enschede, September 2020

Qiansong Zhang

Contents

1. General Introduction.....	1
1.1 Background.....	1
1.2 Research goal and questions.....	4
1.3 Research approach.....	5
1.4 Structure of the thesis.....	7
Part A: Introduction to the green supplier integration part of the thesis.....	11
2. Balancing coercive and non-coercive powers to enhance green supplier integration: Do relationship commitment and closeness matter?.....	15
2.1 Introduction.....	17
2.2 Literature Review and Research Hypotheses.....	20
2.3 Research Methods.....	30
2.4 Results.....	39
2.5 Discussions.....	44
2.6 Conclusion.....	50
3. The impact of green supplier integration on firm performance: The mediating role of social capital accumulation.....	53
3.1 Introduction.....	54
3.2 Theoretical Foundation and Research Hypotheses.....	56
3.3 Research Methods.....	66
3.4 Results.....	75
3.5 Discussion.....	80
3.6 Conclusion.....	85

4. Green supplier integration and environmental performance: Do environmental innovation and ambidextrous governance matter?....87

4.1 Introduction.....	89
4.2 Literature Review and Research Hypotheses.....	91
4.3 Methods.....	101
4.4 Results.....	112
4.5 Discussions.....	117
4.6 Conclusion.....	122

Part B: Introduction to the eco-industrial park part of the thesis....125

Background.....	125
Case studies.....	127
<i>Eco-Industrial Park Management in China</i>	127
<i>Case studies</i>	128
Research methodology.....	134
<i>GAT</i>	134
<i>The sustainability level</i>	139
<i>Data collection</i>	144

5. Case 1: Suzhou Industrial Park.....147

5.1 Introduction.....	147
5.2 Assessment of governance context in SIP.....	151
5.3 Assessment of sustainability in SIP.....	157
5.4 The influence of governance context on sustainability in SIP.....	162
5.5 Conclusion.....	166

6. Case 2: Wuxi National Hi-Tech District..... 167

6.1 Introduction.....	167
6.2 Assessment of governance context in WND.....	171
6.3 Assessment of sustainability in WND.....	177

6.4 The influence of governance context on sustainability in WND.....	183
6.5 Conclusion.....	186
7. Case 3: Nanjing Economic and Technological Development Zone	189
7.1 Introduction.....	189
7.2 Assessment of governance context in NET.....	193
7.3 Assessment of sustainability in NET.....	199
7.4 The influence of governance context on sustainability in NET.....	206
7.5 Conclusion.....	209
8. Case 4: Kunshan Economic and Technological Development Zone...	211
8.1 Introduction.....	211
8.2 Assessment of governance context in KETD.....	216
8.3 Assessment of sustainability in KETD.....	222
8.4 The influence of governance context on sustainability in KETD.....	228
8.5 Conclusion.....	233
9. Case 5: Yangzhou Economic Development Zone.....	235
9.1 Introduction.....	235
9.2 Assessment of governance context in YEDZ.....	239
9.3 Assessment of sustainability in YEDZ.....	246
9.4 The influence of governance context on sustainability in YEDZ.....	252
9.5 Conclusion.....	256
10. Case comparison and conclusions on eco-industrial parks.....	259
10.1 Comparison of the various dimensions of the five cases governance context.....	259
10.2 Comparison of the various dimensions of the five cases sustainability..	

.....	266
10.3 Results of the eco-industrial parks' sustainable development: The relationship between governance quality and sustainability performance.....	272
11. General summary and conclusions.....	285
11.1 Introduction.....	285
11.2 Summary of the answers to research questions.....	286
11.3 Practical implications.....	296
11.4 Limitations and future research directions.....	300
Bibliography.....	303
Appendices.....	347
Supplementary.....	355
Summary.....	359
Samenvatting.....	365
About the author.....	371

1. General Introduction

1.1 Background

With the rapid growth and development of the global economy, natural resource consumption has accelerated considerably, as has demand for social resources, such as human capital (Jill Harness, 2019; Mittal and Gupta, 2015). This is creating a state of scarcity for the planet's natural resources and, at the same time, significant environmental and social problems, e.g., global warming and competition for high-tech talent. Thus, the coordinated development of economy, society and environment has become an important challenge for humanity.

This resulted in the emergence of the field of sustainable development in the 1990s and its subsequent growth and evolution into the United Nations Sustainable Development Goals adopted in 2015. The latter builds on the earlier 'Rio+20' Summit of the United Nations Conference on Sustainable Development that re-emphasized the principle of coordinating the three pillars, namely, economic growth, social development and environmental protection, with a view to fostering a global economy's inclusive, balanced, coordinated and sustainable development (Commission on Sustainable Development, 2012).

From a global perspective, many countries have started to respond. For example, many OECD countries, such as Japan, France and Denmark, have introduced a series of conventions and agreements requiring environmental security, energy conservation and pollution mitigation, which will have a fundamental impact on the environment, resources and economy.

The Chinese government gradually has begun to transform China's economic growth model in order to implement the commitments in line with international conventions and agreements. China regards sustainable development as the strategic approach to its long-term development. Hence, China needs to

establish a renewable, low-carbon, secure and efficient energy supply system and consumption system. Simultaneously, China has pledged to reduce the carbon intensity of GDP by 60%-65% below the 2005 rates by 2030 (Den Elzen et al., 2016). This could allow new and renewable energy to expand at a rate of 6%-8% per year.

China has also adopted specific sustainable development measures from the 15th National Congress through to the 19th National Congress reports and has identified sustainable development as one of its main strategies encompassing ecological, economic and social sustainability. It encourages economic growth, while protecting natural resources and the environment. It aims to improve the well-being of the people and ensure that the needs of the current generation are met without compromising the chances and potential of future generations (Chinese Academy of Translation, 2018).

The enabling of a balanced and harmonious symbiosis of economic, social and ecological environments necessarily needs improvements that cannot be realized just by individual companies separately. China needs to transform its traditional model into a sustainable model (Feng and Wang, 2016) with a view to increasing the competitive advantage and cooperation among companies. Such competition and cooperation exist not only in the industrial sectors' supply chains (Du et al., 2018; Tate et al., 2014; Yu and Huo, 2019), but also in industrial parks (ElMassah, 2018; Hong et al., 2020; Sakr et al., 2011).

As the two main ways for China to achieve sustainable development, green supplier integration and eco-industrial parks have indeed played key roles. Based on this, it is necessary to explore the two different ways to achieve sustainable paths to better enhance the sustainability of Chinese production. As a result, the research of this thesis is divided into two parts. The first part explores the important role of green supplier integration in green supply chain management looking at how to achieve green supplier integration and assessing its impact on company performance. The other part sets out to reveal the

impact of the governance context on the sustainability performance of eco-industrial parks.

On the one hand, although China's manufacturing industry has fostered the rapid growth of the Chinese economy, accounting for around 30% of the total GDP and creating its dominant position in the world, it has polluted the environment severely (De Marchi, 2012), which has threatened people's normal life. This stresses the great importance of implementing green supply chain practices in China to achieve a more sustainable performance of manufacturing companies (Han and Huo, 2020, Kong et al., 2020; Wu, 2013). Furthermore, since many suppliers are at the source of the green supply chain, exploring the role of green supplier integration in the cooperation between companies and their suppliers is conducive to helping companies to achieve and contribute to sustainable development (Du et al., 2018; Pang et al., 2017; Woo et al., 2016). However, the existing studies on how to improve green supplier integration (Zhang et al., 2020b), as well as its impact on the sustainability performance of companies (Du et al., 2018; Villena et al., 2011; Winn et al., 2012) is still limited, so we need to explore these two aspects more deeply.

On the other hand, China realizes that the development of eco-industrial parks is not simply an environmental strategy, but also an economic development strategy (Afshari et al., 2018; Tian et al., 2014). The establishment of eco-industrial parks started in 2001. Since 2004, the National Development and Reform Commission (NDRC) has cooperated with the Ministry of Environmental Protection (MEP) to initiate the circular economy demonstration program in which circular material and energy flows in industrial parks have been proposed (Geng et al., 2012; Su et al., 2013), as well as measures to tackle resource shortages and environmental pollution issues that impact on regional economic development (Shi et al., 2003; Shi et al., 2010; Shi et al., 2012a, b). The effective transformation of eco-industrial parks

is a requirement, not only for the internationalization of companies, but also represents a critical trend in a period when China is pursuing economic benefits in harmony with ecological and social benefits.

The ‘eco-industrial park’ is a policy-concept filled with different meanings depending on the political, socio-economic and cultural context (Boons et al., 2017). Their sustainability levels are rarely examined from the governance perspective (Massard et al., 2014) or time taken to explore how the governance context influences the sustainability of eco-industrial parks. However, the existing literature has pointed out that the governance that is provided by the government combined with the park management departments actually provides preconditions for the sustainability of the eco-industrial park (Chertow and Ehrenfeld, 2012). Therefore, it is essential for this research to explore the impact of the various aspects of the governance context on the eco-industrial park’s sustainability.

This research background sets the scene for, first, the research goal and questions that are described in Section 1.2, the research methodologies and detailed explanations of the two parts that are briefly explained in Section 1.3, and finally, the structure of the entire doctoral thesis outlined in Section 1.4.

1.2 Research goal and questions

The core **goal** of this doctoral research is to combine qualitative and quantitative research to clarify China’s sustainable development strategy from two perspectives that form the two parts of this thesis. These two parts include the importance of green supplier integration and its promotion of company performance to achieve company sustainability. This runs alongside considering the effectiveness of governance for the sustainable development of eco-industrial parks which integrate individual company efforts to address the sustainability challenges. To clearly understand the goals, this thesis addresses the following six main **research questions** (RQ):

RQ1: How do we characterize the China's current development and the historical process impacts? (Mainly for Chapter 1)

RQ2: In what ways do various factors interact in the supply chain and have a direct and indirect impact on green supplier integration? (Chapter 2)

RQ3: How does green supplier integration affect firm performance to promote its sustainable development under the influence of China's serious environmental problems? (Chapter 3)

RQ4: From the perspective of ambidextrous governance, how does green supplier integration improve the environmental performance of firms? (Chapter 4)

RQ5: How to evaluate and improve the governance context and the sustainability level of eco-industrial parks in China? (Part 2: Chapters 5-10)

RQ6: When implementing green supply chain management and eco-industrial parks, what strategies and measures can China use to improve the effectiveness of sustainable development practices? (Final Chapter 11)

1.3 Research approach

I have adopted a variety of approaches to answer these six research questions, including consulting relevant literature materials, undertaking empirical research, and using case studies. The approach is described below. Further specifications are explained in the introductions to the book-parts and the chapters. In addition, since a specific introduction is included in each chapter, the introductions of these two parts (i.e., on the green supplier integration and on the eco-industrial parks) only outline the general research background of each part and the specific questions raised there.

Consulting relevant literature and background information

To answer RQ1 required reviewing a plethora of articles, books, selected sources on the internet, and also holding some interviews with experts. This

question is answered in Chapter 1 and the introduction of two parts. The purpose is to establish a clear research grounding into the study of China's sustainable development landscape and to elaborate on the research topic; namely, the importance of green supplier integration and the historical process of industrial parks, whilst providing a theoretical and background support into the study of China's green practices and sustainable development.

Empirical Research

To research green supplier integration, I conducted a questionnaire survey and established various models to answer RQ2, RQ3 and RQ4 based on the empirical research questions. The detailed answers are given in Chapters 2, 3, and 4. The purpose of answering these three questions is to better understand the importance of implementing green supplier integration and the benefits of green supplier integration in improving firm performance. As a result, the insights might provide Chinese firms with approaches to promote their sustainable development from different theoretical perspectives.

Case studies

While the number of eco-industrial parks in China is still rather limited, a quantitative analysis like done for the first part was not possible for the eco-industrial parks part. Instead, I used the methodological approach of case studies to answer RQ5 regarding the eco-industrial parks in Chapters 5 to 10 based on the evaluation framework shown in Figure 1.1. I adopted the framework developed by Kreiner and Franco-García (2019) because it fits with the purpose of the type of assessment to be carried out in this research. On this basis, this research also adapted this framework to fit the approach of this research better. The field research was conducted on eco-industrial parks in Jiangsu Province and considered aspects of the governance context and sustainability to evaluate the sustainable development level of each park case.

Figure 1.1: Analytical framework for the evaluation of sustainable parks

1.4 Structure of the thesis

This doctoral thesis includes two themed parts. The chapter numbers run consecutively throughout to give a total of 11 chapters with the structure as shown in Figure 1.2.

In summary, it starts with the General Introduction (Chapter 1). This is followed by the green supplier integration part that consists of three published or under review papers. Chapter 2 focuses on the research on the variables influencing green supplier integration which will be referred to as ‘antecedents’. Chapters 3 and 4 assess the impact of green supplier integration on firm performance.

The next part is dedicated to the five eco-industrial park cases and a comparative chapter. Chapters 5 to 9 are case studies of sustainable development in five eco-industrial parks in China, while Chapter 10 draws conclusions by comparing the results of the five park cases.

The thesis concludes with the General summary and conclusions in Chapter 11.

The structure and description of the chapters of this thesis are as follows:

Figure 1.2: Structures of the doctoral thesis

Chapter 2 analyzes how to balance the opposite effects of coercive and non-coercive powers to enhance green supplier integration, as well as the mediating role of relationship commitment between these two variables and the moderating role of relationship closeness. This chapter has been published in Zhang, Q., Pan, J., Xu, D. and Feng, T. (2020). Balancing coercive and non-coercive powers to enhance green supplier integration: Do relationship

commitment and closeness matter? *Supply Chain Management: An International Journal*. 25(6), 637-653.

Chapter 3 examines the relationship between green supplier integration and firm performance (i.e., economic and environmental performances), as well as by dividing social capital accumulation into three dimensions; namely, relational, structural and cognitive capital accumulations. In doing so, we more clearly understand the different mediating roles of various dimensions of social capital accumulation. This chapter has been published in Zhang, Q., Pan, J., Jiang, Y. and Feng, T. (2020). The impact of green supplier integration on firm performance: The mediating role of social capital accumulation. *Journal of Purchasing and Supply Management*. 26(2), 100579.

Chapter 4 explores how green supplier integration can enhance environmental performance through different types of environmental innovation, specifically, incremental environmental innovation and radical environmental innovation. It also discusses whether ambidexterity governance can better address the dark sides encountered by firms in implementing green supplier integration to achieve environmental benefits through the moderating role of balanced ambidexterity and combined ambidexterity. This chapter has been published in Zhang, Q., Pan, J. and Feng, T. (2020). Green supplier integration and environmental performance: Do environmental innovation and ambidextrous governance matter? *International Journal of Physical Distribution & Logistics Management*. (DOI: 10.1108/ijpdlm-01-2020-0027).

Chapters 5, 6, 7, 8 and 9 evaluate the sustainable development of five Chinese eco-industrial park cases, respectively. This is done specifically by combining the governance context based on the Governance Assessment Tool (GAT) and the ‘sustainability framework for industrial parks’. I focus on the evaluation of five park cases with the combined framework named ‘Sustainable Strategic Evaluation Framework (SSEF)’.

Chapter 10 reports on the comparative results of the five eco-industrial park cases from the aspects of governance context and sustainability, and illustrates the similarities and differences between the five cases. At the same time, the sustainable development of the five park cases is evaluated. A detailed analysis of one outlier park case is provided and the results are placed in the Chinese context.

Chapter 11 summarizes the conclusions of the two theme parts and expounds their practical implications based on the research conclusions. Simultaneously, some suggestions are put forward for companies in the green supply chain and the relevant levels of administration and actors in the park. At the end of this chapter, limitations and future research directions are emphasized.

Part A: Introduction to the green supplier integration part of the thesis

The traditional operating model of individual Chinese firms is considered to be no longer suitable as it has produced many environmental problems in recent years (Feng and Wang, 2016; Taoketao, et al., 2018). This is against a wider backdrop of increasingly serious environmental problems, such as pollution and resource depletion that have undoubtedly exerted great pressure on China's economic growth. As a result, firms are discussing and implementing new methods, such as a sustainable development model, to mitigate such pressure (Huang et al., 2019).

Market competition no longer takes place just between individual firms, but between supply chains. Meanwhile, as managers give more attention to green concepts and environmental practices, this promotes the increasingly prominent role of green supply chain management (Zhang et al., 2020a). Suppliers located upstream in the supply chain play a key role in achieving supply chain sustainability (Li et al., 2016a). As a result, if firms work with their suppliers, they can achieve sustainable competitive advantages, while reducing environmental hazards (Feng et al., 2016a; Wu, 2013). The adoption of green management practices by suppliers of Samsung and Huawei are good examples (Yu and Huo, 2019).

This research conducts in-depth research and exploration into green supplier integration. Green supplier integration refers to the strategic interaction between firms and their suppliers to address environmental problems by integrating resources and joint plans in order to reduce the adverse impact of practical activities on the environment and to achieve environmental goals (Du et al., 2018; Philipp et al., 2014; Zhang et al., 2020a). Although, many more scholars are paying attention to green supplier integration, the research on how to realize green supplier integration is not completely clear. Some existing

research has indicated that green supplier integration does help firms improve performance (Diabat and Govindan, 2011; Woo et al., 2016). Therefore, it is important to explore the factors that affect green supplier integration and how green supplier integration improves firm performance. This part explores this from two aspects: namely, the study of its antecedents and the study of the influence of green supplier integration on firm performance.

The study on the antecedent factors influencing green supplier integration (Chapter 2) shows that the lack of incentives for suppliers to participate actively in the firm's environmental practices makes them struggle to implement green supplier integration (Genovese et al., 2017). Power is an important factor influencing decision-making and practical behavior between trading partners, which is conducive to suppliers to be integrated into the firms' environmental practices and them making joint efforts to improve the environment (Berthon et al., 2003; Wang et al., 2015a). Additionally, relationship commitment not only can establish and maintain good long-term relationships (Lee, 2016), but also can be an important resource for implementing environmental reciprocity between firms and their suppliers (Zhao et al., 2011). Specifically, relationship commitment establishes an environment-based interaction platform for firms and their suppliers, and solves environmental problems through enhanced environmental cooperation (Mishra and Banerjee, 2018). Such long-term cooperation, based on transaction cost theory, weakens opportunistic behaviors and reduces costs that lead to green practices (Sancha et al., 2015; Zhao et al., 2011). As a result, relationship commitment can ease the cooperative attitudes due to the implementation of power, and also promote firms and their suppliers to assume corresponding environmental responsibilities (Zhang et al., 2020a). This chapter mainly explores that the different types of power that affect relationship commitment and, ultimately, affect green supplier integration.

The study of the impact of green supplier integration on firm performance (i.e., economic and environmental performances) is explored from two perspectives (Chapters 3 and 4); each of which is a chapter of the thesis. First, according to social capital theory, social capital accumulation can achieve competitive advantages through social relationships. Therefore, green supplier integration can improve the social relationships between firms and their suppliers by integrating various resources and practical activities, thereby forming valuable resources for cooperation (Carey et al., 2011; Geng et al., 2017; Lawson et al., 2008). With the continuous accumulation of resources, it is beneficial for firms to improve their performance levels (Huang et al., 2018). Hence, green supplier integration facilitates social capital accumulation and, thus, affects firm performance. Second, suggested by the natural resource-based view, firms can collaborate with their suppliers in green practices to reduce environmental pollution by implementing environmental innovations (Wijethilake et al., 2018). Specifically, firms can try to reduce the environmental hazards of their activities by improving existing or developing products, technologies, or processes (Chiarvesio et al., 2015; Ziegler and Nogareda, 2009). Thus, green supplier integration can improve environmental performance by promoting environmental innovation.

In summary, green supplier integration can influence firm performance through social capital accumulation or environmental innovation.

This part of the thesis is structured as follows. Chapter 2 is the research into the antecedents of green supplier integration. Chapter 3 explores the mediating role of social capital accumulation between green supplier integration and firm performance. Chapter 4 shows how analyzing the mediating role of environmental innovation helps to explore the impact mechanism of green supplier integration on environmental performance, and the moderating role of ambidextrous governance.

2. Balancing coercive and non-coercive powers to enhance green supplier integration: Do relationship commitment and closeness matter?¹

Abstract

Purpose - Although the importance of green supplier integration (GSI) has been recognized, the knowledge of how it can be enhanced is still limited. Using insights from transaction cost and resource dependence theories, this paper aims to explore how to balance coercive and non-coercive powers to enhance GSI and the mediating role of relationship commitment and the moderating role of relationship closeness.

Design/methodology/approach - To validate the hypotheses, this study conducted hierarchical regression analysis and bootstrapping using the survey data collected from 206 Chinese manufacturers.

Findings - The results indicate that coercive power undermines normative commitment, while non-coercive power promotes normative and instrumental commitments. Both normative and instrumental commitments enhance GSI. Normative commitment mediates the impacts of coercive and non-coercive powers on GSI, while instrumental commitment only mediates the impact of non-coercive power on GSI. Moreover, supplier trust and dependence negatively moderate the positive link between instrumental commitment and GSI.

Practical implications - Executives should carefully balance coercive and non-coercive powers to encourage firms to maintain good relationships with suppliers and develop common environmental values under different mediating

This chapter is based on a journal article:

Zhang, Q., Pan, J., Xu, D. and Feng, T. (2020b). Balancing coercive and non-coercive powers to enhance green supplier integration: Do relationship commitment and closeness matter? *Supply Chain Management: An International Journal*. 25(6), 637-653.

effects of normative and instrumental commitments. However, they should also be aware that high level of trust and dependence can affect the impacts of powers.

Originality/value - This study contributes to GSI literature by opening the ‘black box’ between power and GSI and verifying its boundary conditions.

Keywords: Power, Green supplier integration, Relationship commitment, Relationship closeness, Supplier trust, Supplier dependence

2.1 Introduction

With the increasing concern about environmental degradation and resource shortage, it is necessary for firms to minimize adverse environmental impacts to gain sustainable competitive advantages (Ahi and Searcy, 2013; Jiang et al., 2018; Taoketao et al., 2018; Yang et al., 2020). However, few firms have the ability to deal with environmental issues by themselves, they should integrate ‘green’ suppliers into their environmental practices (Du et al., 2018; Woo et al., 2016; Yeung et al., 2009). Adopting green supplier integration (GSI) may promote reciprocal cooperation and joint planning between the firm and its suppliers (Philipp et al., 2014), which consequently helps the firm to achieve environmental goals by reducing pollutant emission and resource waste (Cheng, 2020; Woo et al., 2016; Zhang et al., 2019; Zhao et al., 2018).

The importance of GSI has been recognized, and most existing studies focus on its performance impacts, such as on operational performance (Zailani et al., 2012; Zhu and Sarkis, 2004), environmental performance (Diabat and Govindan, 2011; Yu et al., 2017), financial performance (Feng et al., 2018a; Woo et al., 2016) or green innovation performance (Jean et al., 2014). However, the literature on how to enhance the degree of GSI is still limited. The lack of research in this topic makes the focal firm struggle to implement GSI smoothly because suppliers may lack the initiative to engage in the firm’s environmental practices (Genovese et al., 2017). As power affects the decision-making behavior and practical ability between partners (Wang et al., 2015a), its utilization may help to increase the willingness of suppliers to be integrated into green practices of the focal firm to achieve environmental goals (Berthon et al., 2003; Meqdadi et al., 2017).

This study divides power into coercive and non-coercive types (Wang et al., 2015a). Previous literature has suggested that coercive power can restrain harmful actions of suppliers, such as delivering poor quality materials, long delivery time or the use of hazardous substances (Chae et al., 2017; Harness et

al., 2018), which benefits environmental collaboration. Non-coercive power has also been proposed to strengthen cooperative partnerships (Hausman and Johnston, 2010) and promote positive behaviors of suppliers (Bazyar et al., 2013), so as to achieve common environmental goals (Ramaseshan et al., 2006). Thus, both coercive and non-coercive powers can promote the implementation of GSI. However, they may play different roles in enhancing GSI (Chicksand, 2015; Ramaseshan et al., 2006; Wang et al., 2016a), which makes firms confused on the development of power balance. Hence, there is a need to explore the effect mechanisms of these two kinds of power, specifically, how and under what conditions powers affect GSI.

Relationship commitment is an important resource, not only in establishing and maintaining good and long-term relationships (Lee, 2016) but also in achieving environmental reciprocity between the focal firm and its suppliers (Zhao et al., 2011). Relationship commitment establishes an interactive platform for the focal firm and its suppliers, and helps to resolve environmental issues through enhanced environmental reciprocity and value belief of cooperation (He et al., 2013; Mishra and Banerjee, 2018). It can ease the attitudes toward cooperation based on implementation of power, and positively influence suppliers' motivations to act responsibly toward the environment (Jain et al., 2014; Liu et al., 2017). Hence, analyzing the mediating role of relationship commitment will be helpful to exploit the effect mechanisms of powers on GSI.

Moreover, relationship closeness is also a significant factor for the collaboration between the firm and its partners in supply chains, especially in the relationship commitment-GSI link (Nielson, 1998). In this research, relationship closeness is mainly measured by trust and dependence (Hoejmose et al., 2012; Narasimhan et al., 2009). Trust is the foremost attribute recognized by the firm as necessary to develop relationship closeness (Srivastava and Singh, 2010). According to transaction cost theory, supplier trust may reduce costs and mitigate opportunism (Wang et al., 2011), which can strengthen the

connection between relationship commitment and GSI by improving the chances for both parties to succeed in achieving common environmental goals (Yeung et al., 2009). Another key aspect of relationship closeness is the degree of dependence on the participants (Feng and Magen, 2016). Based on resource dependence theory, the focal firm's heavy relying on its major suppliers may increase the probability for suppliers to abuse the mutual cooperative relationships (Zaefarian et al., 2016). Consequently, we propose that supplier trust strengthens the influence of relationship commitment on GSI, while supplier dependence weakens the influence of relationship commitment on GSI.

To sum up, we explore how to balance coercive and non-coercive powers to implement GSI by considering the effects of relationship commitment and relationship closeness in this study. Specifically, this study mainly explores three research questions:

- RQ1.** How do different types of power (i.e., coercive and non-coercive powers) affect relationship commitment (normative and instrumental commitments) and subsequently affect GSI?
- RQ2.** How does relationship commitment mediate the connection between power and GSI?
- RQ3.** How does relationship closeness (i.e., supplier trust and dependence) moderate the connection between relationship commitment and GSI?

The rest of the research is structured as follows. We review the related literature on GSI and develop research hypotheses in Section 2.2. Section 2.3 presents our research methods and results are reported in Section 2.4. Subsequently, we discuss the findings and provide theoretical contributions and managerial implications in Section 2.5. Finally, Section 2.6 summarizes research limitations and further directions.

2.2 Literature Review and Research Hypotheses

In this study, for the implementation of GSI, we consider the effects of power, relationship commitment and relationship closeness. Figure 2.1 displays the conceptual framework and linkages among them.

Figure 2.1: Conceptual model

2.2.1 Green supplier integration

With the attention to environmental issues and environmental management, green supply chain integration has been considered as a joint cooperation between firms and their partners to promote sustainable environmental practices and goals (Shi et al., 2012c; Zhu et al., 2012a). Green supply chain integration can be divided into GSI, green customer integration and green internal integration (Cigdem and Anand, 2017). This study mainly focuses on GSI, considering upstream suppliers' critical role in achieving supply chain sustainability (Li et al., 2016a).

GSI represents the business interaction between the focal firm and suppliers based on the shared environmental goals and business vision, which increases

collaboration, knowledge integration and joint development of environmental management measures (Chae et al., 2017; Philipp et al., 2014). In this case, the focal firm can not only maintain long-term and stable collaboration with suppliers but also reduce possible adverse impacts of its products or services on the environment. Previous literature has examined three types of antecedents of GSI: specialized asset investments (Lager and Frishammar, 2010), process coordination (Hsu et al., 2013; Leonidou et al., 2017; Yang et al., 2013) and relationship governance (Lo et al., 2018; Qi et al., 2017; Woo et al., 2016). In this study, we investigate the antecedents of GSI from the perspective of relationship governance.

Resource dependence theory reveals that the focal firm and its suppliers can acquire needed resources, create competitive advantages (Pfeffer and Salancik, 1978) and reduce environmental uncertainty (Hillman et al., 2009) through the cooperative relationship. Sarkis et al. (2011) have clarified how close cooperation and resource sharing facilitate environment and green practices. Additionally, based on transaction cost theory, long-term cooperative partnership can help the focal firm and its suppliers to achieve lower transaction costs, and increase environmental responsibility (Lo et al., 2018).

2.2.2 Power and relationship commitment on supplier

Power is the ability of one party to influence behaviors and attitudes of other parties (Narasimhan et al., 2009; Wang et al., 2015a). It is considered as the basis of the cooperative relationship between the focal firm and suppliers (Cox, 2001; Reimann and Ketchen, 2017). About the dimensions of power, scholars hold different views (Table 2.1). Among these classifications, a popular view is to divide power into coercive and non-coercive types and many scholars have followed this classification (Chang and Huang, 2011; Hunt and Nevin, 1974; Lusch and Brown, 1982; Wang et al., 2015a). So we also adopt this taxonomic view. Coercive power means that the focal firm exerts direct pressure on its suppliers to achieve goals (Frazier and Rody, 1991), aiming to promote

suppliers to perform specific behaviors by imposing penalties or enforcement measures (Hausman and Johnston, 2010; Molm, 1997). Non-coercive power refers to the situation in which the focal firm facilitates the realization of expected behaviors and maintains long-term cooperation by changing the business philosophies of suppliers (Zablah et al., 2005) and providing relevant knowledge, assistance and advice (Bazyar et al., 2013; Yeung et al., 2009).

Effective environmental reciprocity between the firm and suppliers largely depends on how well the exercise of power can stimulate relationship commitment. Relationship commitment reflects the motivations of the focal firm to work together with its suppliers to solve environmental problems (Chae et al., 2017; Morgan and Hunt, 1994), as well as the willingness to maintain long-term and stable partnerships (Zhao et al., 2011). At the organizational level, Brown et al. (1995) classified relationship commitment into normative and instrumental commitments. In our study, normative commitment indicates that the focal firm relies on the internalization of emotional factors and values to maintain a long-term, continuous attachment with its suppliers (Wang et al., 2018; Zhao et al., 2011). Instrumental commitment represents that the focal firm is willing to make efforts to maintain the partnership with suppliers because it has received valuable returns or remunerations (Hausman and Johnston, 2010). Transaction cost theory posits that relationship commitment is regarded as a special asset investment of commercial cooperation, exclusively confined to activities between the focal firm and its suppliers (Heide, 1994). Such non-transferable asset investment strengthens the enthusiasm and willingness for long-term cooperation, undermines opportunistic behaviors and decreases transaction costs (Zhao et al., 2011). Hence, power and relationship commitment play critical roles in affecting environmental collaboration between the firm and suppliers.

Table 2.1: Main classification of power

Basic source of power	Representative research	Major sources
Coercive/ Non-coercive	Bazyar et al., 2013	coercive reward, legitimate, expertise, referent, information threats/legalistic pleas,
	Chang and Huang 2011	promises recommendation, information exchange
	Nygaard and Biong, 2010	coercive reward, expert, referent, legitimate
	Ramaseshan et al., 2006	pressure, punishment assistance, reward
	Brown et.al., 1995	reward, coercion, legitimate expert, referent, information
Mediated/ Non-mediated	Maloni and Benton, 2000	reward, coercive
	Zhao et al., 2008	expert, referent, legitimate coercion, reward, legitimate
	Ke et.al 2009	information, expert, referent
Economic/ Non-economic	Etgar, 1978	reward, punishment
		expert, legitimate, referent
Direct/ Indirect	Frazier and Summers, 1984	promises, threats, legalistic, request information exchange, recommendation
Authoritative/ Nurturing	Johnson et.al., 1993	punishment or coercion, referent, legal, traditional legitimate reward, expert, information

2.2.2.1 The impact of coercive power on relationship commitment

Coercive power is able to motivate suppliers to perform specific behaviors to meet the firm's requirements (Ireland and Webb, 2007). However, in terms of normative commitment, coercive power produces an 'unsatisfactory' effect

(Chae et al., 2017; Flynn et al., 2008). The focal firm imposes more penalties or enforcement measures to coordinate the relationships with its suppliers, reflecting that it regards the trade between the two parties to be a pure transaction instead of a trustful cooperation (John, 1984; Zhuang et al., 2010). Although coercive power can achieve suppliers' compliance, the measures such as threats or constraints undermine intrinsic commitment of the focal firm to long-term partnerships (Handley and Benton, 2012a). This may prompt suppliers to take actions to avoid punishment rather than to establish similar values (Ramaseshan et al., 2006; Yeung et al., 2009). To sum up, coercive power runs counter to the meaning of normative commitment (Hopkinson and Blois, 2014).

In contrast, coercive power promotes instrumental commitment (Zhao et al., 2008). The focal firm controls behaviors to force suppliers to obey with the purpose of obtaining returns (Molm, 1997), which implies that the firm cares more about its own interests rather than cooperative relationships (Huo et al., 2019a). Thus, the enforcement of coercive power provides a prerequisite for maintaining interest-based relationships. In addition, the adoption of coercive power attempts to play an important role in reminding suppliers to reduce opportunistic behaviors. If the firm can achieve its own ideal returns, it is willing to commit financial and capital investments to maintain long-term partnerships (Huo et al., 2017). Hence, we assume:

H1a: Coercive power is negatively linked with normative commitment.

H1b: Coercive power is positively linked with instrumental commitment.

2.2.2.2 The impact of non-coercive power on relationship commitment

Non-coercive power is often used by the focal firm to achieve goals by providing suppliers with its expertise and suggestions (Bazyar et al., 2013). Such friendly actions reflect the sincere signal of the firm's expectation to establish a cooperative relationship (Doney and Cannon, 1997). Therefore, the implementation of non-coercive power manifests the firm's goodwill in

extending affective relationships (Huo et al., 2019a). In addition, as non-coercive power indicates the contributions of the firm to its suppliers, it helps to enhance suppliers' recognition of the firm's value beliefs and goals (Hopkinson and Blois, 2014; Wang et al., 2018).

Non-coercive power is also the affirmation and encouragement given by the firm to those suppliers who contribute to maintaining partnerships (Chae et al., 2017). However, once the focal firm takes into account the resource costs of using non-coercive power, it will stimulate the firm to obtain some kind of returns from the partnership and maintain the longevity of the relationship (Hausman and Johnston, 2010; Huo et al., 2019a; Zhuang et al., 2010). In addition, the firm can provide appropriate environmental protection suggestions to suppliers, hoping to use them as a bargaining chip (Zhao et al., 2008). In this case, the expected environmental goals of the firm are gradually achieved (Meqdadi et al., 2018), which encourages the firm to fulfill its instrumental commitment by providing positive external factors such as support and price concessions. We put forward:

H2: Non-coercive power is positively linked with (a) normative commitment and (b) instrumental commitment.

2.2.3 The impact of relationship commitment on GSI

Relationship commitment is an essential element in maintaining a long-term commercial connection and provides the basis for effective implementation of GSI (Chae et al., 2017; Zhao et al., 2011). When the focal firm undertakes environment-related relationship commitment, it undoubtedly increases its confidence to launch green initiatives with its suppliers (Huo et al., 2015; Liu et al., 2017). Thus, relationship commitment gradually reinforces the environmental consensus and convergence of values between the two parties (Mishra and Banerjee, 2018), which provides an opportunity to implement responsible environmental strategies (Lo et al., 2018).

The essence of normative commitment is that the firm builds and maintains a long-term cooperative relationship based on emotional connections and values (Wang et al., 2018; Wichmann et al., 2016). First, normative commitment increases the pride and team attachment of the focal firm, which will promote its implementation of GSI (Shi et al., 2012c). Second, the firm maintains stable partnerships with a sincere attitude, which is conducive to realizing environmental goals and avoiding opportunism (Huo et al., 2016a). As a result, a consensus on green concepts of both parties is promoted and the understanding of GSI is internalized. Third, normative commitment aims at establishing similar values between the firm and its suppliers (Zhao et al., 2008), which may help both parties collaborate to achieve environmental goals. It facilitates the improvement of green practice activities and further enhances GSI (Li and Huang, 2017). Therefore, the higher the normative commitment, the better the GSI will be.

Instrumental commitment essentially is a particular investment which is devoted by the firm to maintain partnership based on its own interests (Brown et al., 1995; Wang et al., 2018). As a result, instrumental commitment encourages the firm to achieve a binding demonstration of cooperation provided by its suppliers, such as providing appropriate price concessions, rewards or other incentives during the transaction process to obtain some forms of remuneration (Zhao et al., 2008). Based on transaction cost theory, such cooperation decreases the incidence of opportunistic behaviors and costs, which subsequently makes green practice possible (Sancha et al., 2015; Zhao et al., 2011). Additionally, the high level of instrumental commitment also strengthens the enthusiasm of the firm and its suppliers to understand respective environmental responsibilities, thereby reducing impacts of some negative actions on the environment (Li and Huang, 2017). Hence, the firm with a higher level of instrumental commitment promotes GSI better. We bring forward:

H3: (a) Normative commitment and (b) instrumental commitment are positively linked with GSI.

2.2.4 The mediating role of relationship commitment

Existing studies have cleared that the judicious use of power can promote the establishment of long-term commitment (Ramaseshan et al., 2006) and then enhance the firm and its suppliers to implement green procedures in business dealings (Genovese et al., 2017). Accordingly, our research hypothesizes that relationship commitment has a certain mediating influence between power and GSI.

Based on resource dependence theory, the focal firm adopts coercive power to reduce uncertainty and exercises non-coercive power to increase sincerity, which is conducive to obtaining resources to improve competitive advantage (Huo et al., 2019a; Pfeffer and Salancik, 1978). This situation prompts the firm not only to establish an attachment relationship from intrinsic motivations (Chae et al., 2017) but also to effectively form common values (Yu et al., 2013). Such a long-term normative commitment with similar values is particularly helpful to establish green-related goals and promote close integration between the firm and its suppliers (Kannan et al., 2014; Prahinski and Benton, 2004). According to transaction cost theory, power is critical to optimizing the business relationship based on the focal firm's interests (Simpson et al., 2007), which helps to maintain long-term connections and reduce transaction costs (Chae et al., 2017). Specifically, coercive power encourages the firm to reduce opportunistic behaviors through effective control to achieve valuable returns, while non-coercive power increases the profit chips of the firm (Molm, 1997; Zhao et al., 2008). Therefore, the realization of interest-based instrumental commitment improves enthusiasm and willingness of the firm and its suppliers to work together for green practices and environmental plans (Hoejmose et al., 2012; Lo et al., 2018; Sancha et al., 2015). Based on these arguments, power promotes the formation of relationship commitment and subsequently

facilitates GSI. We propose the following hypotheses:

H4: Normative commitment mediates the effects of (a) coercive power and (b) non-coercive power on GSI.

H5: Instrumental commitment mediates the effects of (a) coercive power and (b) non-coercive power on GSI.

2.2.5 The moderating roles of supplier trust and dependence

Trust is considered to be a key element in influencing the expected partnership between supply chain members and addressing environmental issues together (Ashnai et al., 2016; Morgan and Hunt, 1994). It embodies one party's belief in the reliability and consistency of the other party (Moorman et al., 1993). In this research, supplier trust means the extent of trust the focal firm has in its suppliers. This extent of trust describes that the focal firm believes that its suppliers are sincerely willing to provide necessary assistance and support to the firm, and will not make any decisions or take actions that are harmful to either side (Liu et al., 2009).

Therefore, we propose that supplier trust positively affects the relationship commitment-GSI link (Lai et al., 2008; Yeung et al., 2009). The higher the firm's level of trust in its suppliers, the stronger its recognition of the suppliers' reliability and sincerity (Ali and Khalid, 2017). This undoubtedly encourages the firm to achieve closer environmental interactions by establishing relationship commitment based on emotional connection (Yeung et al., 2009). Transaction cost theory also suggests that increasing trust of the focal firm in its suppliers may reduce the costs of bargaining and monitoring (Liu et al., 2009; Wang et al., 2011). The reduction of costs promotes the firm to maintain mutual partnerships to improve the success in GSI (Ireland and Webb, 2007). In addition, the gradual decrease of the firm's trust in its suppliers may bring more relationship risks (Currall and Inkpen, 2002). In this case, it is difficult for the firm to fundamentally reduce the adverse impact of practical activities on the

environment by establishing similar values (Kannan et al., 2014). Based on the above arguments, we bring forward:

H6: Supplier trust positively moderates the effects of (a) normative commitment and (b) instrumental commitment on GSI.

Supplier dependence also affects the connections between relationship commitment and GSI. When the focal firm has difficulty in replacing or finding better major suppliers, dependence on suppliers will be formed and the focal firm will establish closer collaborative relations with suppliers during the transaction (Fawcett et al., 2015; Kembro and Selviaridis, 2015). Once the major suppliers suspend trading with the firm, it will be difficult for the firm to achieve planning objectives (Bode et al., 2011; Kembro and Selviaridis, 2015). Thus, the firm needs to rely on these major suppliers to maintain relations and carry out green practices activities.

In the view of resource dependence theory, the focal firm that is highly dependent on major suppliers may increase its fear of opportunistic behaviors (Laaksonen et al., 2008). This reduces the firm's desire to promote environmental interaction and green practices by maintaining a long-term and stable relationship commitment (Tashman and Rivera, 2016; Wry et al., 2013). Conversely, the lower the supplier dependence, the more sensitive the firm is to the relationship perception of its major suppliers. Such a situation prompts the firm to achieve GSI by clarifying the responsibility of environmental cooperation (Li and Huang, 2017). Thus, dependence on major suppliers may reduce the connection between relationship commitment and GSI. Accordingly, we bring forward:

H7: Supplier dependence negatively moderates the effects of (a) normative commitment and (b) instrumental commitment on GSI.

2.3 Research Methods

2.3.1 Sample and data collection

We obtained data from five Chinese provinces including Shaanxi, Henan, Shandong, Jiangsu and Guangdong. They reflect diversities of economic development, environmental conditions and geographic location. Guangdong and Jiangsu represent the highest level of comprehensive economic competitiveness and ecological environment, located in the Pearl River Delta and the Yangtze River Delta, respectively. Shandong is an eastern coastal region with middle level of economic development and environmental quality. Henan and Shaanxi have relatively low levels of economic development and environmental quality, located in central and northwest China, respectively.

We obtained a list of more than 12,000 manufacturing firms from these five provinces to provide regional and market diversity. To guarantee the representativeness of the sample, 120 firms in each province were randomly selected to take part in the survey according to the suggestions from the administrative division of the economic development zone or universities. We received permissions through e-mails or phone calls and 284 firms were willing to take part in the survey. We sampled firms with a variety of industries, number of employees and different ownership structures to avoid bias. The detailed descriptions are reported in Table 2.2.

We initially contacted the sampled firms by phone to determine key informants. From these connections, we obtained the contact information of these informants, including senior managers, CEOs, presidents and vice presidents. Then, the respondents received a questionnaire, with an attached cover letter explaining our research purpose and guaranteeing the confidentiality of their answers (Feng et al., 2018b). To encourage response rates, we reminded them one week later and promised to provide them with our report if they returned the overall questionnaires. Non-manufacturing firms were excluded and

questionnaires with more than 5% of the survey data missing were deleted. A total of 206 firms replied with valid questionnaires, for a response rate of 34.3%.

To evaluate the potential non-response bias, we performed multiple *t*-tests (Feng et al., 2019). We compared the characteristics of the responding and non-responding firms in line with industry type, number of employees and ownership structure, etc. and found no differences in these characteristics. We also examined the differences between early and late responses (Armstrong and Overton, 1977) about power, relationship commitment, GSI, supplier trust and dependence. Results pointed no significant differences between the two groups (at $p > 0.05$). Therefore, non-response bias does not exist.

Due to the data collected from single informant in each sampled firm, this may result in common method variance (CMV). CMV was detected using several methods (Podsakoff et al., 2003). First, we tried to use accurate and understandable words to represent the measurement items in the questionnaire. Second, we checked for CMV using Harman's one-factor model of variables. The findings revealed seven factors with eigenvalues exceeding 1.0 and the first factor accounted for only 30.9% of the variance. Finally, confirmatory factor analysis (CFA) was also applied to examine the Haman's one-factor model of variables, which yielded $\chi^2(465) = 4510.44$ (contrasted with the seven-factor model of $\chi^2(443) = 872.79$). Based on the above tests, CMV is not a matter of concern in this research.

Table 2.2: Sample characteristics

Characteristics of firms	Frequency	Percentage
Number of employees		
1-49	21	10.2
50-99	9	4.4
100-299	34	16.5
300-999	34	16.5
1,000-1,999	27	13.1
2,000-4,999	37	18.0
Over 5,000	44	21.3
Type of ownership		
Private firms	76	36.9
Foreign-invested firms	47	22.8
State-owned and collective firms	83	40.3
Industry		
Textile	6	2.9
Machinery	18	8.7
Metal products	14	6.8
Food and beverage	8	3.9
Rubber and plastics	14	6.8
Transport equipment	22	10.7
Pharmaceutical and medical	10	4.9
Chemical and related products	11	5.3
Non-metallic mineral products	13	6.3
Instruments and related products	8	3.9
Electrical machinery and equipment	30	14.6
Communication and computers related equipment	45	21.8
Others	7	3.4

2.3.2 Questionnaire design and measures

We developed the questionnaire to make it suitable for collecting data in the Chinese context. The questionnaire was initially completed in English and

afterward translated into Chinese by two scholars. To eliminate cultural and language bias, two other researchers re-translated it into English. After that, we carefully compared two English questionnaires and conducted a pilot test in ten randomly selected firms. The questionnaire was modified again according to the feedback of the interviewees on the scale items. Thus, the final questionnaire was formed.

The structural scales were developed from a study of the previous literature and consideration of the actual connections among firms, their supply chains and the environment in China and the measurement items are all reflective (Kaynak et al., 2015). Power on supplier was assessed using nine items from Wang et al. (2015a). Coercive power was measured using five items on the supplier's performance and overcome difficulties of request in its related firm. Non-coercive power manifests that firms provide suppliers the appropriate supports and suggestions, which evaluated with four items. Based on the research from Zhao et al. (2008), we assessed normative commitment on a five-item scale representing the supplier as a team partner in which the goal was convergence of the green values of both parties and instrumental commitment was employed using a three-item scale mirroring the effects of rewards and bargaining. The six-item scale measuring GSI was based on the work of Vachon and Klassen (2008) and Wu (2013).

To measure supplier trust, adapting a five-item scale covering sincerity, supportiveness and mutual confidence between firms and suppliers (Liu et al., 2009). Supplier dependence was evaluated via four items adapted from Bode et al. (2011), focusing primarily on the difficulties involved in replacing suppliers and the complete dependence of a firm on their suppliers.

To guarantee the strength of the results, this study also covered some control variables. We used the natural logarithm of the number of employees to measure the firm size and the firm age was assessed by the logarithm of establishment year. The command and measure of industry type was expressed

by dummy variables that is heavy-polluting industry = “1” and others = “0”. The logarithm of the years of the partnership was used to assess the longevity of relationship (Handley and Benton, 2012b). We used the seven-point Likert to evaluate all items. For power, relationship commitment, supplier trust and dependence, “1” = extremely disagree and “7” = extremely agree, while for GSI, “1” = not at all participate and “7” = great extent participate. Table 2.3 lists the items in the investigation of the research.

2.3.3 Reliability and validity

Content validity was assessed according to literature review and previous methods, and the items were improved jointly by professors and practitioners. Therefore, content validity is guaranteed.

Exploratory factor analysis was implemented to determine the unidimensionality of the structure scale and to make sure the factor loading with the eigenvalues above 1.0 (Hair et al., 2010). In the research, seven factors were found with the eigenvalues above 1.0, representing 79.8% of the total variance. Then each scale item has greater factor loading on its respective construct. Thus, the unidimensionality of the structure is ensured. Moreover, Cronbach’s alpha values were all greater than the recognized value of 0.7 (Table 2.3), indicating sufficient reliability. We also calculated the composite reliability (CR) to ensure the reliability of the estimation. All CR results were greater than 0.7. Therefore, the scales are reliable in our survey (Fornell and Larcker, 1981).

The convergent validity was guaranteed by CFA and the average variance extracted (AVE). The CFA model fit indices were $\chi^2(443) = 872.79$ ($\chi^2/df = 1.97$), NNFI = 0.93, CFI = 0.93, SRMR = 0.06 and RMSEA = 0.07. Additionally, the findings in Table 2.3 present that the minimum loading was 0.65 and *t*-values were beyond 2.0. Then the AVE values of all constructs were greater than 0.5 (Table 2.3). Therefore, the convergent validity of this study is acceptable (Huo et al., 2016a).

The discriminant validity was verified by comparing the square root of AVE and correlations between this structure and other structures. In Table 2.4, the square root of the AVE on each diagonal is greater than all respective correlation coefficients, showing receivable discriminant validity (Fornell and Larcker, 1981).

Table 2.3: Results of validity and reliability analysis

Construct	Item	Factor loading	Cronbach's alpha	CR	AVE
Coercive power	CP1: This supplier must comply even if our requirements are beyond the contract	0.81	0.924	0.925	0.713
	CP2: This supplier cannot gain special treatment if it does not meet our requests	0.94			
	CP3: We usually suggest that we will take action to reduce this supplier's profit if it does not meet our requests	0.74			
	CP4: We will not give this supplier necessary service if it does not meet our requests	0.92			
	CP5: This supplier avoids many difficulties as it meets our request	0.80			
Non-coercive power	NP1: We convinced this supplier that it makes sense to follow our suggestions	0.77	0.835	0.838	0.566
	NP2: Our business expertise enabled us to give this supplier proper suggestions	0.86			
	NP3: We usually give good advice to this supplier	0.71			
	NP4: This supplier did what we anticipated because we had largely congruent business philosophies	0.65			

Normative commitment	NC1: We feel that this supplier views us as being an important team member rather than being just a customer	0.79			
	NC2: We are proud to tell others that we are a customer for this supplier	0.83			
	NC3: Our attachment to this supplier is primarily based on the similarity of our values and those of this supplier	0.90	0.925	0.926	0.716
	NC4: During the past year, our firm's values and those of the major supplier have become more similar	0.88			
	NC5: What this supplier stands for is important to our firm	0.82			
Instrumental commitment	IC1: Unless we are rewarded for it in some way, we see no reason to expend extra effort on behalf of this supplier	0.67			
	IC2: How hard we work for this supplier is directly linked to how much we are rewarded	0.70	0.784	0.785	0.552
	IC3: Bargaining is necessary to obtain favorable terms in dealing with this supplier	0.85			
	GSI1: Achieving environmental goals collectively	0.90			
Green supplier integration	GSI2: Developing a mutual understanding of responsibilities regarding environmental performance	0.89			
	GSI3: Working together to reduce environmental impact of our activities	0.82	0.961	0.961	0.805
	GSI4: Conducting joint planning to anticipate and resolve environmental-related problems	0.94			
	GSI5: Making joint decisions about	0.92			

	ways to reduce the environmental impact of our products/services				
	GSI6: Accumulating and sharing environmental knowledge	0.90			
	ST1: We believe in this supplier because it is sincere	0.86			
	ST2: Though the circumstances change, we believe that this supplier will be ready and willing to offer us assistance and support	0.93			
Supplier trust	ST3: When making important decisions, this supplier is concerned about our welfare or interests	0.92	0.938	0.939	0.755
	ST4: We can count that this supplier's future decisions and actions will not adversely affect us	0.87			
	ST5: When it comes to things that are important to us, we can depend on this supplier's support	0.75			
	SD1: If our relationship with the major supplier is discontinued, we would have had difficulty achieving our goals	0.87			
Supplier dependence	SD2: It would have been difficult for us to replace the major supplier	0.92	0.959	0.960	0.858
	SD3: We were quite dependent on the major supplier	0.96			
	SD4: We did not have a good alternative to the major supplier	0.95			

Table 2.4: Mean, standard deviations, and correlations

Constructs	Mean	SD.	1	2	3	4	5	6	7	8	9	10	11
1. Firm size	6.704	1.723	-										
2. Firm age	2.604	0.770	0.435**	-									
3. Longevity of relationship	1.715	0.600	0.261**	0.393**	-								
4. Industry type	0.369	0.484	-0.081	-0.110	0.033	-							
5. Coercive power	3.199	1.391	0.126	0.073	-0.001	-0.066	0.844						
6. Non-coercive power	4.680	1.021	-0.028	-0.021	0.036	0.013	0.203**	0.752					
7. Normative commitment	4.794	0.997	-0.106	-0.077	0.028	-0.044	-0.156*	0.231**	0.846				
8. Instrumental commitment	4.532	1.037	0.115	-0.005	0.063	0.077	0.059	0.188**	0.310**	0.743			
9. Green supplier integration	4.869	1.180	-0.101	-0.024	0.076	0.087	0.049	0.268**	0.496**	0.427**	0.897		
10. Supplier trust	5.311	1.096	-0.060	0.024	-0.016	-0.087	-0.266**	0.151*	0.351**	0.230**	0.313**	0.869	
11. Supplier dependence	4.967	1.410	-0.174*	-0.185**	-0.158*	0.050	-0.338**	0.101	0.379*	0.273*	0.326**	0.429**	0.926

Note: * $\alpha = 0.05$; ** $\alpha = 0.01$; *** $\alpha = 0.001$; Square root of AVE value is on the diagonal.

2.4 Results

Since this study examined both direct and moderating effects, we used hierarchical regression analysis for hypotheses testing (Aiken and West, 1991; Cohen and Cohen, 1983), which is widely used in the supply chain management studies (Danese and Romano, 2011; Feng et al., 2016a; Hoejmose et al., 2012). Results are expressed in Table 2.5.

As we see in Table 2.5, coercive power is negatively connected with normative commitment ($\beta = -0.203, p < 0.01$), whereas is insignificantly connected with instrumental commitment ($\beta = 0.014, p > 0.1$). Hence, H1a is supported, but H1b is not supported. Findings suggest that non-coercive power is statistically positive associated with normative commitment ($\beta = 0.268, p < 0.001$), as well as with instrumental commitment ($\beta = 0.185, p < 0.01$), supporting H2a and H2b. In addition, normative commitment ($\beta = 0.391, p < 0.001$), and instrumental commitment ($\beta = 0.311, p < 0.001$) enhance GSI. Therefore, H3a and H3b are supported.

The moderating roles of supplier trust and dependence on the relationship commitment-GSI link are also displayed in Table 2.5. In Model 8, the interaction of normative commitment and supplier trust is not significant ($\beta = 0.071, p > 0.1$), however, remarkable negative interaction effect is found in instrumental commitment and supplier trust ($\beta = -0.224, p < 0.01$). Hence, H6a and H6b are not supported. Furthermore, the interaction of normative commitment and supplier dependence is not statistically significant ($\beta = 0.031, p > 0.1$), whereas the interaction of instrumental commitment and supplier dependence is negative ($\beta = -0.186, p < 0.01$). As such, our results provide support for H7b, but do not support H7a.

Table 2.5: Results of regression analysis

Variable	Normative commitment		Instrumental commitment		Green supplier integration					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Control variables										
Firm size	-0.102	-0.070	0.142 ⁺	0.145 ⁺	-0.120	-0.124 ⁺	-0.115 ⁺	-0.124 ⁺	-0.114 ⁺	-0.118 ⁺
Firm age	-0.074	-0.059	-0.079	-0.074	-0.005	0.048	0.037	0.047	0.055	0.070
Longevity of relationship	0.086	0.062	0.055	0.046	0.107	0.056	0.062	0.070	0.070	0.092
Industry type	-0.063	-0.075	0.078	0.077	0.073	0.073	0.083	0.069	0.069	0.067
Independent variable										
Coercive power (CP)		-0.203 ^{**}		0.014						
Non-coercive power (NP)		0.268 ^{***}		0.185 ^{**}						
Mediators										
Normative commitment (NC)						0.391 ^{***}	0.355 ^{***}	0.343 ^{***}	0.358 ^{***}	0.367 ^{***}
Instrumental commitment (IC)						0.311 ^{***}	0.292 ^{***}	0.303 ^{***}	0.290 ^{***}	0.284 ^{***}
Moderator										
Supplier trust (ST)							0.121 ⁺	0.073		
Supplier dependence (SD)								0.109 ⁺		0.085

Variable	Normative commitment		Instrumental commitment		Green supplier integration					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Interaction terms										
NC × ST							0.071			
NC × SD										0.031
IC × ST							-0.224**			
IC × SD										-0.186**
R ²	0.022	0.111	0.026	0.061	0.027	0.349	0.361	0.397	0.358	0.388
R ² change		0.089		0.035		0.322	0.012	0.036	0.009	0.030
F(d, f) change		9.956***		3.732*		49.176***	3.859 ⁺	5.771**	2.852 ⁺	4.810**

Note: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

To further verify the moderating effect, Figures 2.2 and 2.3 are plotted according to the recommendation of Aiken and West (1991). When the degree of supplier trust is low, the connection between instrumental commitment and GSI is stronger (Figure 2.2). These results provide a further evidence for not supporting H6b. Therefore, a high level of supplier trust reduces the impact of instrumental commitment on GSI. Similarly, a low degree of supplier dependence increases the impact of instrumental commitment on GSI, whereas a high degree decreases the impact (Figure 2.3). Thus, the findings support H7b. The connection between instrumental commitment and GSI will become weaker as supplier dependence increases.

Figure 2.2: Simple slopes for the interaction effect of instrumental commitment and supplier trust on green supplier integration

Figure 2.3: Simple slopes for the interaction effect of instrumental commitment and supplier dependence on green supplier integration

In addition, we also examined the effects of mediators using the Bootstrapping method (Preacher and Hayes, 2004). The direct impact of coercive power on GSI does not include zero for normative commitment, which is significant in the 95% confidence interval (Table 2.6). However, zero is included with instrumental commitment, which is not significant. Meanwhile, the indirect effect of normative commitment is significant (excluding zero), whereas instrumental commitment is not (including zero). Results manifest that normative commitment has a mediating effect on the coercive power-GSI link, but the mediating role of instrumental commitment is negligible. In addition, in the 95% confidence interval, the direct impact of non-coercive power on GSI is significant (excluding zero), and the indirect effects of normative and instrumental commitments are also significant (excluding zero). Thus, normative commitment and instrumental commitment play mediating roles in the connection between non-coercive power and GSI. Our study results support H4a, H4b and H5b, but do not support H5a.

Table 2.6: Bootstrapped mediation results

Model	Total effect		Direct effect		Indirect effect		
	Coefficient	<i>t</i> value	Coefficient	<i>t</i> value	Point estimate	Lower	Upper
CP→NC→GSI	0.060	1.010	0.124*	2.380	-0.063	-0.130	-0.001
CP→IC→GSI	0.060	1.010	0.041	0.753	0.020	-0.038	0.080
NP→NC→GSI	0.302***	3.871	0.182*	2.566	0.119	0.035	0.226
NP→IC→GSI	0.302***	3.871	0.214**	2.952	0.088	0.024	0.173

Note: 5000 Bootstrap samples; CP: Coercive power; NP: Non-coercive power; NC: Normative commitment; IC: Instrumental commitment; GSI: Green supplier integration; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

2.5 Discussions

Our research explores the connections among power (coercive and non-coercive powers), relationship commitment (normative and instrumental commitments) and GSI, as well as the moderating effects of relationship closeness (supplier trust and dependence) on the relationship commitment-GSI link.

2.5.1 The direct effects

Our findings reveal that coercive power is significantly negatively correlated with normative commitment, whereas it has an insignificant correlation with instrumental commitment. This is partially supported by Hopkinson and Blois (2014) and Zhao et al. (2008). Coercive power is suggested to be negatively linked with normative commitment as it represents negative feedback to suppliers from both emotional and value-oriented aspects (Chae et al., 2017). Such feedback hinders the formation of common values and further undermines the firm's intrinsic commitment to maintain cooperative relationships. The reasons why the impact of coercive power on instrumental commitment is insignificant may be as follows. The firm usually measures the value of the returns it receives from exercising coercive power and the costs of maintaining the partnership. If the costs are greater than the return values, the firm will

consider such relationship commitment a bad investment (Huo et al., 2017). Moreover, as the enforcement of coercive power displays a coercive attitude, the firm with such a strong attitude may be refused to implement its specific behaviors (Reuter et al., 2010), thus preventing the realization of interest-based instrumental commitment. Thus, instrumental commitment does not work under these conditions where specific behaviors and net returns cannot be achieved.

As predicted, non-coercive power has positively correlated with both normative and instrumental commitments. This is consistent with the findings of Hausman and Johnston (2010). The adoption of non-coercive power is the core factor for the firm to establish and maintain an active cooperation (Huo et al., 2019a). It not only enhances the degree of attachment relationships and the similarity of values but also greatly increases the interests gained from green practice relationships.

In conclusion, the results of this study illustrate that the two types of power have opposite impacts on relationship commitment, that is, coercive power reduces normative commitment, while non-coercive power improves normative and instrumental commitments. This seems to indicate that only the firm using non-coercive power can be more committed to the relationship with suppliers to achieve GSI. However, the results of bootstrapping (Table 2.6) indicate that coercive power also plays a direct role in promoting GSI. Furthermore, the focal firm and its suppliers may act out different levels of relationship commitment because of the distinct backgrounds and goals. While the focal firm using coercive power reduces its normative commitment, previous studies have indicated that coercive power promotes relationship commitment of the supplier side, such as instrumental commitment (Huo et al., 2017; Zhao et al., 2008), and subsequently enhances GSI. As a result, the role of coercive power cannot be ignored and the utilization of two types of power needs to be balanced.

This study also demonstrates that both normative and instrumental commitments are positively linked with GSI, which is supported by the view of Zhao et al. (2011). This indicates that a high level of special investment in commercial cooperation plays an important role in the effective implementation of GSI (Yeung et al., 2009), and therefore partners are more committed to establishing and maintaining relationship commitment before undertaking environmental integration activities. With the increase of normative or instrumental commitment, the firm is willing to form common environmental beliefs with its suppliers and conduct environmental cooperative actions (Krause et al., 2007; Zhao et al., 2011), which further facilitates GSI.

2.5.2 The mediating effects

This study concludes that all the hypothesized mediating effects are significant, except for the mediating effect of instrumental commitment in the link between coercive power and GSI. These findings are partially in line with those of Zhao et al. (2008). First, we explore the mediating effects of relationship commitment in the relationships between two types of power and GSI, which extends the scope of research on power in Zhao et al. (2008). Second, we conclude that instrumental commitment does not have a mediating effect on the coercive power-GSI relationship. It is probably because coercive power is intended to promote the firm to benefit from specific behaviors (Molm, 1997). However, such intention based on calculated benefits has no impact on the stable environmental cooperation between the firm and its suppliers (Brown et al., 1995; Huo et al., 2015). As a result, coercive power may not facilitate green practices through instrumental commitment. Instrumental commitment based on interests cannot be fulfilled, let alone GSI.

2.5.3 The moderating effects

Interestingly, our results indicate that supplier trust and dependence negatively moderate the positive impact of instrumental commitment on GSI, but have no

significant moderating effects on the positive link between normative commitment and GSI.

For supplier trust, these findings are inconsistent with our hypotheses, which may provide some novel insights for understanding the boundary conditions of the relationship commitment-GSI link. The insignificant moderating effect of supplier trust on the normative commitment-GSI link suggests that the role of normative commitment in enhancing GSI is not affected whether the level of supplier trust is high or low. Furthermore, we provide several possible reasons to explain why supplier trust negatively moderates the positive link between instrumental commitment and GSI. First, the firm increases trust in suppliers may hide certain risks and reduce the ability of the firm to perceive risks, which prompts suppliers to engage in opportunistic behaviors (Chong et al., 2013; Kumar et al., 2018; Villena et al., 2011). Such uncertain behaviors may put the firm in dangerous situations, increasing the transaction costs of maintaining the environmental cooperation relationship. Second, the firm that has higher trust in its suppliers may result in fewer formal contracts (Zaefarian et al., 2016). This situation provides suppliers with the space and opportunity of encouraging them to engage in speculations (Jiang et al., 2012; Li et al., 2007), which reduces the enthusiasm of the firm to implement GSI.

The results of the role of supplier dependence on negative moderation are consistent with Zaefarian et al. (2016). The higher level of supplier dependence may lead to speculation by suppliers to obtain more profits (Laaksonen et al., 2008). Such behaviors weaken the implementation of GSI for those firms that are concerned about the relationship of interests. Moreover, the firm's dependence on major suppliers may be abused by these suppliers, which undoubtedly increases the potential costs of the firm to achieve GSI (Zaefarian et al., 2016). Hence, supplier dependence weakens the positive instrumental commitment-GSI link. The difference in our study indicates that supplier dependence has no significant impact on the link between normative

commitment and GSI. This may be because suppliers provide green raw materials and the focal firm provides necessary information and channels to promote environmental practices through interactive partnerships (Woo et al., 2016). Such interaction process displays an interdependent state.

2.5.4 Robustness analysis

In this study, we further tested the results using the partial least squares method of structural equation modeling (SEM), as displayed in the Appendix 2.A. By comparing the results in Appendix 2.A and Table 2.5, we can see that the results of hypotheses testing are consistent just except for H7b (supplier dependence negatively moderates the effect of instrumental commitment on GSI), which indicates that the results of this study are robust.

2.5.5 Theoretical contributions

This study has three theoretical contributions. First, our research expands the theoretical framework of antecedents of GSI from the perspective of balancing coercive and non-coercive powers. By distinguishing the different moderating effects of supplier trust and dependence, this study demonstrates that these two different types of power can enhance GSI through different channels. Therefore, balancing coercive and non-coercive powers affects the execution of specific behaviors, thereby promoting green practice cooperation between the focal firm and its suppliers, which contributes to the theoretical literature of GSI.

Second, the study opens the ‘black box’ in the power-GSI link by revealing the mediating role of relationship commitment. Due to previous studies focusing on the direct impact of power on the environmental partnership between firms, the understanding of how power affects GSI is unclear. Relationship commitment, as the basis for establishing cooperative relationships, not only provides a practical platform for power to implement environmental behaviors but also helps to establish environmental goals and solve environmental problems (Liu et al., 2017). Taken together, based on transaction cost and

resource dependence theories, our research provides new ideas and directions for power to promote green practices between the focal firm and its suppliers by examining the mediating effect of relationship commitment.

Finally, this study enriches our understanding of GSI by investigating the boundary conditions on the relationship commitment-GSI link. Different from previous studies in the GSI literature stream, this study explores the moderating effects of supplier trust and dependence on the link between different types of relationship commitment and GSI. When the focal firm has a high level of trust in or dependence on its suppliers, the underlying risks and opportunistic behaviors can undermine the impact of relationship commitment between the firm and its suppliers on GSI. Therefore, our research explores the conditions under which relationship commitment affects GSI.

2.5.6 Managerial implications

The research provides some managerial implications for executives. First, this study illustrates that coercive and non-coercive powers have opposite effects on relationship commitment, whereas both have positive impacts on GSI. Although coercive power reduces relationship commitment, in some cases it may have a positive influence on product quality, social responsibility, etc. (Chae et al., 2017; Harness et al., 2018; Theyel and Hofmann, 2012). Executives should be aware that coercive power is equivalent to a ‘stick’ as a tool to guide suppliers in desired direction, whereas non-coercive power is the ‘carrot’ as a way to engender cooperation with suppliers. Based on our results, firm executives should balance coercive and non-coercive powers to influence GSI.

Second, this study indicates that although normative and instrumental commitments have different purposes, both of them enhance GSI. Therefore, firm executives should recognize the importance of relationship commitment and the need to improve environmental programs by establishing and maintaining both types of relationship commitment. This is because such a

partnership with suppliers has good opportunities to be subsequently used, thereby achieving green practices and environmental benefits.

Finally, this study clarifies that environmental effectiveness of instrumental commitment is actually depending on the degree of relationship closeness between the focal firm and its suppliers. To achieve environmental goals through building partnerships, the firm should adopt the appropriate degree of supplier trust and dependence to avoid adverse effects (Chong et al., 2013). Although firm executives acknowledge that relationship commitment enhances GSI, it is worth noting that the instrumental commitment-GSI link maintains stable when the levels of supplier trust and dependence are at a modest level.

2.6 Conclusion

This paper arrives at some conclusions as follows. First, this study suggests that coercive power weakens normative commitment, whereas non-coercive power improves both normative and instrumental commitments. Second, both normative and instrumental commitments enhance GSI. Third, normative commitment mediates the influences between two types of power and GSI, while instrumental commitment only mediates the influence between non-coercive power and GSI. Finally, supplier trust and dependence negatively moderate the connection between instrumental commitment and GSI, without significant effect on the connection between normative commitment and GSI.

Although this research makes several contributions, it has some limitations that should be further solved. First, as the samples are from Chinese manufacturing firms, the generalizability of the results is limited to a single country and a special cultural context. Future research should further explore adaptability and examine differences in cross-cultural outcomes among power, relationship commitment, supplier trust and dependence and GSI. Second, considering the convenience and validity of data collected, we design ‘relationship commitment’ from the view of the focal firm rather than from the supplier. In future research, the effect of suppliers’ relationship commitment should be

emphasized and it can be compared with the effect of the focal firm's relationship commitment to complete the research framework. Third, the study verifies the moderating roles of supplier trust and dependence. Future research may discuss other moderating factors, such as environmental uncertainty, reputation and satisfaction. It will complete our comprehension of effect mechanisms between relationship commitment and GSI. Fourth, this study only explores the factors that affect GSI, while green internal integration and green customer integration are also important components of green supply chain integration. Hence, the antecedents of green internal integration and green customer integration should be explored in future research.

3. The impact of green supplier integration on firm performance: The mediating role of social capital accumulation²

Abstract

Although green supplier integration has received widespread attention, how it impacts various types of firm performance remains unclear. Based on social capital theory, this study explores the influence of green supplier integration on three dimensions of social capital accumulation, which further affect economic and environmental performances. To verify the hypotheses, we collect two-wave survey data from 206 Chinese manufacturers. Results show that green supplier integration significantly affects social capital accumulation. Relational and structural capital accumulations have positive effects on both economic and environmental performances, while cognitive capital accumulation only has a positive impact on environmental performance. Additionally, relational and structural capital accumulations partially mediate the effects of green supplier integration on economic and environmental performances, whereas cognitive capital accumulation only partially mediates the impact of green supplier integration on environmental performance. This research deepens the understanding of how green supplier integration influences firm performance via social capital accumulation, and provides a theoretical basis for firms attempting to enhance their performance.

Keywords: Green supplier integration, Social capital accumulation, Firm performance, Mediating effect

The chapter is based on a journal article:

Zhang, Q., Pan, J., Jiang, Y. and Feng, T. (2020a). The impact of green supplier integration on firm performance: The mediating role of social capital accumulation. *Journal of Purchasing and Supply Management*. 26(2), 100579.

3.1 Introduction

With the increasingly serious environmental problems, such as pollution and resource depletion, firms need to transform their traditional business model to a sustainable one (Feng and Wang, 2016; Taoketao et al., 2018). However, few firms can deal with environmental issues using their own resources (Lai et al., 2013). Most firms need to collaborate with their suppliers to achieve sustainable competitiveness while reducing environmental hazards (Feng et al., 2016a, b; Kühne et al., 2013; Wu, 2013). For example, Samsung and Huawei encourage their suppliers to adopt green management practices to minimize the emission of hazardous substances (Yu and Huo, 2019). Consequently, it is necessary to explore why and how green supplier integration (GSI) impacts different types of firm performance (Pang et al., 2017).

GSI is an environmental strategy that aims to achieve green development and environmental goals, which requires addressing environmental issues by integrating the special resources of firms and suppliers (Du et al., 2018). Although the goals and benefits of GSI have been mentioned in previous studies, how it affects both economic and environmental performances remains unclear (Woo et al., 2016). Moreover, existing literature has provided mixed results on GSI's impact on firm performance. A few studies have shown that GSI is positively linked with firm performance (e.g., Du et al., 2018), while others have pointed out that the link is insignificant (e.g., Flynn et al., 2010). Some scholars, recently, suggested that GSI may impact firm performance indirectly through certain mediating factors (e.g., Yu et al., 2019; Villena et al., 2011).

Considering the inconsistent results on the link between GSI and firm performance, our study focuses on the mechanism through which GSI affects firm performance. As suggested by social capital theory, GSI is an environmental-based interaction between firms and suppliers, which can reduce the uncertainty of information exchange, strengthen the cooperation of both

parties, and improve the capability for knowledge and resource sharing (Philipp et al., 2014; Nyaga et al., 2010). For example, Toyota advocates compatibility with suppliers regarding environmental concepts to achieve common goals, and obtains special social capital through the development and establishment of social relations, which further enhances performance (Villena et al., 2011). As firms attach more importance to the crucial role of social relations in operations, we need to explore how GSI can promote economic and environmental performances from the view of social capital.

This research proposes that GSI affects three dimensions of social capital accumulation, that is, relational capital accumulation (e.g., respect, dependence and trust), structural capital accumulation (e.g., connection mode and path), and cognitive capital accumulation (e.g., common values, ideas and goals), which then influence both economic and environmental performances out of two reasons. First, suppliers and firms can strengthen their collaboration by integrating various green practices, thus improving their social relations (Philipp et al., 2014). With frequent interactions, mutual trust and interdependence increase, and social networks are gradually formed, which promotes both parties to obtain more valuable resources (Geng et al., 2017; Krause et al., 2007). The continuous accumulation of resources indicates that GSI contributes to social capital accumulation (Lawson et al., 2008; Villena et al., 2011; Woo et al., 2016). Second, social capital accumulation is a kind of resource formed through social relations (Nahapiet and Ghoshal, 1998), and can be a long-term resource for firms and suppliers to gain competitive advantage and achieve environmental collaboration. Moreover, firms should encourage participants to strengthen relational networks through communication to promote the convergence of ideas and improve firm performance (e.g., Cousins, et al., 2006; Huang et al., 2018; Kim and Rhee, 2012; Lawson et al., 2008; Shen et al., 2013). Thus, GSI can affect firm performance via social capital accumulation.

This research principally explores three questions. First, what is the impact of GSI on the three dimensions of social capital accumulation? Second, what are the impacts of these different dimensions of social capital accumulation on firms' economic and environmental performances? Third, does social capital accumulation mediate the link between GSI and firm performance?

The paper is organized as follows. Section 3.2 suggests a theoretical foundation with a review of previous literature and develops the research hypotheses. Research methods are depicted in Section 3.3. Section 3.4 indicates hypotheses testing and results, and Section 3.5 includes theoretical contributions and managerial implications. Finally, Section 3.6 illustrates conclusions, limitations, and future research directions.

3.2 Theoretical Foundation and Research Hypotheses

In view of social capital theory, we explore the impacts of GSI on economic and environmental performances, and the mediating role of social capital accumulation. The conceptual model is presented in Figure 3.1.

Figure 3.1: Conceptual model

3.2.1 Green supplier integration (GSI)

GSI implies the extent to which the focal firm integrates suppliers into its environmental planning programs to make decisions and solve environmental issues jointly (Rao, 2002; Yang et al., 2013). Since environmental pollution and resource shortages seriously threaten the sustainable development of firms, implementing GSI is imperative. The strategy advocates to set environmental goals with suppliers by sharing knowledge, information, and understanding of the operation modes of both parties (Andersen and Gadde, 2019; Green et al., 2012; Zhu et al., 2013), which can help to better define the environmental responsibilities and obligations of each party. Accompanying with the integration, firms and suppliers would also work together to implement various practices, such as quality management (Huo et al., 2014) to reduce the adverse impact of goods or services on the environment.

Researchers have conducted extensive studies on the factors influencing GSI from three aspects of capital investment, relationship governance, and process coordination. From the view of capital investment, special asset investment, social capital, and commitment have actual or potential impacts on GSI (Lager and Frishammar, 2010; Lee, 2015a; Wang et al., 2018). In terms of relationship governance, firms restrict and control environmental collaboration activities with suppliers through contracts, risk sharing, and management models (Blome et al., 2013; Lo et al., 2018) to reduce environment hazards. In addition, firms and suppliers coordinate processes by implementing environmental strategies and structural integration (Hsu et al., 2013; Leonidou et al., 2017), so as to improve GSI.

Existing literature has discussed the link between GSI and firm performance (such as economic and environmental performances), but not reaching a consensus (e.g., Du et al., 2018; Flynn et al., 2010; Lee, 2015b). To clarify the inconsistent results, this research develops an in-depth analysis of the impact of GSI on firm performance. In essence, GSI is an environmental interaction

based on social capital (Philipp et al., 2014). The role of social capital investment in the green practice activities of firms and suppliers is significant and considerable (Villena et al., 2011). Hence, it is need to further explore the link between GSI and firm performance from the perspective of social capital theory.

3.2.2 Social capital theory

The initial research on social capital originated in communities and suggested that a strong network of neighborhood relationships would form the basis of trust, teamwork, and action (Peng et al., 2018). Subsequently, social capital was widely applied to investigate different social aspects, for instance, human capital development (e.g., Coleman, 1988; Huo et al., 2016a), green supply chain management (e.g., Lee and Kim, 2011; Wu et al., 2012), and firm performance (e.g., Gelderman et al., 2016; Krause et al., 2007).

Social capital theory demonstrates the relational networks between firms and participants and clarifies the importance of cooperative behavior (Carey et al., 2011; Son et al., 2016). Combined with this theoretical perspective, this study focuses on the joint environmental management and collaboration between the focal firm and its suppliers. The resource derived from relational networks in actual or potential forms is a kind of social capital (Granovetter, 1992). As a valuable relational resource, social capital exists among individuals or social groups (Coleman, 1990; Nahapiet and Ghoshal, 1998), affecting the development level of performance (Adler and Kwon, 2002; Matthews and Marzec, 2012). Previous research revealed that social capital, considered as a ‘relational binder’, is a special resource for transaction participants to implement effective green practices (McGrath and Sparks, 2005; Peng et al., 2018), particularly in a firm-supplier link. Such special resources facilitate communication and collaboration between firms and suppliers to achieve common environmental goals. Nahapiet and Ghoshal (1998) separated social capital into three-dimension: relational capital, structural capital, and cognitive

capital. In this study, we also separate social capital accumulation into three dimensions: relational capital accumulation, structural capital accumulation, and cognitive capital accumulation.

Relational capital accumulation represents the respect, dependence, and trust that individuals or organizations form through communication, indicating a special, long-term relationship (Granovetter, 1992; Son et al., 2016). This continuous relationship promotes reciprocity and the sharing of ideology between firms and suppliers (Koka and Prescott, 2002; Nahapiet and Ghoshal, 1998). Structural capital accumulation refers to the connection mode between participants (Yu et al., 2006) and is also an important path for information sharing, resource flow, and social network connections (Carey et al., 2011; McEvily et al., 2003). It represents the existence of multiple network connections between firms and suppliers, as well as the ways to contact and develop with each other (Lee, 2015a). Meanwhile, cognitive capital accumulation mainly emphasizes the common values, ideas, and visions between firms and suppliers (Tsai and Ghoshal, 1998), which facilitates to achieve common economic and environmental goals and generate consensus between the two parties (Son et al., 2016).

3.2.3 GSI and social capital accumulation

GSI is essentially an environmental interaction process that requires firms and suppliers to enhance a mutual understanding of environmental concepts and goals through frequent sharing of resources and knowledge. This mutual understanding can reduce conflicts and increase the strength of relational (Nyaga et al., 2010; Wu et al., 2012). On this basis, firms are more willing to let their suppliers directly participate in environmental planning and joint decision-making, so that the collaborative behavior of both parties becomes more transparent, thereby enhancing trust (Dyer and Singh, 1998). Moreover, firms and suppliers work together to develop environmental activities and measures, such as technical assistance, which is considered as a signal to

sustain long-term partnerships (Krause et al., 2007; Lee, 2015b). Numerous support and joint activities have increased the loyalty and interdependence of firms and suppliers (Ağan et al., 2016; Lee, 2015a), which facilitates the establishment of a family-like collaborative relation. Therefore, GSI enables the accumulation of relational capital. According to the views above, we bring forward the following hypothesis:

H1a: GSI is positively linked with relational capital accumulation.

The purpose of GSI is to enable firms and suppliers to jointly carry out green practices to address environmental issues (Rao, 2002; Wu, 2013). These practices may create an interactive network aimed at environmental improvement (Vachon and Klassen, 2008), so that firms can better realize the environmental capabilities of their suppliers and the willingness of both parties to solve environmental issues jointly. With frequent interactions, knowledge transfer and sharing are accelerated and mutual understanding between the two parties is enhanced (Lee, 2015b). Moreover, common environmental goals motivate firms and suppliers to solve problems by seeking new technical knowledge and skills (Lee, 2015a; Yu et al., 2006). That is, GSI is expected to facilitate the establishment of social networks and expedite information transfer, thereby enhancing structural capital accumulation (Villena et al., 2011). Hence, we present our hypothesis:

H1b: GSI is positively linked with structural capital accumulation.

GSI supports the joint development of environmental sustainability by firms and suppliers, which leads to similar management styles for both parties (Formentini and Taticchi, 2016). That is, the more they attach importance to joint environmental planning and decision-making, the more similar their management styles will be. Simultaneously, these firms and suppliers form consistent cultures and goals by communicating and sharing environmental knowledge (Yim and Leem, 2013), promoting the willingness of both parties to share business in collaborative relations to better understand common values

(Gelderman et al., 2016; Son et al., 2016). Moreover, firms and suppliers increasingly focus on environmental practices, such as environmental planning and management (Lee and Klassen, 2008; Wong et al., 2012), which facilitates the sharing of similar trade patterns. Therefore, GSI is expected to increase the extent of cognitive capital accumulation (Woo et al., 2016). We bring forward the following hypothesis:

H1c: GSI is positively linked with cognitive capital accumulation.

3.2.4 Social capital accumulation and firm performance

3.2.4.1 Relational capital accumulation

Relational capital accumulation depends highly on the length of cooperation between supply chain partners (Granovetter, 1992). The longer the cooperation, the higher the degree of interdependence and trust between firms and their suppliers will be (Ağan et al., 2016), which helps to engage in reciprocal behaviors (Aurier and N'Goala, 2010). Previous findings have revealed that relational capital accumulation significantly impacts economic performance (Carey et al., 2011; Moran, 2005; Yawar and Seuring, 2017).

Based on social capital theory, frequent reciprocal behaviors and a high level of trust encourage firms and suppliers to exchange more resources and knowledge, so as to establish stronger connections (Huang and Li, 2017; Yu et al., 2006). Strong connections generate positive externalities, including firms' pursuit of new economic goals (Lee and Kim, 2011), which are conducive to improving economic performance. The closer the link between firms and suppliers, the greater the likelihood of cooperation between the two parties will be. A long-term partnership motivates both parties to be in a trusting and co-dependent environment, decreases opportunism and increases economic performance by reducing monitor costs and transaction costs (Dyer and Singh, 1998; Lee and Kim, 2011; Lee, 2015b). Thus, relational capital accumulation is expected to promote long-term and stable cooperative relations, facilitate

mutual trust and interdependence, which provides opportunities for firms to improve economic performance (Schmidt et al., 2017). In view of this, we hypothesize as follows:

H2a: Relational capital accumulation is positively linked with economic performance.

Environmental performance can also be improved by relational capital accumulation. In view of social capital theory, long-term cooperation and reciprocal behavior between firms and suppliers set the foundation for dealing with environmental problems jointly (Chiou et al., 2011). In this context, firms and suppliers may obtain effective communication, diverse information, and trust (Chen et al., 2017) to help each other avoid environmental constraints and better address environmental challenges (Parmigiani et al., 2011; Yawar and Seuring, 2017). Moreover, relational capital accumulation can promote the establishment of a family-like relationship between firms and their green suppliers (Lee, 2015a). Such a relationship strengthens the credibility of both parties' commitment toward environmental protection, thereby encouraging the implementation of environmental protection measures (Parmigiani et al., 2011; Touboulie and Walker, 2015). Hence, we bring forward the following hypothesis:

H2b: Relational capital accumulation is positively linked with environmental performance.

3.2.4.2 Structural capital accumulation

Structural capital accumulation refers to the 'bonding' and 'bridging' aspects of a firm-supplier relationship (Burt, 1992), suggesting that firms regard their green suppliers as part of their social resources for promoting a strong social network (Yu et al., 2006). Drawing on social capital theory, structural capital accumulation is an important channel and opportunity for information transmission and resource sharing (Lawson et al., 2008), providing a guarantee

for firms to establish close social networks with green suppliers. Firms can use such networks to better set and achieve their economic goals (Lee and Kim, 2011) to improve economic performance. Moreover, the density and configuration of social networks also affect the assessment and development of green suppliers (Lee, 2015b). The weaker the social network is, the weaker the understanding of green suppliers and the direction of future development will be, which weakens the economic capability of firms. Firms should encourage interaction and sharing with their green suppliers, which has indicated that almost every firm can benefit from such connections (Lawson et al., 2008). Thus, structural capital accumulation manifested by the degree of connection between information sharing and social networks is statistically linked to economic performance. We present the following hypothesis:

H3a: Structural capital accumulation is positively linked with economic performance.

Firms and suppliers provide various channels through frequent communication and interaction patterns to help identify environmental opportunities and trends, and determine which products and production processes are beneficial for the environment (Huang and Li, 2017). A stronger interaction with green suppliers encourages firms to discover their own harmful behavior towards the environment, which accelerates the process of solving environmental issues (Dyer and Nobeoka, 2000). In addition, neither firms nor green suppliers have sufficient resources, technology, and structural knowledge (Tsai and Ghoshal, 1998). Thus, interactions such as technical communication and knowledge sharing have motivated both parties to seek solutions that reduce environmental impact and achieve environmental performance (Feng et al., 2016a, b; Lawson et al., 2008). For instance, even small technological adjustments and information exchanges between American automotive firms and their suppliers can improve environmental performance (Kotabe et al., 2003). Hence, we hypothesize as follows:

H3b: Structural capital accumulation is positively linked with environmental performance.

3.2.4.3 Cognitive capital accumulation

Cognitive capital accumulation is conducive to the improvement of firms' economic performance. In view of social capital theory, because of common norms and values between firms and suppliers, their understanding of interests and goals is more consistent (Inkpen and Tsang, 2005; Yim and Leem, 2013). In this case, the enthusiasm in joint efforts between firms and suppliers can be enhanced (Jap and Anderson, 2003), and conflicts and risks can be reduced (Villena et al., 2011), thereby improving the level of economic returns. Moreover, if firms and suppliers have similar management styles and cultural background (Formentini and Taticchi, 2016; Gelderman et al., 2016), this may motivate them to pursue collective profits, thereby inhibiting both parties from taking unfavorable behavior (Carey et al., 2011; Coleman, 1990). On the contrary, inconsistency in management styles is likely to generate misunderstanding (Krause et al., 2007), which may negatively impact economic development. Accordingly, we assume:

H4a: Cognitive capital accumulation is positively linked with economic performance.

Environmental sustainability can also be enhanced through cognitive capital accumulation. Based on social capital theory, cognitive capital accumulation refers to the subjective revelation of values and goals between different participants (such as firms and suppliers). If firms share adequate information and resources with suppliers, this may promote the formation of common beliefs and norms (Claro et al., 2006), which helps both parties to reach a consensus on improving the environment (Son et al., 2016). The deeper the understanding, the better response to environmental uncertainties will be, which further improve environmental performance. Moreover, firms can share their environmental beliefs, knowledge, and cultural orientation with suppliers,

helping them form common environmental concepts and goals, and work together to enhance environmental performance (Wu et al., 2012). Thus, we put forward the following hypothesis:

H4b: Cognitive capital accumulation is positively linked with environmental performance.

3.2.5 The mediating role of social capital accumulation

GSI is believed to influence firm performance by sharing information, improving design processes, and establishing common goals and norms, thus reducing environmental hazards and costs (Feng et al., 2016a, b; Cousins et al., 2006). Hence, this study hypothesizes that social capital accumulation has a mediating effect between GSI and firm performance.

Drawing on social capital theory, if firms are willing to involve their suppliers directly in environmental planning and decision-making, they may promote the establishment of long-term relationships based on trust and dependence (Ağan et al., 2016). In this relationship, resources can be leveraged to reduce the reciprocal cost of both parties (Carey et al., 2011), which also provides opportunities to improve environmental capabilities (Lee, 2015a). Furthermore, green practices between firms and suppliers can improve social interaction (Vachon and Klassen, 2008), and strengthen the information flow and structural networks to improve firm performance (Yim and Leem, 2013). Moreover, clarifying the environmental responsibilities and obligations of firms and suppliers may facilitate joint activities and promote the gradual convergence of cognitive concepts. On this basis, it can not only achieve common goals and values (Gelderman et al., 2016), but also ensure that firms implement the concept of green development (Zhao et al., 2018). Hence, GSI is recognized to continuously expand the social capital accumulated by both parties, thereby improving firm performance. Drawing on these views, we bring forward the following hypothesis:

H5: Relational capital accumulation plays a mediating role in the link between GSI and (a) economic and (b) environmental performances.

H6: Structural capital accumulation plays a mediating role in the link between GSI and (a) economic and (b) environmental performances.

H7: Cognitive capital accumulation plays a mediating role in the link between GSI and (a) economic and (b) environmental performances.

3.3 Research Methods

3.3.1 Data collection

As China has distinct provinces, autonomous regions, or municipalities, we employed a stratified sampling approach (Walker et al., 2014; Shu et al., 2016). First, we grouped regions into five categories according to different economic development level and geographical location. For each category, we chose a representative province (i.e., Jiangsu, Guangdong, Shandong, Henan, and Shaanxi). Jiangsu, located in the Yangtze River Delta, has a relatively high economic level. Guangdong, located in the Pearl River Delta, has the highest economic level. Shandong reflects the middle level of economic development in China. Henan represents early economic development that is dominated by traditional agriculture. Shaanxi, located in western China, is a traditional industrial base. Second, we randomly selected 120 firms in each province to form our sampling frame. The firm list was provided by the administrative division of the economic development zone. Thereafter, we invited these firms to join in the investigation. Finally, 284 firms agreed to involve in this study.

The sample of this study is obtained from Chinese manufacturing firms. Since the traditional development paradigm of Chinese manufacturing firms has polluted the environment severely (De Marchi, 2012), they have recognized the importance of implementing green supply chain practices recently. It made China an ideal context for exploring the link between GSI and firm performance. In addition, business operations in China should consider the

existence of *guanxi* (Zhao et al., 2008), which may affect the implementation and effectiveness of green supply chain practices (Zhan et al., 2018). Thus, the influence of *guanxi* cannot be overlooked when investigating the performance consequences of GSI in China (Yen et al., 2007). Social capital theory also indicates that *guanxi* is one of the most important governance mechanisms in Chinese culture (Berger et al., 2018). This provides an interesting cultural background for this research.

Moreover, we called each selected firm to recognize a suitable informant. These informants are mostly CEO/President, Vice president, or general managers of the firms. We also suggested that if they have doubts or difficulties in answering certain questions, they could seek appropriate colleagues for assistance. Manufacturers were asked to respond to the questionnaire according to their relationship with major suppliers (Feng et al., 2016a, b). We informed respondents about the importance of the research and the confidentiality of their answers. To improve the response rate, we offered to provide them our overall survey results if they send back a filled-in questionnaire.

We collected data at two time periods with an interval of six months to reduce the possible influence of common method bias (Podsakoff et al., 2012). Moreover, we excluded non-manufacturing firms and deleted samples with more than 5% of the survey data missing. At T1, 261 valid questionnaires (e.g., independent, mediating, and control variables) were collected, yielding a response rate of 43.5%. At T2, 206 manufacturing firms returned validly filled questionnaires (dependent variables), with a response rate of 34.3%. The sample firms were from various industries and had different ownership structures, increasing the representation of the sample. In addition, more than 90% of the respondents were at least middle managers, and the average job tenure in the current firm was 6.2 years. Thus, we can infer that these respondents were knowledgeable about their firms' operating activities. A detailed description of the sample is presented in Table 3.1.

To evaluate non-response bias, this study executed some *t*-tests and variance analysis contrasting the demographics between the respondent and non-respondent firms in terms of size, ownership structure, industry, and market region. We found no differences in *t*-statistics. Thus, we conclude that non-response bias has no effect in our research.

Table 3.1: Profile of the sample

Characteristics of firms	Frequency	Percentage
Industry		
Food and beverage	8	3.9
Textile	6	2.9
Chemical and related products	11	5.3
Pharmaceutical and medical	10	4.9
Rubber and plastics	14	6.8
Non-metallic mineral products	13	6.3
Metal products	14	6.8
Machinery	18	8.7
Transport equipment	22	10.7
Electrical machinery and equipment	30	14.6
Communication and computers related equipment	45	21.8
Instruments and related products	8	3.9
Others	7	3.4
Number of employees		
1-49	21	10.2
50-99	9	4.4
100-299	34	16.5
300-999	34	16.5
1,000-1,999	27	13.1
2,000-4,999	37	18.0
Over 5,000	44	21.3
Type of ownership		
State-owned and collective firms	83	40.3
Private firms	76	36.9

Foreign-invested firms	47	22.8
Position of respondents		
CEO/President or Vice president	18	8.7
General manager	43	20.9
Middle manager	126	61.2
Junior manager	19	9.2
Years stayed in the firm		
1-3	11	5.3
3-5	42	20.4
5-7	97	47.1
7-10	50	24.3
> 10	6	2.9

3.3.2 Measurements

Valid measures were determined by reviewing current literature and adopting multi-item scales to measure GSI, social capital accumulation, economic and environmental performances. Appendix 3.A presents all the items that were investigated. All indicators were weighed by employing the 7 points Likert scale.

Our questionnaire was initially developed in English, as well as two researchers were asked to translate it into Chinese. Subsequently, another two scholars re-translated it into English to check the accuracy (Flynn et al., 2010). This approach helps reduce the possibility of deviation from national-level reactions because of inaccurate translation. Finally, we applied the Chinese version in our investigation. The variables are described as follows.

GSI: A six-item scale was adopted to measure GSI. Five items relate to environmental management that demonstrate joint efforts from both participants (Vachon and Klassen, 2008), and one item relates to green supply chain integration (Wu, 2013).

Social capital accumulation: The measurement items of relational and

structural capital accumulations were taken from (Lee, 2015a,b), which emphasize trust, long-term partnership, and knowledge and information sharing. Cognitive capital accumulation was assessed via four items adopted from Villena et al. (2011), which includes similar corporate culture, values, management style, and common goals and objectives.

Firm performance: The measurement scale of economic performance was taken from Li et al. (2007) and Lai et al. (2015), which measures the degree of economic development using a five-item scale. We assessed environmental performance based on five items of measurement from Zhu et al. (2013), which considers wastes and emissions.

Control variables: The study also covered several control variables, for instance, firm size and age, longevity of relationship, and industry type. We took the natural logarithm of employees' number to indicate firm size. Firm age was assessed by using the logarithm of a firm's year of establishment (Jiang et al., 2018). We controlled for the longevity of relationship via the log of duration of existing cooperative transactions between a firm and its major supplier (Handley and Benton, 2012b). We used virtual variables to control for and represent the industry types (high-polluting industry = "1", other industry = "0").

3.3.3 Reliability and validity

This survey executed an exploratory factor analysis to ensure the one-dimensionality of the measurements. Six factors with characteristic values beyond 1.0 appeared, illustrating 82.8% of the total variance. Each scale item has a good factor loading. Therefore, one-dimensionality was ensured.

We determined Cronbach's α to evaluate the reliability of the scales used. All Cronbach's α values are beyond 0.90 (Table 3.2), exceeding the standard value of 0.7. Subsequently, we calculated the composite reliability (CR) and average variance extracted (AVE) to estimate reliability. The findings are displayed in

Table 3.2. The CR values are beyond 0.90 and AVE results are over 0.7. Therefore, the scales used in this study are reliable.

We ensured content validity based on the extensive literature review and measured convergent validity by confirmatory factor analysis (CFA). Results suggest that the structure of the data is identical to the functional integration of the two features. The model fit indices are $\chi^2(335) = 747.44$ ($\chi^2/df = 2.23$), comparative fit index (CFI) = 0.96, non-normed fit index (NNFI) = 0.96, standardized root mean square residual (SRMR) = 0.054, and root mean square error of approximation (RMSEA) = 0.071. These values are acceptable only if all factor loadings are beyond 0.50 and the *t*-value is higher than 1.96 or both (Huo et al., 2016a). We find that all factor loadings are above 0.70, with *t*-values beyond 2.0, representing good significance. Therefore, convergent validity is ensured.

Concerning discriminant validity, we tested it by contrasting AVE with shared variance among distinct structures (Fornell and Larcker, 1981). Table 3.3 indicates the square root of AVE value, descriptive statistics, and variable correlations. The diagonal constructs reflect the square root of AVE and are greater than the non-diagonal constructs, manifesting the acceptable discriminant validity (Fornell and Larcker, 1981).

3.3.4 Assessing common method variance

Since the samples collected from each firm were derived from a single informant, common method variance (CMV) may exist. This was detected by adopting several methods. First, we tried to elaborate the measurement items with an accurate and easy-to-understand questionnaire (Zhu et al., 2013). Second, we collected data at two periods so that CMV can be reduced to some extent. Third, we identified ten firms around our university on the basis of the geographical location to assess possible CMV. Two respondents from each sampled firm were asked to participate separately using the same questionnaire. The reliability test shows high internal consistency in these groups of responses.

Thus, we conclude that complying with the standard procedures has avoided CMV as much as possible in the early stage.

Furthermore, Harman's one-factor model of variables was adopted to test CMV (Podsakoff et al., 2003). First, findings concluded a six-factor model with characteristic values beyond 1.0, illustrating 82.8% of the total variance, and the first factor obtained over a third of the variance (35.09%). Second, we tested CFA Harman's one-factor model of variables, yielding $\chi^2(350) = 4329.82$ (comparing to the six-factor model $\chi^2(335) = 747.44$). Finally, we adopted the method factor model to slightly improve the model fit (CFI by 0.01) and further verified the CMV, with the common method factor accounting for 1.62% of the total variance (Paulraj et al., 2008). The above findings all reveal that CMV is not critical.

Table 3.2: Results of confirmatory factor analysis

Construct	Item code	Factor loading	<i>t</i> -value	Cronbach's α	CR	AVE
Green supplier integration	GSI1	0.90	16.59***	0.961	0.961	0.805
	GSI2	0.88	16.04***			
	GSI3	0.82	14.36***			
	GSI4	0.94	17.93***			
	GSI5	0.93	17.46***			
	GSI6	0.91	16.75***			
Relational capital accumulation	RCA1	0.77	12.72***	0.911	0.917	0.734
	RCA2	0.86	15.06***			
	RCA3	0.93	17.35***			
	RCA4	0.86	15.15***			
Structural capital accumulation	SCA1	0.85	15.04***	0.914	0.920	0.743
	SCA2	0.90	16.40***			
	SCA3	0.92	17.08***			
	SCA4	0.77	12.87***			
Cognitive capital accumulation	CCA1	0.95	18.29***	0.937	0.936	0.787
	CCA2	0.98	19.29***			
	CCA3	0.85	15.25***			
	CCA4	0.75	12.63***			
Economic performance	ECP1	0.80	13.58***	0.933	0.934	0.739
	ECP2	0.82	14.15***			
	ECP3	0.92	17.11***			
	ECP4	0.91	16.82***			
	ECP5	0.84	14.70***			
Environmental performance	ENP1	0.89	16.12***	0.947	0.948	0.785
	ENP2	0.87	15.68***			
	ENP3	0.91	16.87***			
	ENP4	0.88	15.90***			
	ENP5	0.88	15.79***			

Note: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$ (two-tailed).

Table 3.3: Mean, standard deviations, and correlations

Constructs	Mean	SD.	1	2	3	4	5	6	7	8	9	10
1. Firm size	6.704	1.723	-									
2. Firm age	2.604	0.770	0.435**	-								
3. Longevity of relationship	1.715	0.600	0.261**	0.393**	-							
4. Industry type	0.369	0.484	-0.081	-0.110	0.033	-						
5. Green supplier integration	4.869	1.180	-0.101	-0.023	0.076	0.086	0.897					
6. Relational capital accumulation	5.694	1.038	-0.031	-0.044	-0.019	-0.018	0.267**	0.855				
7. Structural capital accumulation	5.332	1.119	-0.133	-0.056	-0.115	0.054	0.371**	0.382**	0.864			
8. Cognitive capital accumulation	5.199	1.271	-0.063	-0.098	-0.112	-0.102	0.228**	0.331**	0.269**	0.887		
9. Economic performance	5.295	1.081	-0.026	-0.074	-0.083	-0.075	0.338**	0.300**	0.400**	0.181**	0.858	
10. Environmental performance	5.276	1.061	0.021	0.030	0.029	0.029	0.331**	0.250**	0.251**	0.184**	0.435**	0.884

Note: * $\alpha = 0.05$; ** $\alpha = 0.01$; *** $\alpha = 0.001$; Square root of AVE value is on the diagonal.

3.4 Results

Table 3.4 demonstrates the hierarchical regression analysis results. H1a, H1b, and H1c propose that GSI is significantly linked with relational, structural, and cognitive capital accumulations, respectively. As shown in Table 3.4, GSI is positively linked with relational capital accumulation ($\beta = 0.274, p < 0.001$), structural capital accumulation ($\beta = 0.373, p < 0.001$), and cognitive capital accumulation ($\beta = 0.246, p < 0.001$), as demonstrated in Models 2, 4, and 6. Hence, GSI is conducive to social capital accumulation, providing support for H1a, H1b, and H1c.

The findings reveal the impact of social capital accumulation on economic and environmental performances, as demonstrated in Table 3.4. In Model 9, relational capital accumulation ($\beta = 0.160, p < 0.05$) and structural capital accumulation ($\beta = 0.339, p < 0.001$) display remarkable influence on economic performance. Therefore, H2a and H3a are supported. However, no significant impact of cognitive capital accumulation on economic performance is found. H4a cannot be supported. In Model 15, relational capital accumulation ($\beta = 0.155, p < 0.05$), structural capital accumulation ($\beta = 0.174, p < 0.05$), and cognitive capital accumulation ($\beta = 0.130, p < 0.10$) are suggested having significant influence on environmental performance. Therefore, H2b, H3b, and H4b are supported. Thus, our findings indicate that most of the various types of social capital accumulation enhance economic and environmental performances.

To evaluate the mediating effects (H5, H6, and H7), we adopted the Bootstrapping interval estimation. The findings on Table 3.5 reveal that the direct impact of GSI on economic performance is significant (excluding zero) in the 95% confidence interval. The indirect effects via relational and structural capital accumulations are also significant (excluding zero), but not for cognitive capital accumulation (including zero). Thus, relational and structural capital accumulations play mediating roles on the link between GSI and

economic performance, while cognitive capital accumulation does not play a mediating role. Similarly, the direct influence of GSI on environmental performance is significant (excluding zero) in the 95% confidence interval. The indirect effects via relational, structural, and cognitive capital accumulations are also significant (excluding zero), indicating that all types of capital accumulations mediate the impact of GSI on environmental performance. Hence, H5a (b), H6a (b), and H7b are supported, but H7a is not.

To further verify the mediating effects, we used the basic mediated regression analyses (Baron and Kenny, 1986). We executed a regression analysis of the mediating variables (relational, structural, and cognitive capital accumulations) with the independent variable (GSI). Then, we conducted a regression analysis between the dependent (economic and environmental performances) and independent variables. The last step was to enter the mediators into the regression model.

In Models 2, 4 and 6, GSI is positively linked with relational, structural, and cognitive capital accumulations. In Models 8 and 14, GSI has positive impact on economic performance ($\beta = 0.359, p < 0.001$) and environmental performance ($\beta = 0.338, p < 0.001$). When relational capital accumulation is added, the correlation between GSI and economic performance becomes weaker ($\beta = 0.300, p < 0.001$), and so as structural capital accumulation ($\beta = 0.241, p < 0.01$). The results demonstrate that relational and structural capital accumulations partially mediate the link between GSI and economic performance. Hence, H5a and H6a are supported. However, when adding cognitive capital accumulation in Model 12, the impact of cognitive capital accumulation on economic performance is not significant ($\beta = 0.082, p > 0.1$). Thus, H7a is not supported. Furthermore, after adding relational capital accumulation ($\beta = 0.290, p < 0.001$), structural capital accumulation ($\beta = 0.280, p < 0.001$) and cognitive capital accumulation ($\beta = 0.308, p < 0.001$) respectively into Models 16, 17 and 18, GSI's influence on environmental

performance also becomes weaker than in Model 14. Therefore, H5b, H6b, and H7b are supported.

Table 3.4: Results of regression analysis

Variable	Relational capital Structural capital Cognitive capital											
	accumulation			accumulation			accumulation			Economic performance		
	(RCA)			(SCA)			(CCA)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Control variables												
Firm size	-0.015	0.018	-0.121	-0.075	-0.022	0.008	0.011	0.054	0.054	-0.050	0.078	0.054
Firm age	-0.041	-0.040	0.042	0.044	-0.070	-0.069	-0.065	-0.063	-0.071	-0.055	-0.077	-0.058
Longevity of relationship	0.002	-0.027	-0.102	-0.142*	-0.075	-0.102	-0.058	-0.096	-0.022	-0.090	-0.051	-0.088
Industry type	-0.023	-0.043	0.052	0.025	-0.109	-0.127+	-0.079	-0.105	-0.091	-0.096	-0.113	-0.095
Independent variable												
GSI	0.274***			0.373***		0.246***		0.359***		0.300***	0.241**	0.339***
Mediators												
RCA						0.391***			0.160*	0.215**		
SCA						0.311***			0.339***		0.317***	
CCA									0.022			0.082
R ²	0.003	0.076	0.028	0.164	0.028	0.087	0.015	0.141	0.200	0.184	0.225	0.147
R ² change	0.073		0.136		0.059			0.126	0.185	0.043	0.084	0.006
F(d, f) change	15.813***		32.367***		12.870***			29.179***	15.243***	10.456**	21.617***	1.442

Variable	Economic performance							
	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18		
Control variables								
Firm size	0.009	0.050	0.035	0.047	0.062	0.049		
Firm age	0.023	0.024	0.029	0.031	0.017	0.033		
Longevity of relationship	0.017	-0.019	0.042	-0.015	0.003	-0.007		
Industry type	0.031	0.007	0.037	0.014	0.003	0.022		
Independent variable								
GSI		0.338***		0.290***	0.280***	0.308***		
Mediators								
RCA			0.155*	0.176*				
SCA			0.174*		0.156*			
CCA			0.130 ⁺			0.122 ⁺		
R ²	0.002	0.113	0.105	0.142	0.134	0.127		
R ² change		0.111	0.103	0.029	0.021	0.014		
F(d, f) change		25.065***	7.541***	6.618*	4.696*	3.100 ⁺		

Note: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

Table 3.5: Bootstrapped mediation results

Model	Total effect		Direct effect		Indirect effect		
	Coefficient	<i>t</i> value	Coefficient	<i>t</i> value	Point estimate	Lower	Upper
GSI→SCA→ECP	0.329***	5.402	0.221***	3.528	0.108	0.059	0.162
GSI→CCA→ECP	0.329***	5.402	0.310***	4.946	0.019	-0.009	0.049
GSI→RCA→ENP	0.304***	5.007	0.261***	4.191	0.043	0.016	0.072
GSI→SCA→ENP	0.304***	5.007	0.251***	3.879	0.052	0.009	0.096
GSI→CCA→ENP	0.304***	5.007	0.277***	4.445	0.027	0.001	0.058

Note: A total of 5000 Bootstrap samples were used. GSI: Green supplier integration, RCA: Relational capital accumulation, SCA: Structural capital accumulation, CCA: Cognitive capital accumulation, ECP: economic performance, and ENP: environmental performance. ⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

3.5 Discussion

Our study examines the effects of GSI on firms' economic and environmental performances, and the mediating role of social capital accumulation. In view of social capital theory, we hypothesize that GSI has positive influences on social capital accumulation (relational, structural and cognitive capital accumulations), which further influences firm performance. We also hypothesize that the link between GSI and firm performance is mediated by social capital accumulation.

As predicted, GSI has positive impacts on three dimensions of social capital accumulation, extending the view of Lawson et al. (2008). First, *guanxi* strengthen the conduction of GSI, which promotes the growth of relational capital accumulation. In the traditional Chinese culture, *guanxi* promotes and maintains long-term environmental cooperation among trading partners in the supply chain (Cai and Yang, 2014; Zhu and Lai, 2019). GSI helps the focal firm build a trusting relationship with their suppliers by integrating these suppliers into their green initiatives. Thus, GSI encourages both parties to jointly plan and take act to address environmental issues, in order to build a family-like relationship (Lee, 2015b), increasing relational capital accumulation. Second,

the presence of *guanxi* could enhance GSI's capability to help the focal firm acquire valuable information and resources from its suppliers, and promote mutual understanding by sharing environmental knowledge (Luo et al., 2011). This is conducive to develop social networks and increase structural capital accumulation. Finally, most studies have neglected the role of cognitive capital accumulation. Our study suggests that GSI also promotes cognitive capital accumulation, which enriches the GSI literature. GSI ensures common decisions and goals on environmental issues between the focal firm and its suppliers. The longer the environmental collaboration is, the more similar the management styles and firm culture of both parties will be (Formentini and Taticchi, 2016), which is conducive to cognitive capital accumulation.

These findings also provide evidence that relational and structural capital accumulations are linked with economic and environmental performances. This is partially supported by Krause et al. (2007) and Lee and Kim (2011). *Guanxi*-based relational capital accumulation helps to establish a sense of trust and belonging between firms and their suppliers (Cai and Yang, 2014). This reduces the monitoring cost and promotes the enthusiasm and ability to implement environmental practices, thereby increasing firm performance (Yang et al., 2008; Yim and Leem, 2013). Suggested by social capital theory, relational capital accumulation promotes the establishment of long-term environmental cooperation between firms and their suppliers, which stimulates the willingness of both parties to pursue economic intentions (Lee and Kim, 2011). Structural capital accumulation contributes to resource flows and information sharing, thereby increasing access to economic and environmental resources. Moreover, firms establish unique social networks with their suppliers based on their independent environmental standards to evaluate the suppliers' environmental capabilities and future direction. For example, Sony implemented the 'Green Supplier Certification System' (Parmigiani et al., 2011), which helps to strengthen economic and environmental capabilities, thereby improving firm performance.

Interestingly, while cognitive capital accumulation is positively correlated with environmental performance, it is not significantly correlated with economic performance. These findings are partially in line with Villena et al. (2011). This research not only explores the impact of cognitive capital accumulation on economic performance, but also supplements the study on environmental performance, extending the scope of previous research. In addition, environment-oriented firms transfer environmentally relevant knowledge and culture to suppliers, so as to form common values and concepts that improve environmental performance (Wu et al., 2012). As for the insignificant impacts on economic performance, the possible reasons are as follows. First, due to differences or unpredictability of uncertain factors (such as consumer preference and goal orientation), it is difficult for firms and suppliers to form common values and concepts related to economic performance (Krause et al., 2007). In such an uncertain environment, firms may not be able to profit from cognitive capital accumulation. Second, cognitive capital accumulation may not affect economic performance alone, but needs to interact with other indicators to affect economic performance. Previous studies have suggested that cognitive capital accumulation is special capabilities and resources formed through long-term collaboration between the firm and its suppliers, and exist in the social networks (Touboullic and Walker, 2015). Hence, cognitive capital accumulation may need to work along with relational or structural capital accumulation to affect economic performance. Third, there may be other factors that can affect the link between cognitive capital accumulation and economic performance. For instance, there is a correlation between cognitive capital accumulation and organizational learning (Lee and Jones, 2008), which can promote firms' economic performance (Paulraj et al., 2008). Furthermore, commitment plays a significant role in cognitive capital accumulation and increases the level of economic performance (Nyaga et al., 2010). Based on the above, we can infer that some factors may increase the accumulation of intangible assets, which is beneficial to the link between cognitive capital

accumulation and economic performance (Alvarez et al., 2010).

Moreover, our findings provide evidence that the connections among GSI, economic, and environmental performances are mediated by social capital accumulation (Cousins et al., 2006). Interestingly, except for cognitive capital accumulation, other types of social capital accumulation play a significant mediating role in the link between GSI and economic performance. These findings support the study of (Lee, 2015a, b). According to social capital theory, GSI is deemed to be able to reduce environmental hazards and cost inputs through relational capital accumulation (e.g., establishing long-term relations and dependence) and structural capital accumulation (e.g., sharing information and supplier development), thereby affecting firm performance (Cousins et al., 2006; Feng et al., 2016a, b). Meanwhile, cognitive capital accumulation mediates the link between GSI and environmental performance, but does not function in GSI-economic performance link. There are several explanations for these findings. First, manufacturing firms in China are developing rapidly and are considered to pollute the environment severely (De Marchi, 2012). Thus, firms have recognized the importance of implementing GSI, which has prompted the focal firm and suppliers to establish an environmentally-oriented *guanxi*. The establishment of *guanxi* improves the capability of environmental communication (Cheng et al., 2012), and forms similarly and compatible culture and objectives between the focal firm and its suppliers. These further mitigate conflicts in dealing with environmental issues jointly (Wong, 2010), which reduces potential deviations between supply chain partners in environmental cognitive capital (Luo, 2007). As environmental awareness increases, firms and suppliers are encouraged to invest more time, capital, and ability to carry out green practices. Such practices are conducive to the continuous improvement of firms' environmental performance (Lai et al., 2013), but may not necessarily impact economic performance. Second, the pursuit of short-term goals is not seen as the path towards sustainability (De Giovanni, 2012). Sharing the goals and values of sustainable development is a long-term

process that may not be reflected in economic performance in the short term. Only when economic performance exceeds the critical value of environmental performance, and actors increase their market share and sales profit through long-term practical activities will the impact on economic performance be reflected (Zhu et al., 2007a).

3.5.1 Theoretical contributions

This study extends the literature on GSI and social capital theory in several aspects. First, this research explores the link between GSI and firm performance (e.g., economic and environmental performances) by deeming social capital accumulation as a mediating variable. This provides a more comprehensive explanation of how the focal firm and its green suppliers improve performance through trust and dependence, information sharing (Yim and Leem, 2013), and common goals and culture (Carey et al., 2011). Thus, this study reveals the process of sustainable development of firms from the view of social capital theory, which strengthens the theoretical system.

Second, as a rapidly developing country and a manufacturing power, taking China's manufacturing industry as the research sample provides a strong research foundation for exploring the effective use of resources to achieve the sustainable development of firms (Lai et al., 2013). In addition, in China, the traditional *guanxi* culture is of great significance for the successful implementation of GSI (Zhan et al., 2018), and firms and suppliers are still in the early stages of development to improve performance through the implementation of green practices (Yu et al., 2019), providing the necessary conditions and background for this research.

Finally, by considering the significance of GSI in both economic and environmental performances of firms, the research scope and theoretical literature of GSI are enriched. Firms should strive to achieve integration with green suppliers and take advantage of resources, information, and common goals of firms and suppliers to promote firm performance.

3.5.2 Managerial implications

The research has several managerial implications. First, supervisors should take notice of the significance of GSI in the face of increasingly severe environmental pollution and stringent environmental regulations. Firms should invest their energy and resources into the implementation of GSI to achieve sustainable development strategies and goals.

Second, managers should encourage communication and connection between firms and green suppliers, and discover and analyze problems in a timely manner in the process of integration with green suppliers. This can strengthen the sense of trust and dependence between the two parties and establish an interactive platform for long-term cooperation. Based on this, the ‘win-win’ situation between firms and green suppliers can be achieved, thereby enhancing the economic and environmental performances of firms more effectively.

Third, firms must clearly understand that the efficiency and reliability of resource allocation affect the sustainable development of firms. Managers should build a *guanxi* ‘bridge’ according to shared goals and values of green suppliers to capture the resources they need and better disseminate information across the green supply chain (Cai and Yang, 2014). In the long run, this interaction network facilitates the transfer of environmental ideas and knowledge sharing, while also providing firms with support based on social resources to obtain profits and sales.

3.6 Conclusion

Implementing GSI provides an important way for firms to obtain social resources and improve their performance. First, based on social capital theory, the results indicate that GSI promotes the accumulation of three types of social capital. Second, relational and structural capital accumulations enhance economic and environmental performances, while cognitive capital accumulation only enhances environmental performance. Finally, relational and

structural capital accumulations mediate the links between GSI and the two types of firm performance, while cognitive capital accumulation only mediates the link between GSI and environmental performance.

This study also has several limitations, which provide avenues for future research. First, the survey data adopted in this study were only obtained from manufacturing firms. Environmental issues are complicated, since they may not only arise from manufacturers, but also suppliers even second-tier suppliers (Foerstl et al., 2010; Grimm et al., 2014). Thus, using data solely from manufacturing firms may limit our understanding on the consequences of GSI (Lee, 2010). Future research should collect data from multiple sources including manufacturing firms and multi-tier suppliers (Dou et al., 2018) to better understanding GSI.

Second, our study examines the mediating role of three dimensions of social capital accumulation in the relationship between GSI and firm performance. However, other potential mediators may also exist to explain the relationship between these two variables. Future studies should explore the mediating effects of these mediators through which GSI influences firm performance.

Third, certain contingency factors (i.e., commitment, trust, and dependency) may exist to affect the correlation between GSI and firm performance (Jehn and Mannix, 2001; Wang et al., 2015a). Future study should explore the moderating effects of these contingency factors on the link between GSI and firm performance to achieve an in-depth understanding.

Fourth, this research only discussed the impacts of GSI on economic and environmental performances. However, social performance also plays a significant role, especially in green purchasing and green marketing (Ağan et al., 2016; Reuter et al., 2010). Thus, future research should link GSI to the triple bottom line, specifically, considering the role of GSI in influencing social performance to develop a more comprehensive understanding on the link between GSI and firm performance.

4. Green supplier integration and environmental performance: Do environmental innovation and ambidextrous governance matter?³

Abstract

Purpose - Since firms are often puzzled with the adoption of proper governing mechanism to achieve their environmental benefits, this research examines how green supplier integration (GSI) affects environmental performance via environmental innovation and the moderating role of ambidextrous governance.

Design/methodology/approach - The authors tested the hypotheses by adopting two-waved survey data from 206 Chinese manufacturers and the hierarchical regression analysis.

Findings - The results revealed that GSI is positively linked with both incremental and radical environmental innovation, which further enhance environmental performance. Moreover, balanced ambidexterity enhanced the link between GSI and incremental environmental innovation, while combined ambidexterity alleviated the link between GSI and radical environmental innovation.

Practical implications - Firms should integrate suppliers into their activities of dealing with environmental issues to realize environmental benefits through facilitating environmental innovation. Moreover, the choice of different dimensions of ambidextrous governance can affect the environmental benefits of GSI.

Originality/value - This research enriches the authors' understanding of how

The chapter is based on a journal article:

Zhang, Q., Pan, J. and Feng, T. (2020). Green supplier integration and environmental performance: Do environmental innovation and ambidextrous governance matter? *International Journal of Physical Distribution & Logistics Management*. DOI: 10.1108/ijpdlm-01-2020-0027.

to achieve environmental benefits by engaging in GSI, and it provides a novel and insightful approach for better managing GSI from the perspective of ambidextrous governance.

Keywords: Ambidextrous governance, Green supplier integration, Environmental performance, Environmental innovation

4.1 Introduction

As environmental degradation has seriously threatened the sustainable development of firms, solving environmental issues has become a priority for them (Taoketao et al., 2018; Zhan et al., 2018). Strict environmental regulations and strong external pressures also urge firms to attach importance to the influence of products/services on the natural environment (Tang et al., 2018; Vanalle et al., 2017). To address these challenges, firms should implement green practices to enhance their ‘environmental’ attributes (Li et al., 2016b). However, only few firms are able to solve environmental issues by adopting their own resources and capabilities (Du et al., 2018). Firms should integrate their suppliers into green practices to realize environmental performance (Ghadimi et al., 2016; Lee et al., 2015; Woo et al., 2016). Thus, this research explores the impact of green supplier integration (GSI) on environmental performance.

GSI is able to help firms reduce environmental hazards and achieve common environmental goals by implementing green practices collaboratively with their suppliers (Du et al., 2018; Zhang et al., 2020). However, how GSI affects environmental performance is still limited. Several prior studies have stated that GSI is critical for improving environmental performance (e.g., Busse et al., 2016; Lee et al., 2015; Xu et al., 2016), while others have suggested that GSI is not substantially related to environmental performance (e.g., Hajmohammad et al., 2013; Han and Huo, 2020). Some studies have even indicated that GSI has a negative impact on environmental performance (e.g., Winn et al., 2012; Zhu et al., 2007).

These inconsistent findings suggest that mediators may exist in the GSI-environmental performance link. Based on natural resource-based view (NRBV), the focal firm can collaborate with suppliers to conduct green practices, in order to reduce pollution emissions through environmental innovation (Wijethilake et al., 2018; Wu, 2013). Specifically, firms try to

decrease the environmental hazards and waste generation of their activities by improving existing or developing new products, technologies and processes, which help to increase clean energy consumption and improve material utilization (Huang and Li, 2017; Wong et al., 2020). Accordingly, GSI is likely to enhance environmental performance by promoting environmental innovation (Chiarvesio et al., 2015; Duhaylongsod and De Giovanni, 2019; Fernando et al., 2019). Hence, environmental innovation may mediate the GSI-environmental performance link.

Although the bright sides of GSI have been recognized in prior studies, its dark sides cannot be neglected. GSI may reduce the environmental resource asymmetry between firms and their suppliers through knowledge sharing and joint decision-making (Hammervoll et al., 2012; Xu et al., 2016). Nevertheless, both parties may drop their guard as collaboration deepens, which creates possible opportunism (Canzaniello et al., 2017; Feng et al., 2020). Further, GSI may make the focal firm lose the control of supplier, which is likely to trigger reputation risk (Busse et al., 2017). If the dark sides of GSI are incorrectly addressed, then they may lead to a failure in obtaining expected environmental benefits from GSI. Thus, firms are required to adopt reasonable governance mechanisms to mitigate the possible dark sides of GSI (Liu et al., 2009; Shou et al., 2017). However, firms are often puzzled with what governing mechanisms should be adopted to maximize the environmental benefits of GSI. This leaves a research gap for exploring that under what conditions firms can achieve the environmental benefits of GSI.

According to transaction cost economics (TCE), relational norms and contract control are two different types of governance mechanisms that the focal firm can adopt (Li et al., 2010a; Sancha et al., 2016). Several studies have verified the independent role of constraint or enhancement generated by these governance mechanisms (Huang et al., 2014; Wang and Liu, 2019). However, considering the complex process of GSI, firms are increasingly adopting

different governance mechanisms simultaneously to more efficiently mitigate risks and opportunism, rather than utilizing governance mechanisms independently (Blome et al., 2013; Poppo and Zenger, 2002; Shou et al., 2017). Accordingly, firms should find the appropriate trade-offs between these two governance mechanisms to gain more environmental benefits by implementing GSI (Blome et al., 2013; Cao and Lumineau, 2015). Previous scholars have used ambidextrous governance which reflects an organization's dual orientation with respect to relational norms and contract control, so as to conceptualize different combinations of interactions between them, such as balanced and combined dimensions (Blome et al., 2013; Cao et al., 2009). Hence, our research explores the moderating impact of ambidextrous governance on the GSI-environmental innovation link.

Based on NRBV and TCE, this study explores three major research questions to address the above-mentioned research gaps. First, whether GSI affects environmental innovation, which further affects environmental performance? Second, whether environmental innovation mediates the link between GSI and environmental performance? Third, whether ambidextrous governance (i.e. balanced and combined dimensions) moderates the relationship between GSI and environmental innovation? Exploring these questions would extend the GSI literature and practice by uncovering how firms should select the proper governance mechanisms to achieve the environmental benefits of GSI.

4.2 Literature Review and Research Hypotheses

We presented the conceptual model in Figure 4.1, which depicts the relationships among GSI, environmental innovation, environmental performance and ambidextrous governance.

Figure 4.1: Conceptual model

4.2.1 Green supplier integration and environmental innovation

NRBV suggests that organizations can obtain special resources and achieve competitive advantages by interacting with the natural environment (Hart, 1995). Specifically, firms are likely to proactively integrate green practices into development strategies to reduce environmental pollution, thus helping them gain sustainable competitiveness (Li et al., 2016b; Yang et al., 2020). GSI is an important driving force for achieving environmental goals (Wang et al., 2018). It aims to enhance resource exchange and business connections between firms and their suppliers by collaboration, mutual communication and sharing environmental knowledge, thereby jointly developing programs to solve environmental issues (Wong et al., 2020). Thus, GSI motivates both parties to collaboratively conduct environmental innovation activities (Chiarvesio et al., 2015).

Further, environmental innovation also helps firms acquire core competitiveness, and it can be further divided into incremental (IEI) and radical environmental innovation (REI) (Dai et al., 2015; Liao, 2018). IEI is a

relatively stable and less risky innovation method, which primarily focuses on improving or utilizing existing technologies, products and processes to rapidly meet environmental expectations (Duhaylongsod and De Giovanni, 2019). REI is a challenging and time-consuming process that makes firms significantly different from existing resources and capabilities by implementing breakthrough innovation changes (Cheng and Chen, 2013), such as introducing or developing new products and technologies (Dai et al., 2015). Hence, GSI can promote environmental innovation by strengthening resource sharing and environmental interaction.

4.2.1.1 The impact of green supplier integration on incremental environmental innovation

IEI usually uses existing resources to improve related processes and products to make them more environment-friendly, so appropriate incentives are sufficient (Anh et al., 2019; Lee et al., 2011). For example, if firms and their suppliers can obtain quick benefits through the interaction of environmental technologies, it increases the willingness of both parties to improve products and processes (Lee and Kim, 2011), thereby promoting IEI. Moreover, firms expect to achieve rapid product improvement through their suppliers' green supply, such as utilizing less harmful or recycled materials (Vachon and Klaser, 2008). Herman Miller, for example, keeps close contact with its suppliers who provide environment-friendly materials to ensure environmental products. Accordingly, we propose the following hypothesis:

H1a: GSI is positively linked with IEI.

4.2.1.2 The impact of green supplier integration on radical environmental innovation

The risks and uncertainties caused by REI's frontier nature and novelty make both development and introduction tricky, so the role of GSI cannot be ignored (Cainelli et al., 2015; Dai et al., 2015; Liu et al., 2018). GSI may clarify the

attribution of responsibilities through mutual understanding, information sharing and joint decisions to minimize opportunism, thus facilitating the development and introduction of new products, concepts or technologies (Anh et al., 2019; Hammervoll et al., 2012; Wong et al., 2020). For instance, Dell cooperated with Chinese suppliers to develop a pure plant packaging material that can be used as a fertilizer (Kruschwitz, 2012).

Another advantage of GSI is the ability to cope with the communication challenges posed by REI that requires a richer staffing type (Dai et al., 2015; Huang and Li, 2017). Specifically, GSI provides different channels to better understand norms, requirements and goals (Zhao et al., 2018), which helps to form similar green concepts and improve development efficiency. For example, Amazon created recyclable boxes through repeated collaboration with suppliers with different functions. Therefore, the environmental integration of firms and suppliers can promote REI (Liao, 2018). We hypothesize the following hypothesis:

H1b: GSI is positively linked with REI.

4.2.2 The impact of environmental innovation on environmental performance

Based on NRBV, the pressure of external environment motivates the focal firm to adopt environmental innovation with suppliers to cope with environmental degradation (Li et al., 2017), thereby obtaining core competition advantages and improving environmental performance (Fraj et al., 2013; Huang et al., 2016; Wijethilake et al., 2018).

Utilizing existing technologies to improve products is a relatively certain method that can quickly increase production efficiency and decrease the adverse influence of products on the environment (Cecere et al., 2014; Huang and Li, 2017). For instance, firms use degradable materials provided by suppliers to improve the polluting packaging, which reduces harmful

consumption and improves environment status (Dangelico and Pujari, 2010). Moreover, improving production processes can enhance environmental performance in terms of material input and waste management (Cecere et al., 2014). Thus, IEI enhances environmental performance. We hypothesize the following hypothesis:

H2a: IEI is positively linked with environmental performance.

NRBV suggests that firms should implement subversive innovation (i.e., REI) if they want to stand out from the competition (Liao, 2016). Existing literature has indicated that environmental patents significantly reduce the emission of toxic substances produced by US manufacturers and promote sustainable development (Carrión-Flores and Innes, 2010). Moreover, firms and their suppliers with transformative environmental innovative methods can better enhance environmental performance. First, the development or introduction of new products, such as easy-to-recycle and degradable products (Amores-Salvadó et al., 2014), helps reduce environmental accidents. Second, technological innovations, such as converting waste into clean energy, are conducive to cleaner production (Cronin et al., 2011). Third, introducing radically new concepts to implement process innovations can essentially reduce pollution emissions and consumptions, thereby improving environmental performance (Huang and Li, 2017). Thus, we propose the following hypothesis:

H2b: REI is positively linked with environmental performance.

4.2.3 The mediating role of environmental innovation

GSI promotes frequent ‘green’ interaction and the establishment of environmental goals to reduce environmental hazards (Huo et al., 2019). Such an environmental strategy can stimulate the enthusiasm for minimizing environmental accidents and improving environmental performance by utilizing or improving existing technologies and products (Baea and David, 2018; Sancha et al., 2016). For example, Geely has reached an environmental

consensus with its suppliers that can use proven technologies from its suppliers to make new models more energy-saving and environment-friendly (Wang et al., 2016).

Additionally, GSI encourages the accumulation and sharing of environmental knowledge to expand the scope of innovation exploration and create the necessary uniqueness for achieving environmental innovation (Du et al., 2018; Li et al., 2016b). In view of NRBV, the uniqueness of environmental knowledge prompts the launch of new environmental innovation programs and practices (e.g., material recycling and reuse and hydrogen cars) to increase competitive advantage (Fernando et al., 2019; Xu et al., 2016), which further reduces pollution emissions. Simultaneously, close communication and mutual understanding effectively integrate the ‘environmental voice’ into green practices, thus promoting environmental innovation (Li et al., 2018; Liao, 2018). Additive manufacturing, as an example of environmental innovation, enhances environmental performance by changing supply chain processes or technologies to improve material utilization (Luomaranta and Martinsuo, 2019). In summary, environmental innovation mediates the GSI-environmental performance link. Hence, we propose the following hypothesis:

H3: (a) IEI and (b) REI mediate the effect of GSI on environmental performance.

4.2.4 The moderating role of ambidextrous governance

Governance mechanism plays a significant role in mitigating the dark side of GSI, such as risk, uncertainty and opportunism (Liu et al., 2009; Shou et al., 2017). Previous studies have shown that firms typically use two types of governance mechanisms (i.e., relational norms and contract control) to manage the environmental cooperation with suppliers (Sancha et al., 2016). Relational norms, an informal governance mechanism, focus primarily on the behaviors of trading partners in a united and flexible way to achieve common environmental expectations (Huo et al., 2016; Yang et al., 2016). Contract control stems from

the rational economy of TCE (Wever et al., 2012), indicating that firms sign binding contracts in written form with suppliers to clarify responsibilities and obligations (Li et al., 2010b; Wang et al., 2016).

To effectively enhance environmental innovation by engaging in GSI, firms should adopt appropriate governance mechanisms. Most firms favor contract control as it can guarantee evidence-based cooperation with suppliers, whether in good or bad conditions (Saenz et al., 2015). For example, Mattel required its suppliers to sign and execute detailed result-focused contracts that would bring displeasure to suppliers. Hence, they provided lead-based paints to develop and produce a large number of new products with Mattel, leaving the firm exposed to reputational risk (Sancha et al., 2016). To avoid inappropriate supplier behaviors, firms can simultaneously use relational norms to achieve the consistency of supplier behaviors and firms' environmental goals (Subramaniam et al., 2019). Thus, it is a process of seeking trade-offs between relational norms and contract control (Wu, 2013).

The ambidexterity generally emphasizes how to use two different abilities or methods simultaneously to achieve environmental goals (Blome et al., 2013; Rothaermel and Alexandre, 2009). Thus, firms should adopt ambidextrous governance and distinguish the interaction between relational norms and contract control into balanced and combined dimensions according to previous research (Cao et al., 2009). Balanced ambidexterity reflects the relative degree of using relational norms and contracts, while combined ambidexterity emphasizes the degree of reinforcement between the two. Consequently, we focus on the interaction between relational norms and contract control and explore the moderating role of ambidextrous governance on the GSI-environmental innovation link.

4.2.4.1 Balanced ambidexterity and environmental innovation

TCE demonstrates that the more harmonious matching of relative degree between relational norms and contract control, the greater the link between GSI

and IEI (Wang et al., 2011). Although relational norms inspire the enthusiasm for improving or utilizing existing resources by creating environmental interactive climate (Shou et al., 2017), focusing too much on relational norms and ignoring contracts may increase opportunism. Specifically, firms may mistakenly assume that social relations are enough to govern GSI's process of achieving IEI (Li et al., 2010a). In such cases, however, firms and suppliers may achieve their respective goals via 'exploit loopholes' (Huang and Chiu, 2018), which results in opportunism and thus weakens the GSI-IEI link. For example, Japanese automobile manufacturing firms that lack formal contracts suddenly announced they would withdraw from innovation activities with suppliers, which could lead to suppliers' bankruptcy (Saenz et al., 2015). Conversely, when adopting contract control goes well beyond relational norms, it also has a negative impact on the GSI-IEI link. First, limited rational contract control in the face of emergencies may lead to structuring and improving products and technologies in a rigid way (Fang et al., 2011; Huang and Chiu, 2018). Second, the signing of contracts indicates a lack of mutual trust (Cao and Lumineau, 2015; Lu et al., 2015) and reduces relational norms, which weakens the rapid realization of environmental innovation activities through interaction. Based on the above-mentioned discussion, a high level of balanced ambidexterity strengthens the GSI-IEI link. Thus, we hypothesize the following hypothesis:

H4a: Balanced ambidexterity positively moderates the effect of GSI on IEI.

Implementing GSI to achieve REI with challenging and high-risk requires more time, energy and resources (Sheng and Chien, 2016), thus emphasizing both governance mechanisms simultaneously would cause waste. That is, the lower the level of balanced ambidexterity, the stronger the link between GSI and REI. First, adopting relational norms can promote the understanding of environmental goals and expectations between firms and their suppliers, in order to minimize cognitive differences and improve the adaptability of

transformative innovation activities (Poppo and Zenger, 2002). Second, both prior control and post-execution of contracts can increase the transparency of environmental cooperation in achieving REI, thereby reducing the potential conflicts caused by environmental uncertainty (Cao and Lumineau, 2015). Lenovo, for example, has developed specific contracts with its suppliers, providing strong legal protection for the process innovation challenges faced by both parties in green practice (Huang and Chiu, 2018; Wang et al., 2016). In summary, the close balance between the two governance methods weakens the GSI-REI link. Hence, we propose the following hypothesis:

H4b: Balanced ambidexterity negatively moderates the effect of GSI on REI.

4.2.4.2 Combined ambidexterity and environmental innovation

Since the risks and challenges of IEI are relatively small, the pursuit of relational norms and contract control simultaneously may increase the possibility for GSI to achieve IEI better (Blome et al., 2013). First, formal contract signing is the beginning of green practice between firms and suppliers. Such pre-rational cognition reduces difference in the interaction process, thereby enabling faster establishment of clear innovation models and goals (Abdi and Aulakh, 2017; Carson et al., 2006). Second, relational norms emphasize in a coordinated way to enhance environmental innovation through green practices, which makes up for the lack of flexible terms in the contract (Chi et al., 2017). For example, Panasonic is offering its suppliers greater flexibility and autonomy, which promotes environmental cooperation to achieve innovative activities (Wang et al., 2016). Thus, strengthening these two types of governance mechanisms simultaneously can better reduce default and reformulation costs of achieving IEI by GSI. That is, combined ambidexterity enhances the GSI-IEI link. Thus, we hypothesize the following hypothesis:

H5a: Combined ambidexterity positively moderates the effect of GSI on IEI.

The process of realizing REI by GSI requires the establishment of

environmental cooperation channels to address challenges and promote new environmental innovation initiatives (Cao and Lumineau, 2015). Relational norms can achieve common environmental aspirations through joint collaboration and close interaction (Blome et al., 2013), thereby promoting GSI's REI. Moreover, in the face of insufficient legislation and regulatory systems, Chinese firms should also draft complete and complex contracts. These contracts not only contain basic transaction information, but also clarify responsibilities and quality agreements in response to the changing environment during REI (Cao and Lumineau, 2015). However, the uncertainty and complexity of innovation process restrict the joint strengthening of two governance mechanisms (Burkert et al., 2012). First, contracts cannot identify all potential transformative emergencies in advance (Abdi and Aulakh, 2017), such as the cost surge due to changes (Sancha et al., 2016). Thus, strict contract terms provide only limited protection to reduce the routine opportunistic behaviors in GSI's innovation activities (Lu et al., 2015; Wang et al., 2011). Second, strengthening multiple governance mechanisms in achieving complex innovation activities of GSI may increase transaction and maintenance costs, which runs counter to TCE. Hence, combined ambidexterity weakens the GSI-REI link. We hypothesize the following hypothesis:

H5b: Combined ambidexterity negatively moderates the effect of GSI on REI.

We present all hypothesized relationships in Table 4.1.

Table 4.1: A summary of research hypotheses

Hypotheses	Description of hypotheses contents	Relationship direction
H1a	GSI → Incremental environmental innovation	positive
H1b	GSI → Radical environmental innovation	positive
H2a	Incremental environmental innovation → Environmental performance	positive
H2b	Radical environmental innovation → Environmental performance	positive
H3a	GSI → Incremental environmental innovation → Environmental performance	-
H3b	GSI → Radical environmental innovation → Environmental performance	-
H4a	GSI × Balanced ambidexterity → Incremental environmental innovation	positive
H4b	GSI × Balanced ambidexterity → Radical environmental innovation	negative
H5a	GSI × Combined ambidexterity → Incremental environmental innovation	positive
H5b	GSI × Combined ambidexterity → Radical environmental innovation	negative

4.3 Methods

4.3.1 Data collection

The sample of our research comes from Chinese manufacturing firms for several reasons. First, as the key driving force of China's economy, manufacturing accounts for about one-third of gross domestic product (GDP) (CSY, 2019). However, its high resource consumption has accelerated environmental degradation and the occurrence of pollution accidents, which threaten people's lives (Li et al., 2017; Ni and Sun, 2019). Chinese manufacturing firms are increasingly aware of the importance of implementing green supply chain practices. Second, China has proposed relevant innovation development strategies, such as 'Made in China 2025' (Liu, 2016), to deal with environmental issues caused by manufacturing firms. This provides an important context for exploring environmental innovation in China. Finally, China today is valuing interpersonal relations and striving to improve the formal institutional framework (Wang et al., 2019a). This context provides a setting for manufacturing firms to explore the joint implementation of relational norms and contract control to better achieve environmental

innovation by adopting GSI.

Due to the numerous provinces in China, we chose five representative provinces, namely, Jiangsu, Guangdong, Shandong, Henan and Shaanxi. Jiangsu and Guangdong represent a higher stage of advanced manufacturing and economic growth, located in the Yangtze River Delta and the Pearl River Delta, respectively. Shandong represents the average degree of manufacturing level and economic growth, located in the east. Henan, located in the central China, is a heavy industry base. Shaanxi, a traditional manufacturing base in western China, is at an early stage of economic growth. Differences in degree of industrialization, economic development level and geographic diversity can reduce the possible influence of these factors. Thus, we obtained sample firms from these five provinces (Table 4.2). Based on the list gained from administrative division of the economic development zone, this study randomly selected 600 firms as our research samples. Then, firms were invited to participate in the investigation by email and phone. Finally, 284 firms were identified to join in the survey. Table 4.3 indicates that the sample represents a diversity of firms based on type of ownership and industry (CSY, 2019).

To examine the differences between the distribution of sample selection and the distribution of the target population (i.e., Chinese manufacturing firms), the Mann-Whitney U test was adopted (Mann and Whitney, 1947). Our findings demonstrate that the sample selection has no statistical differences in the distribution of type of ownership and industry ($p > 0.05$). We identified one key informant in each sample by phone. Since we mainly examine the environmental benefits of GSI and the moderating role of ambidextrous governance, the informant should be a chief executive officer (CEO), vice president or supply chain manager, who is aware of firms' green supply chain practices and relationship governance style. Although this study only collected data from the focal firm, we also selected 15 firms to collect data of GSI from both the focal firm and its supplier, in order to test the reliability of using

internal measures (Feng et al., 2014). The results indicated substantial correlation between the data from focal firms and their suppliers ($p < 0.001$), suggesting the reliability of data obtained from focal firms.

Table 4.2: Sample characteristics

Characteristics of firms	Frequency	Percentage
Number of employees		
1-49	21	10.2
50-99	9	4.4
100-299	34	16.5
300-999	34	16.5
1,000-1,999	27	13.1
2,000-4,999	37	18.0
Over 5,000	44	21.3
Type of ownership		
Private firms	76	36.9
Foreign-invested firms	47	22.8
State-owned and collective firms	83	40.3
Industry		
Textile	6	2.9
Machinery	18	8.7
Metal products	14	6.8
Food and beverage	8	3.9
Rubber and plastics	14	6.8
Transport equipment	22	10.7
Pharmaceutical and medical	10	4.9
Chemical and related products	11	5.3
Non-metallic mineral products	13	6.3
Instruments and related products	8	3.9
Electrical machinery and equipment	30	14.6
Communication and computers related equipment	45	21.8
Others	7	3.4

Table 4.3: The diversity of Chinese manufacturing firms

Characteristics	Percentage
Type of ownership	
Private firms	62.2
Foreign-invested firms	7.0
State-owned and collective firms	30.8
Industry	
Textile	12.5
Machinery	16.8
Metal products	7.0
Food and beverage	12.0
Rubber and plastics	5.5
Transport equipment	1.4
Pharmaceutical and medical	2.2
Chemical and related products	7.5
Non-metallic mineral products	10.3
Instruments and related products	1.3
Electrical machinery and equipment	7.1
Communication and computers related equipment	4.9
Others	11.5

Note: the same order as displayed in Table 4.2.

The questionnaire was designed according to previous studies on GSI, environmental innovation, relationship governance and environmental performance (Blome et al., 2013; Dai et al., 2015; Li et al., 2010b; Liu et al., 2009; Vachon and Klassen, 2008; Wu, 2013; Zhu et al., 2013). The questionnaire was initially developed in English. Since it is difficult to guarantee the equivalence of concepts by directly translating the scale because of cultural and linguistic biases, the questionnaire was developed with the ‘Chinese-English-Chinese’ method (Du et al., 2018; Wang et al., 2019b). Finally, the Chinese version was adopted in our investigation. Then, a pilot test was conducted in ten firms. In line with the respondents’ feedback, the

expressions and unclear concepts of six items were revised to ensure that they were understandable. Subsequently, a questionnaire survey was sent along with a cover letter stating the purpose and significance of this research and committing the confidentiality of answers. We would remind them every other week and promise to submit a report to them.

Since variables included environmental performance, we collected data by adopting two-waved survey with an interval of six months. First, our study obtained a total of 261 valid questionnaires, reporting a response rate of 43.5%. Second, 206 firms' effective questionnaires (environmental performance) were obtained, reporting a response rate of 34.3%. Although the same survey sample was used to explore the mediating role of social capital accumulation in the GSI-environmental performance link (Zhang et al., 2020), this study focuses on the mediating role of environmental innovation.

4.3.2 Measures

We developed measures of GSI, environmental innovation, environmental performance and relationship governance based on the prior research. GSI was measured via six items taken from Vachon and Klassen (2008) and Wu (2013) to demonstrate that joint action or joint efforts reduce the impact on environment. According to the research study of Dai et al. (2015), environmental innovation is classified into IEI and REI. We measured IEI by using a five items scale, indicating the improvement and utilization of existing resources. A five-item scale was employed to measure REI, which includes the creation and introduction of new environmental concepts and resources. The measurement of environmental performance was derived from the five-item scale of Zhu et al. (2013), illustrating the conditions for improving the environment. Relational norms were assessed by adopting five items from Blome et al. (2013), reflecting the involvement of suppliers in solving environmental problems. Contract control was measured by adopting the three-item scale from Li et al. (2010b) and Liu et al. (2009), which clarifies the

responsibilities and obligations under the contract system. The specific measurement items are displayed in Appendix 4.A.

Ambidextrous governance is divided into balanced and combined dimensions. Balanced ambidexterity refers to the relative size of equilibrium relational norms and contract control. In line with He and Wong (2004)'s method, this study performed the absolute value operation of subtraction between relational norms and contract control. For ease of understanding, we subtract the measure by 7 to represent the larger the value, the higher the balanced ambidexterity will be. In regard to combined ambidexterity, the data of relational norms and contract control were multiplied (Cao et al., 2009), declaring that jointly strengthening these two types of governance will produce a positive/negative effect.

This study included several control variables to reflect the effects of organizational environment and external factors. We adopted the logarithm of the number of employees, the establishment year of firms and the number of years of cooperation with suppliers to measure firm size, firm age and longevity of relationship, respectively. Also, two dummy variables (i.e., state-owned, collective and private firms) were used to measure the type of ownership, with foreign-invested as the base. Industry was measured using four dummy variables: communication and computers-related equipment, electrical machinery and equipment, transport equipment and machinery, with other industries as the base. Since technological uncertainty plays a crucial role in green manufacturing and environmental protection (Wu, 2013), we also control it. All items were evaluated adopting the seven-point Likert scale. Among them, respondents were asked to evaluate GSI from "1" = not at all to "7" = large extent and to assess environmental performance from "1" = none to "7" = very significant. The measures of other constructs were assessed from "1" = strongly disagree to "7" = strongly agree.

4.3.3 Non-response bias and common method variance

This research conducted *t*-tests on the samples to calculate the potential nonresponse bias. First, according to firms' size and age, we compared the responding and nonresponding sample firms (Feng et al., 2019). Results indicated that no differences were found. Subsequently, we also explored the difference between early and late responses and found no statistical difference. Hence, there is no nonresponse bias.

Since each firm only obtained one respondent's questionnaire data, a common method bias (CMB) may exist. According to Podsakoff et al. (2003), the study used several methods to inspect CMB. First, we used different scale standards to measure dependent and independent variables. Second, the first factor accounted for 34.5% of the variance, which was not the majority. Third, we tested Haman's single-factor model using confirmatory factor analysis (CFA), which yielded $\chi^2(435) = 4551.385$ (compared to the six factors model $\chi^2(362) = 783.849$). In line with the above measurement method, CMV does not pose a threat.

4.3.4 Reliability and validity

The study used the exploratory factor analysis (EFA) to assess structural validity (Feng et al., 2014). Findings discovered that there were six factors with eigenvalues beyond 1.0, accounting for 82.9% of the total variance. Additionally, all factor loadings were above 0.8, and *t*-values were exceeding 2.0. Thus, a higher unidimensionality of the structure was demonstrated.

The reliability was evaluated based on Cronbach's alpha. As reported in Table 4.4, Cronbach's alpha values were all greater than 0.8, which was the evidence of reliability. Subsequently, the structure reliability was further verified by composite reliability (CR). Results displayed that all CR values were above 0.8. In summary, the scale of this study has favorable reliability (Fornell and Larcker, 1981).

Additionally, we validated the validity of the structure by CFA and average variance extracted (AVE). First, the correlation between sample data and structure was determined by CFA. All AVE values were above 0.6 (Table 4.4), demonstrating an adequate convergent validity. Simultaneously, the model fit indices were $\chi^2(362) = 783.849$ ($\chi^2/df = 2.17$), NNFI = 0.92, CFI = 0.93, SRMR = 0.07, RMSEA = 0.05. Based on this, this research meets the criteria of convergent validity. Second, this study validated discriminant validity by contrasting AVE with shared variance between the construct and other constructs. Results indicated that the square root of AVE of each diagonal is richer than their non-diagonal dependence (Table 4.5), manifesting the validity of discriminant (Fornell and Larcker, 1981).

Table 4.4: Results of confirmatory factor analysis

Construct	Measurement item	Factor loading	Cronbach's alpha	CR	AVE
Green supplier integration	GSI1	0.900	0.961	0.961	0.805
	GSI2	0.883			
	GSI3	0.824			
	GSI4	0.942			
	GSI5	0.926			
	GSI6	0.904			
Incremental environmental innovation	IEI1	0.907	0.955	0.955	0.811
	IEI2	0.915			
	IEI3	0.840			
	IEI4	0.934			
	IEI5	0.905			
Radical environmental innovation	REI1	0.856	0.958	0.959	0.822
	REI2	0.932			
	REI3	0.929			
	REI4	0.924			
	REI5	0.890			
Environmental performance	ENP1	0.887	0.947	0.948	0.783
	ENP2	0.872			
	ENP3	0.909			
	ENP4	0.878			
	ENP5	0.878			
Relational norms	RN1	0.856	0.891	0.895	0.631
	RN2	0.932			
	RN3	0.929			
	RN4	0.924			
	RN5	0.890			
Contract control	CC1	0.807	0.911	0.914	0.780
	CC2	0.934			
	CC3	0.904			

Table 4.5: Mean, standard deviations, and correlations

Constructs	Mean	SD.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Firm size	6.704	1.723	-															
2. Firm age	2.604	0.770	0.435**	-														
3. Longevity of relationship	1.715	0.600	0.239**	0.387**	-													
4. State-owned and collective firms	0.403	0.492	0.281**	0.298**	0.062	-												
5. Private firms	0.369	0.484	-0.390**	-0.261**	-0.134	-0.628**	-											
6. Communication and computers related	0.218	0.414	0.093	0.096	-0.033	-0.099	-0.015	-										
7. Electrical machinery and equipment	0.146	0.354	-0.137	-0.150*	-0.053	-0.059	0.027	-0.218**	-									
8. Transport equipment	0.107	0.310	0.249**	0.184**	0.078	0.165*	-0.069	-0.183**	-0.143*	-								
9. Machinery	0.087	0.283	0.011	0.111	0.048	0.096	-0.130	-0.164*	-0.128	-0.107	-							
10. Technological	4.581	1.234	-0.058	-0.109	-0.065	-0.074	0.048	-0.055	0.156*	-0.065	-0.020	-						

Constructs	Mean	SD.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
11. Green supplier integration	4.869	1.180	0.098	0.044	-0.003	0.075	-0.060	-0.034	-0.077	-0.024	0.166*	-0.010	0.897					
12. Incremental environmental innovation	4.802	1.257	0.088	0.094	-0.030	0.005	0.029	0.126	-0.118	-0.041	0.093	-0.110	0.387**	0.901				
13. Radical environmental innovation	4.791	1.327	0.079	0.138*	0.045	0.032	-0.048	-0.037	-0.114	-0.007	0.135	-0.089	0.270**	0.399**	0.907			
14. Environmental performance	5.275	1.058	-0.007	0.014	-0.037	0.001	0.007	0.101	-0.032	-0.036	0.069	-0.045	0.331**	0.253**	0.331**	0.885		
15. Relational norms	4.670	0.958	-0.007	-0.028	-0.132	0.052**	-0.203**	0.068	-0.062	-0.062	0.137*	0.001	0.475**	0.281**	0.195**	0.185**	0.794	
16. Contract control	5.304	1.202	0.027	-0.004	-0.011	0.054	-0.109	-0.081	-0.027	-0.047**	0.222**	0.119**	0.323**	0.061**	0.077**	0.076**	0.244**	0.883

Note: * $\alpha = 0.05$; ** $\alpha = 0.01$; *** $\alpha = 0.001$; Square root of AVE value is on the diagonal.

4.4 Results

Our research conducted the hierarchical regression analysis to test hypothesized relationships (Du et al., 2018; Tate et al., 2014). Table 4.6 represents the findings.

The findings indicate that GSI is positively linked with IEI ($\beta = 0.311, p < 0.001$), as does with REI ($\beta = 0.209, p < 0.05$), supporting H1a and H1b. Our results manifest that IEI ($\beta = 0.126, p < 0.10$) and REI ($\beta = 0.291, p < 0.001$) enhance environmental performance. As a result, H2a and H2b are also supported.

To validate the mediating effect of environmental innovation, the basic-mediated regression analysis was adopted (Baron and Kenny, 1986). As indicated by the direct effects above, GSI is significantly linked with both IEI and REI. In model 11, GSI is positively related to environmental performance ($\beta = 0.335, p < 0.001$). As represented in Table 4.6, when IEI ($\beta = 0.132, p < 0.10$) and REI ($\beta = 0.273, p < 0.001$) are added to the Models 12 and 13, respectively, the GSI-environmental performance link was weakened. Based on the above-mentioned steps, the results verified that IEI and REI partially mediate the GSI-environmental performance link. Thus, H3a and H3b are supported.

The moderating role of ambidextrous governance in the GSI-environmental innovation link is manifested in Table 4.6. As presented in model 3, the interaction between GSI and balanced ambidexterity has statistically positive effect on IEI ($\beta = 0.157, p < 0.05$), whereas no remarkable interaction effect is confirmed on REI ($\beta = -0.113, p > 0.1$). Therefore, H4a is supported, while H4b is not supported. Moreover, the impact of the interaction between GSI and combined ambidexterity on IEI is insignificant ($\beta = 0.080, p > 0.1$), while the interaction effect on REI is negatively significant ($\beta = -0.196, p < 0.05$). Thus, H5b is supported, while H5a is not supported.

Table 4.6: Results of regression analysis

Variable	Incremental environmental innovation			Radical environmental innovation			Environmental performance						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Control variables													
Firm size	0.100	0.071	0.062	0.083	0.038	0.035	0.030	0.055	-0.008	-0.032	-0.046	-0.054	-0.049
Firm age	0.071	0.077	0.071	0.058	0.125	0.121	0.117	0.087	0.011	-0.034	0.016	0.006	-0.019
Longevity of relationship	-0.074	-0.045	-0.053	-0.032	-0.024	0.001	-0.003	0.023	-0.039	-0.023	-0.028	-0.020	-0.024
State-owned and collective firms	0.029	0.028	0.026	0.027	-0.045	-0.046	-0.047	-0.049	0.021	0.030	0.003	0.002	0.019
Private firms	0.111	0.141	0.127	0.142	-0.019	0.014	0.007	0.016	0.029	0.021	0.021	0.007	0.028
Communication and computers related equipment	0.100	0.099	0.102	0.095	-0.078	-0.075	-0.073	-0.080	0.115	0.125 ⁺	0.128 ⁺	0.113	0.146 [*]
Electrical machinery and equipment	-0.058	-0.030	-0.026	-0.026	-0.096	-0.088	-0.087	-0.080	0.009	0.044	0.029	0.034	0.051
Transport equipment	-0.055	-0.037	-0.018	-0.038	-0.054	-0.040	-0.030	-0.041	-0.005	0.017	0.013	0.017	0.024
Machinery	0.100	0.040	0.033	0.055	0.091	0.069	0.065	0.094	0.090	0.051	0.041	0.035	0.026
Technological uncertainty	-0.092	-0.079	-0.078	-0.091	-0.068	-0.082	-0.082	-0.103	-0.040	-0.009	-0.041	-0.029	-0.022

Variable	Incremental environmental innovation				Radical environmental innovation				Environmental performance				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Independent variable													
Green supplier integration (GSI)		0.311***	0.346***	0.317***		0.209*	0.227**	0.220**		0.335***	0.287***		0.268***
Relational norms		0.150 ⁺	0.166*	0.177*		0.110	0.118	0.157 ⁺					
Contract control		-0.055	-0.084	-0.016		-0.029	-0.044	0.039					
Mediators													
Incremental environmental innovation (IEI)										0.126 ⁺		0.132 ⁺	
Radical environmental innovation (REI)										0.291***			0.273***
Moderator													
Balanced ambidexterity (BA)		-0.037	0.006	-0.034		0.048	0.069	0.052					
Combined ambidexterity (CA)		0.060	0.028	0.049		-0.136 ⁺	-0.152 ⁺	-0.155 ⁺					

Variable	Incremental environmental innovation				Radical environmental innovation				Environmental performance				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Interaction terms													
GSI × BA			0.157*			0.080							
GSI × CA				-0.113				-0.196*					
R ²	0.062	0.211	0.232	0.220	0.051	0.130	0.135	0.156	0.021	0.143	0.129	0.143	0.195
R ² change		0.149	0.021	0.009		0.079	0.005	0.026		0.122	0.107	0.014	0.066
F(d, f) change		7.162***	5.106*	2.116		3.436**	1.165	5.928*		13.715***	23.938***	3.156+	15.862***

Note: + $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

This research depicts Figures 4.2 and 4.3 to further examine the moderating roles. In Figure 4.2, as balanced ambidexterity of governance gradually increases, the GSI-IEI link continuously strengthens. This finding further validates H4a. Moreover, as indicated in Figure 4.3, a lower combined ambidexterity of governance increases the positive impact of GSI on REI. As such, H5b is further confirmed.

Figure 4.2: Simple slopes for the interaction effect of green supplier integration and balanced ambidexterity on incremental environmental innovation

Figure 4.3: Simple slopes for the interaction effect of green supplier integration and combined ambidexterity on radical environmental innovation

4.5 Discussions

This study explores whether GSI enhances environmental performance through environmental innovation, and it also explores the moderating role of ambidextrous governance on the GSI-environmental innovation link. Our findings indicate that GSI is positively linked with both IEI and REI. This finding is partly supported by Dai et al. (2015). The difference is that our research also indicates that GSI promotes REI. In fact, NRBV manifests that firms are willing to implement GSI to achieve REI, in order to respond to the crisis caused by environmental degradation and achieve greater competitive advantages (Cheng and Chen, 2013; Duhaylongsod and De Giovanni, 2019). First, GSI establishes communication channels for environmental goals to strengthen the awareness of environmental responsibility (Wong et al., 2020; Zhao et al., 2018), which helps reduce risks and challenges of REI. Second, GSI promotes the sharing of environmental knowledge and related technologies (Hammervoll et al., 2012; Wu, 2013), which is an important part of achieving REI and enhances confidence in developing new products and technologies. In summary, our research provides new insights into how GSI can achieve different types of environmental innovation.

Similarly, as hypothesized, both IEI and REI are positively linked with environmental performance. These results expand the views proposed in previous studies in some respects (Cecere et al., 2014; Huang et al., 2016). Firms and their suppliers rapidly reduce environmental hazards by implementing IEI activities, such as utilizing existing environment-friendly materials (Dangelico and Pujari, 2010). Simultaneously, improving processes can also reduce the burden of emissions caused by production and operation. Moreover, REI can avoid harmful consumption and meet regulatory requirements by introducing new environmental protection concepts, thereby reducing the negative impacts on environmental performance (Huang and Li, 2017). The introduction and development of new products and technologies reduce environmental accidents and emissions of toxic substances (Zhu et al.,

2013), which is beneficial to improve environmental state. Hence, environmental innovation promotes environmental performance.

Additionally, we examine the mediating role of environmental innovation, which is of great importance for further understanding the indirect connection between GSI and environmental performance. First, we not only validate Wu (2013)'s result of GSI promoting environmental performance through REI but also add study on the mediating role of IEI. Second, GSI's environmental interaction and knowledge sharing improve the environmental coordination capabilities and stimulate the enthusiasm and willingness to implement environmental innovation activities (Huo et al., 2019; Li et al., 2016b; Wever et al., 2012). As a result, the environment-friendly products, processes and technologies will be gradually developed, which promotes environmental optimization (Li et al., 2018; Sancha et al., 2016). Thus, both IEI and REI play positive mediating roles in the GSI-environmental performance link.

Surprisingly, the moderating role of ambidextrous governance is inconsistent with previous results in some ways (Blome et al., 2013; Liu et al., 2009). These contradictory results need further exploration to make up for the lack of research and expand the boundary conditions. For balanced ambidexterity, it positively moderates the positive effect of GSI on IEI, while it has a negligible moderating effect on the positive connection between GSI and REI. The possible explanations for that are as follows: first, in line with TCE, the closer the relative degree between relational norms and contract control, the lower the adverse effects of governance mechanism dominated by relational norms (or contract control) alone on the GSI-IEI link (Cao and Lumineau, 2015; Chi et al., 2017). In other words, adopting balanced ambidexterity not only ensures equal status of environmental interaction in achieving IEI (Blome et al., 2013; Liu et al., 2009), but also increases flexibility and adaptability of GSI to implement IEI (Fang et al., 2011; Huang et al., 2014). Hence, balanced ambidexterity plays a positive moderating role. Second, considering the complexity of GSI achieving REI, it may be divided into different development stages (Cheng and

Chen, 2013; Huang and Chiu, 2018). For example, adopting contract control at the initial stages of innovation can better reduce concerns regarding opportunistic behaviors, thereby increasing GSI's guarantee of environmental innovation activities (John and Reve, 2010). The development stage usually adopts both relational norms and contract control to cope with various complex environmental changes, which facilitates the development of new products through environmental interaction (Lawson et al., 2009). As a result, firms need to choose the corresponding governance mechanisms according to different development stages, namely, there is no fixed plan. Hence, balanced ambidexterity has no obvious moderating impact on the GSI-REI link.

Our findings manifest that combined ambidexterity negatively moderates the impact of GSI on REI but has no moderating effect of GSI on IEI. It may be because firms and suppliers face uncertainties and risks in the process of implementing joint environmental plan to develop products, such as free riding and abuse of environmental knowledge (Bstieler and Hemmert, 2015). These challenges cannot be entirely addressed even with a higher level of combined governance (Lu et al., 2015; Poppo and Zenger, 2002), instead increasing the time and cost of maintaining relational norms and the transaction cost of contracts (Carson et al., 2006; Nie et al., 2011). Therefore, combined ambidexterity weakens the positive relationship between GSI and REI. Moreover, China has about 75% of small manufacturing firms, so they prefer to adopt IEI that is more stable and gains benefits quickly to achieve 'continued life' (CSY, 2019; Lee and Kim, 2011; Zhu et al., 2012). The size of the firm implies the lack of sufficient capital and technical support (Radas and Bozic, 2009), restricting the implementation of governance mechanisms that strengthen relational norms and contracts jointly. Hence, combined ambidexterity has no moderating impact on the positive relationship between GSI and IEI.

4.5.1 Theoretical contributions

The study contributes to GSI literature in several aspects. First, this study examines the mediating role of environmental innovation, which opens the ‘black box’ in the GSI-environmental performance link. Due to different results on the effect of GSI on environmental performance (Busse et al., 2016; Han and Huo, 2020; Zhu et al., 2007), we explore the mediating role of environmental innovation to unfold the underlying mechanism. Moreover, previous studies mostly adopted only one environmental innovation method (Cainelli et al., 2015; Lee and Kim, 2011), which may weaken the firm’s environmental benefits. Thus, from the perspective of NRBV, we can clarify the benefits among GSI, environmental innovation and environmental performance more comprehensively by distinguishing IEI and REI.

Second, we explore the boundary conditions of ambidextrous governance, providing theoretical contributions to explore under what conditions firms can achieve environmental benefits by implementing GSI. The research study clarifies the moderating role of ambidextrous governance on the GSI-environmental innovation link by analyzing and discussing the different interactions between relational norms and contract control (Cao et al., 2009). Hence, the difference in the degree of using relational norms and contract control affects the environmental innovation achieved by green practices between firms and their suppliers, which expands GSI’s theoretical literature.

Third, this study investigates GSI from the ambidexterity perspective, which enriches our understanding of how to better manage GSI to improve environmental performance. Although the roles of governance mechanisms have been studied in previous studies, most of them focused on the independent impact of one or two governance mechanisms (Cao and Lumineau, 2015; Huang et al., 2014; Wang and Liu, 2019). However, studies have suggested that different governance mechanisms may deal with GSI’s dark side more effectively through collaborative governance (Blome et al., 2013; Shou et al.,

2017). Thus, we explore ambidexterity effects of the two governance mechanisms (i.e., balanced and combined ambidexterity). These results provide insightful views for how to adopt appropriate governance mechanisms to achieve the environmental benefits of GSI.

4.5.2 Managerial implications

This study provides several managerial implications for managers. First, with the continuous deterioration of environment and the increase of social pressure, executives should be deeply aware of the significance of GSI. Thus, firms integrate their suppliers into environmental interaction to encourage both parties to use knowledge and information, and to carry out innovative practices jointly through communication and collaboration to improve environmental performance.

Second, although different types of environmental innovation can improve the social environment, executives should choose appropriate innovation activities according to their own resources and expected goals. Such planned implementation of environmental innovation activities can not only reduce environmental pollution rapidly but also achieve additional economic and social benefits (Fraj et al., 2013; Wijethilake et al., 2018). Moreover, executives should support environmental innovation activities and pay close attention to their implementation process.

Third, when choosing the different dimensions of ambidextrous governance, managers should consider the types of firm's environmental innovations. If firms want to pursue IEI by adopting GSI, managers should be concerned with balanced ambidexterity. For example, firms can offset the negative effects of inflexibility and structuring if they do not implement contract-led governance (Huang and Chiu, 2018; Liu et al., 2009). If firms want to obtain REI by implementing GSI, managers should avoid deficiencies caused by combined ambidexterity. Firms may excessively adopt both relational norms and contracts to achieve REI of GSI, which not only brings opportunistic behaviors

but also increases additional costs (Nie et al., 2011). Hence, managers should cautiously use ambidextrous governance to realize the environmental benefits of GSI.

4.6 Conclusion

This research explores how GSI improves environmental performance through environmental innovation and the boundary conditions of ambidextrous governance on the balanced and combined dimensions. First, GSI promotes both IEI and REI. Second, environmental innovation mitigates environmental pollution in order to enhance environmental performance. Third, both IEI and REI partially mediate the GSI-environmental performance link. Finally, balanced ambidexterity strengthens the GSI-IEI link, and combined ambidexterity weakens the GSI-REI link.

Although our research has several contributions, there are still limitations that should be addressed. First, the research study uses data from Chinese manufacturing firms. Future research can validate the findings in nonmanufacturing firms. It may be interesting to compare and analyze how GSI achieves environmental benefits and the operation of governance mechanisms in different industries. Furthermore, we can also focus on a specific industry in future research. Second, our research only collected data from manufacturers. Future research should also include the perceptions of suppliers. A dual study can better inspect both parties' understanding of concepts to reduce differences (Huang and Chiu, 2018). Third, the research study mainly investigates the boundary conditions of relational norms and contract control from the aspect of ambidextrous governance. Future research can further examine the moderating role of other governance mechanisms, that is, trust, power and social control (Cao and Lumineau, 2015; Huang et al., 2014; Zhou and Poppo, 2010). Finally, since ambidexterity is a dynamic process, future research should adopt longitudinal data to observe how balanced and combined ambidexterity change at different stages of innovation, thereby

affecting the GSI-environmental innovation link.

Part B: Introduction to the eco-industrial park part of the thesis

Background

Over the past three decades, China's economy has grown positively transforming from high-speed growth to high-quality development with the mode of economic growth increasingly changing from extensive⁴ to intensive⁵. According to data released by the National Statistics Bureau, China's GDP grew by more than 6.1% on-year from 2010 to 2019 (NBS, 2020). This indicated that the main macro indicators were kept within a reasonable range in line with this 'stability' remaining a strategic principle of China's economic development.

To maintain stable economic growth, the Chinese government proposed developing industry in geographical clusters and since 2001 local governments were encouraged to develop industrial parks (Depner and Bathelt, 2005; Gu, 2008). By 2018, China established 484 national industrial parks, including 218 economic and technological development zones, 168 high-tech industrial parks, 18 free trade zones, 19 border economic cooperation zones, 19 national new zones, national 19 self-made zones and 23 other development zones (China Development Zones, 2018). So today, industrial parks play a strategically important role in the Chinese economic development.

However, while industrial clustering has indeed achieved rapid economic growth, the concentration of companies in a limited area has also created a

⁴ The mode of extensive economic growth depends on increasing the input of production factors (e.g., increasing investment, expanding factories) to expand the scale of production and achieve economic growth. This method may result in high consumption and cost, poor product quality, as well as low economic benefit (Wilczynski, 1971).

⁵ The mode of intensive economic growth depends on improving the quality and utilization efficiency of production factors (e.g., new technology, improved equipment, increased scientific and technological content). This method may result in lower consumption and cost, thus improving product quality and achieving higher economic benefits (Wilczynski, 1971).

significant increase in pollutants, contributing to environmental degradation and destruction (Yuan et al., 2010). As a result, avoiding environmental pollution and degradation of the ecological environment, whilst also improving energy efficiency have become the focus of attention in China's industrial parks. This has led to a redefining of the industrial ecosystem in the industrialized countries (Lambert and Boons, 2002) into a model of the Eco-Industrial Park (EIP). This was strategy and tool to reduce environmental pollution from industrial clusters, minimize energy consumption and waste generation, and foster resource exchange to achieve sustainable industrial development (Chertow and Ehrenfeld, 2012; Lai, 2013; Song and Shen, 2015), thereby improving the level of sustainable development performance for the economy, environment and society (Tian et al., 2014; Valenzuela-Venegas et al., 2016; Zhang et al., 2010). EIPs have since become a global feature with sustainable practices achieving varying degrees of success (Gibbs and Deutz, 2007; Sakr et al., 2011).

The ecological transformation of traditional industrial parks requires appropriate policy tools and measures to be adopted by key stakeholders (i.e., the local government, relevant park management departments, individual companies, employees and local communities). In China, the coordination, participation and governance of local authorities or other departments have contributed to the sustainability of EIPs (Chertow and Ehrenfeld, 2012). However, the debate on the governance and sustainability levels of EIPs needed further study. Hence, this study provides a theoretical basis to further improve the management of EIPs in China by reviewing and assessing the development history and experience of Chinese EIPs in the last 20 years and with analysis of five case studies. These cases were evaluated using the combined 'sustainability framework for industrial parks' of Kreiner and Franco-García (2019) and the governance context based on the Governance Assessment Tool (GAT) of Bressers et al. (2016). The results first verify the interconnection between the governance context and sustainability.

Subsequently, this study elaborated which specific governance items affect which aspects of sustainability performance by further analyzing the case studies' conclusions.

Case studies

Eco-Industrial Park Management in China

The introduction of concept of eco-industry into China led to the construction of the first EIP projects in 2001 that gradually formed 15 national demonstration EIPs and 45 national trial EIPs (Shi et al., 2003; Shi et al., 2012a). The development of China's EIP can be viewed as a three stage process each with different characteristics.

The first stage was a ***system exploration*** (from the late 1990s to 2006). In October 1999, the State Environmental Protection Administration of China (SEPA-later becoming the Ministry of Environmental Protection [MEP] in March 2008) and the United Nations Environment Program (UNEP) jointly implemented the 'Environmental Management Project of China Industrial Parks', introducing the concept of eco-industry into the planning of industrial parks for the first time. China established its first EIP demonstration park in August 2001 (Zhu et al., 2007c). After six years of exploration, 24 EIPs have since been established (MEP, 2014).

The second stage was a ***comprehensive pilot*** (from 2007 to 2012), focusing on policy development and promotion. In April 2007, the SEPA and two other ministries (the Ministry of Commerce and the Ministry of Science and Technology) jointly released the 'Notice on the Construction of National EIPs'. This gave the requirements for the development of low-carbon economy of EIPs to promote technological innovation and the institutional development policy measures to increase EIP's development (Geng et al. 2012). Subsequently, the ministries issued the 'Guidance on Strengthening the Construction of National EIPs' in December 2011.

The third stage was the ***construction of an ecological civilization*** (from 2013 to present). In this stage, China has integrated green and low-carbon development into the overall layout of development. It has used EIPs as the main measure to promote the construction of ecological civilization (Zhong et al., 2014). China has explored numerous measures and governance programs to achieve the EIP principles, including how to deal with the contradiction between EIP construction and existing environmental policies (Su et al., 2013; Zhang et al., 2010). This stage has provided a fertile territory to validate the influence of EIPs policies on ecological transformation, environmental governance and sustainable development.

Case studies

The five cases examined in this thesis are all located in the Jiangsu Province. Jiangsu is located in the eastern-central coastal province of the People's Republic of China, with its provincial capital in Nanjing. It is bordered by the Yellow Sea to the east, Shanghai to the southeast, Zhejiang to the south, Anhui to the west, and Shandong to the north, as shown in Figure B.1 (Chinafolio, 2019). Jiangsu consists primarily of a wide alluvial plain, accounting for two-thirds of the total area, and most of the province does not exceed 150 feet (45 meters) above sea level (Victor and Frederick, 2016).

Jiangsu is abundant in water resources. It has a large amount of arable land and an relatively well-developed irrigation system, which makes it one of the richest agricultural provinces in China. About 60% of the total arable land is used for rice production. This means the area is often referred to as the 'land of fish and rice' (Chinafolio, 2019).

Jiangsu is also a communication hub of the eastern China region hosting one of the most extensive and convenient water, land and air transportation networks. The construction of the Beijing-Shanghai Railway, the Intercity Railway, the Nanjing Yangtze River Railway, and multiple bridges has made Jiangsu an important railway hub for north-south and east-west travel. The province has

several international airports for international trade. Jiangsu's highway network is one of the most developed in the country. The Beijing-Shanghai Highway runs through the province, and there are several highways connecting the northern part of the province to the southern coastal areas (Jiangsu Chamber of International Commerce, 2016).

Figure B.1: The Map of China. Source: Chinafolio, 2019.

Jiangsu's water transport network has more than 14,000 miles (22,500 kilometers) of inland waterways and around a quarter of goods are transported by water (Victor and Frederick, 2016). These geographical advantages and developed transportation network make Jiangsu a leading province in economy, education, technology and tourism. From 2010 to 2018, Jiangsu has the second-highest GDP of Chinese provinces, after Guangdong as displayed in Table B.1 (NBS, 2019).

Jiangsu has a large urban population, a well-developed industry and its industrial added value has been in the forefront of the country for a long time. The pillar industries are mainly machinery, electronics, chemicals and automobile (The China Perspective, 2016). Traditional development policy advocated economic growth without considering environmental and social benefits. This seriously threatened people's living environment and personal safety such that the development of eco-industry in Jiangsu became inevitable. Jiangsu now attaches great importance to environmental protection and has vigorously promoted the elements to help construct an ecological civilization and gradually established EIPs. From the first batch of national eco-industrial demonstration parks, seven are in Jiangsu and these accounted for nearly half of China's total in 2011 (Jiangsu People, 2011).

Table B.1: List of Chinese provinces by Nominal GDP

Provinces	2018	2017	2016	2015	2014	2013	2012	2011	2010
Chinese yuan per US dollar⁶	6.6174	6.7518	6.6423	6.2284	6.1428	6.1932	6.3125	6.4588	6.7695
Guangdong	1,470.03	1,328.61	1,217.27	1,169.04	1,103.89	1,008.76	904.05	823.84	679.71
Jiangsu	1,399.27	1,271.81	1,165.08	1,125.75	1,059.59	964.82	856.37	760.36	611.94
Shandong	1,155.59	1,075.78	1,024.11	1,011.53	967.42	891.79	792.29	702.33	578.62
Zhejiang	849.23	766.73	711.37	688.56	653.99	609.65	549.15	500.39	409.52
Henan	726.21	659.87	609.30	594.09	568.77	519.78	468.90	416.97	341.12
Sichuan	614.72	547.71	495.83	482.52	464.56	426.15	378.18	325.55	253.87
Hubei	594.90	525.46	491.78	474.44	445.71	400.31	352.48	303.96	235.88
Hebei	550.46	503.81	482.82	478.55	478.95	459.26	420.99	379.57	301.27
Hunan	544.18	502.13	475.01	464.04	440.15	397.56	350.96	304.54	236.92
Fujian	541.06	476.64	433.74	417.12	391.61	353.11	312.11	271.88	217.70

⁶ The historical exchange rates of Chinese yuan to US dollar are based on China Statistical Yearbook 'China Statistical Yearbook (Annual Data)'.

Thus, Jiangsu has played a driving role in accelerating the ecological transformation and industrial upgrading of industrial parks by promoting the sound and rapid development of EIPs. With Jiangsu a clear frontrunner in its development of EIPs, the concentration of the case studies in one province also has the advantage that the analysis and comparison are not complicated by different provincial policies.

The specific geographical locations of the five EIPs in Jiangsu are shown in Figure B.2 (China Tourist Maps, 2010). The information, governance context and sustainability of each park are elaborated in detail through document analysis and in-depth interviews, while the basic descriptions of each cases are given in Table B.2.

Figure B.2: The Map of Jiangsu Province. Source: China Tourist Maps, 2010.

Table B.2: Basic description of the park

Case Feature	Suzhou Industrial Park		Wuxi National Hi-Tech District		Nanjing Economic and Technological Development Zone		Kunshan Economic and Technological Development Zone		Yangzhou Economic Development Zone	
Location	Suzhou, Jiangsu, China		Wuxi, Jiangsu, China		Nanjing, Jiangsu, China		Kunshan, Jiangsu, China		Yangzhou, Jiangsu, China	
Date Established	1994		1992		1992		1984		1992	
Developed area (km ²)	288		220		200		108		133	
Population (thousand)	807.8		569.2		300		660		200	
Main industries	Biomedicine, nanotechnology application, artificial intelligence		Microelectronics, bio-pharmaceuticals, high-end equipment manufacturing, new materials, new energy		Optoelectronic display, biomedicine, high-end equipment, modern logistics, scientific and technological services		Electronics, optoelectronic displays, precision machinery, equipment manufacturing, household goods		Electronic information, solar photovoltaic, automotive equipment, port logistics	
Start time of national eco-industrial demonstration park	2008		2010		2012		2010		2010	

Research methodology

This study adopts the framework of ‘the evaluation of sustainable industrial parks’ (Kreiner and Franco-García, 2019). This results in two tables (i.e., Table B.3 and Table B.4) to be applied to the five Chinese EIPs case studies. The first concerns the governance issues and uses the GAT (Bressers et al., 2016). The second covers the specific evaluation index of the sustainability level of selected EIPs.

GAT

GAT is an assessment tool proposed by Bressers et al. in 2016 to determine under what circumstances the governance environment is supportive, neutral or restrictive for the implementation of measures. GAT can evaluate the overall governance environment to better respond to the way that such context supports or restricts the implementation of policies, or has just a neutral effect that can neither be assessed as being particularly supportive or restrictive.

GAT is derived from the analysis of policy implementation in Contextual Interaction Theory (Bressers, 2004, 2009; De Boer and Bressers, 2011). In Contextual Interaction Theory, policy implementation is seen not only as implementing policy decisions, but assumes that such (un)successful application taken place in multi-actor interaction processes driven by the characteristics of the relevant actors involved (Bressers et al., 2016). These characteristics can be influenced by many factors, of which the policy-to-be-implemented is just one.

The core of GAT is an evaluation matrix of regional governance composed of questions (Bressers et al., 2013a). These special questions discuss the five dimensions of governance context (i.e., levels and scales, actors and networks, problem perspectives and goal ambitions, strategies and instruments, and responsibilities and resources), as well as four quality criteria (extent, coherence, flexibility and intensity).

The different meanings of the four quality criteria are elaborated in detail. Extent refers to whether all relevant aspects or factors are considered. Coherence means that governance elements are cooperating and strengthening without contradicting each other. Flexibility is the option to combine and change multiple channels that support achieving goals or solving problems. Intensity is the degree to which the governance environment requires and supports improving the status quo or current development.

GAT covers all aspects of evaluating the governance context, viewed from five dimensions and four quality criteria. Whenever policies involve the implementation of measures in a complex and dynamic setting, the GAT with its 20 cells provides a structure to better assess the degree to which the governance context affects the implementation of measures. In addition, GAT is not only applied in different countries, such as the Netherlands, Canada, the United Kingdom and the United States (De Boer and Bressers, 2011; De Boer, 2012; Staas, 2017; Vikolainen et al., 2017), but also applicable to various fields, for example field of water policy and climate change adaptation (Casiano Flores et al., 2019; Özerol and Bressers, 2015), industrial parks (Kreiner and Franco-García, 2019), 0-energy buildings (Jain, 2018) and urban mining (Xue, 2018). Based on this, GAT is an important framework for comprehensively evaluating the supportiveness of the governance context, and it is also universal as it can be applied in different countries and at various fields.

This research mainly evaluated the governance context of each EIP through field surveys and interviews guided by the governance questions in Table B.3. Simultaneously, the researchers produced a ‘score card’ for each EIP’s matrix, indicating the relative supportiveness, neutrality, or restrictiveness of the EIP’s governance context with green/yellow/red respectively. The main governance assessment questions shown in Table B.3 were adapted to the Chinese context from the SSEF (Kreiner and Franco-Garcia, 2019), which already included the GAT (Bressers et al., 2016) and sustainability performance criteria.

Table B.3: The governance assessment tool matrix with its main evaluative questions

Governance dimension	Quality of the governance regime		
	Extent	Coherence	Flexibility Intensity
Levels and scales	Which administrative level do you belong to?	Will these levels hold meetings on the main issues and ask for most of the consent?	Once a problem occurs, can it be decisive impact on behavior
	Are these levels taking into account all aspects, or which level is not considered?	Will each level be discussed separately, taking into account all levels of advice (including employees)?	change or management reform? Is there a high level of authority?
	Dose dealing with the issue cover all levels (including cities, parks, companies and individuals)?	To what degree do they depend on each other or are they able to act on their own?	Does the company or employee level only act as an executor or listener?
	Are there any important missing?		suggestions can be heard and adopted?
Actors and networks	Which stakeholders are involved in the process?	What are the respective functions of the stakeholders (participants, decision-makers or beneficiaries)?	Does joint action among stakeholders put strong pressure on behavior change or management reform?
	Are there any stakeholders not involved or even excluded (e.g., the lowest-station employees and the surrounding community)?	What are the dialogue forms between them (who is the leader, the mediator or the bearer)?	Which one can more effectively and quickly change and reform behavior or implement management, is it a single stakeholder or joint action?
		Are these interactions institutionalized in stable structures?	Will the capital in the park be shared behavior or implement
		Do they believe that the decisions others make among various are beneficial or are they willing to comply?	stakeholders? stakeholder or joint action?

Governance dimension	Quality of the governance regime			
	Extent	Coherence	Flexibility	Intensity
Problem perspectives and goal ambitions	To what extent are the various problem perspectives taken into account?	To what extent do the various views and goals support each other, or are they in competition or conflict?	Will the industrial park re-determine its goals after a period of development?	Is there a difference between completion situation and business goal?
	Will the goals of stakeholders with lower status be considered (e.g., environmental protection, remuneration)?	Which stakeholders (decision-makers, implementers or participants) are more important when there is competition or conflict?	Do these goals be disclosed in the White Paper?	When the difference is big, who is responsible for it?
		(e.g., environmental protection, remuneration)?	How do these goals be determined, is it seeking all, part or dictatorship?	Does the completion situation in different pressure on different stakeholders?
			Can multiple goals be optimized in package deals?	
Strategies and instruments	What types of strategies and instruments are included in the policy (e.g. incentives, monitoring and enforcement)?	Are the diverse types of instruments based on synergies (e.g. regulative, incentive, communicative, technical)?	Will different strategies and instruments be used or combined to change the status quo of the problem?	Do these strategies or instruments produce negative behavior? Are these instruments must be required and enforced?
	Does the monitoring tool be included in the development of the industrial park?	Do trade-offs, overlaps or conflicts between the instruments exist?	Is there a choice of strategy or instrument?	What is the extent (strongly, generally)?
				Does it affect different to different stakeholders?

Governance dimension	Quality of the governance regime		
	Extent	Coherence	Intensity
Responsibilities and resources	Which organizations have responsibilities for what tasks under the relevant policies and customs?	To what extent do the assigned responsibilities create competence struggles or cooperation within or across institutions?	Do responsibilities and resources be allocated reasonably without compromising accountability and transparency?
	Does each stakeholder have separate responsibilities?	What legal authorities and other resources are given to them in order to achieve the goals of the park?	Will the stakeholder responsibilities and resources change as the situation changes?
	Does the use of resources involve all stakeholders or parts?	Will these given resources promote inter-agency cooperation or hinder?	Whether resources can flow freely in the park?
	Who is not included?		Will a lower-station actor easily get the resources they need from decision-makers?
			Is there sufficient information and knowledge resource in the park to promote industrial development or regional development?
			What kind of role do these information and resources play in the development of the park and the region?

The sustainability level

To assess sustainability levels, this research adopted the planning and construction, as well as the criteria used in the SSEF that were divided into 14 social, 12 environmental and five economic criteria (Kreiner and Franco-García, 2019). Planning and construction describe the integrated layout of the social, environmental and economic aspects. The social aspects consider the needs of people's livelihood, their education situation, the influence and relevance of organizations and measures, as well as the development strategy. The environmental aspects involve related environmental policies and standards, the implementation of environmental measures, waste management and biodiversity. The economic aspects include the influence on the region, the cost performance of establishing the park and the financial impact. These questions aim to determine the maturity of industrial parks in implementing management tools correlated to the social, economic and environmental aspects. SSEF's subdivision with criteria for social, environment and economic sustainability can clarify the performance of various aspects in different dimensions. Such a framework provides the government or the park management department with detailed aspects that need to be improved.

Using the criteria of the SSEF adopted by Kreiner and Franco-García (2019), which has been applied in Mexico, this study sought questions most suitable for the local scenario and China's special background. Every aspect of the original framework had some dimensions that were inconsistent with Chinese background or expression. For example, in considering the social aspects, we revised the promotion of lodging standards from the original framework to housing infrastructure and standards so it would be more conducive for interviewees to understand its meaning. Namely, whether the park provides housing and subsidies. At the same time, the identification of product responsibility is not explicit in China. In terms of environmental aspects, we removed the water supply dimension from the original framework as this item can be included in the water and wastewater management. In China, water

supply is generally not considered by the park, but is planned and constructed by the government for the use of the whole city, so a park cannot be considered alone. For economic aspects, China pays less attention to eco-efficient transport systems. Therefore, it made little sense to investigate this dimension.

The researchers conducted a field survey on the relevant questions of planning and construction, as well as sustainability aspects. The planning and construction elements can provide more arguments to justify some sustainability effects when prioritizing in the decision-making process. Planning and construction items were not included because this would require more intensive data gathering at the company level and modify the original scope of this research. Thus, these items in each park case are no longer separately explained and shown in Appendix B.1.

Questions of economic, environmental and social aspects in Table B.4 were assessed by the researcher to gain a picture of the sustainability level of each EIP. A color code was again used (green/yellow/red) to represent the sustainability level of each aspect in terms of high/medium/low.

Table B.4: The sustainable strategic evaluation framework

Aspects per dimension	Main descriptive questions
Social Aspects	
Basic public transportation	Does public transportation exist which guarantees an efficient service from dwelling sites to industrial park?
Housing infrastructure and standards	What is the standard of housing, and will there be a subsidy if there is no housing?
Child care	Do childcare centers for tenants exist? Who can have access? Will there be a subsidy?
Social infrastructure	Does a center exist which provides education, leisure, local supply, common catering, medical services for the tenants?
Job creation and Labor	Is the job creation contribution substantial to the region? Are jobs with value created? Does the government have any policies to attract human resources, such as high talent introduction subsidies?
Gender questions (Diversity and equal opportunity)	Are gender policies implemented in the companies? Has the park itself a policy related to it?
Security Practices	Does the park have a secured access? What criteria are checked? Is the work environmentally safe?
Education and training, Job training	Will conduct employee education (including pre-job and post-learning)? Will such training activities be carried out in the long run? Is it strategic?
Health standard	Are specific health standards promoted or asked to be fulfilled by companies in the park?
Emergency service	Are there any emergency service measures in case of emergency?
Anti corruption	Do the park managers or the companies have a code of conduct

	(anti-corruption policy)? Is this demonstrable?
Anti-competitive behavior	Does an anti-competitive policy exist to avoid product price speculation and exhausting raw materials by only one company?
Encouragement of trade unions and NGOs	Are there other non-governmental organizations, such as trade unions? To what extent are trade unions and NGOs influential?
Clear goals and directions	Does the park have a basic development strategy? Does the park have a clear strategy for working with local institutions? Does the park participate in activities that promote economic regional development? Does the park regularly disclose information? Are there included all aspects of environmental, economic and social dimensions?
Environmental Aspects	
Stewardship for environmental laws and standards	Does stewardship for environmental laws and standards exist? Does every company have a basic environmental permit? Does the park have specific energy conservation and emission reduction policies?
Environmental management systems	Are environmental management systems implemented and certified?
Promotion of resource efficiency and industrial symbiosis	Is resource efficiency and industrial symbiosis promoted by the park administration?
Monitoring and control of emissions	Is monitoring and control of emissions performed? Will measures be taken once emissions are found to be excessive?
Water and soil protection	Are measures in place to protect water and soil?
Water and	Is a sustainable water management assured?

wastewater management	Can central wastewater be disposed of in a timely and proper manner? How to recycle the central wastewater, and how often?
Promotion of biodiversity	Is biodiversity promoted?
Efficient land use	Has the land been effectively utilized?
Climate change mitigation and adaptation	Is the development of the park beneficial for mitigating adverse climate change? How are greenhouse gas emission reductions addressed, adaption or mitigation actions performed?
Energy consumption, generation and distribution	Are energy aspects addressed in a sustainable way? Is there a renewable energy and energy network in the park?
Waste management	Does an integrated waste management concept exist? How is the waste management in the park carried out? Will you exchange experiences from time to time?
Materials and energy interchanges	Are materials and energy interchanges taken place? Will enterprises achieve by-product exchanges? Can it achieve zero waste?
Economic Aspects	
Economic viability of management and site concept	Is the economic viability of management and site concept given? Is the cost of resource acquisition lower here?
Fiscal effects on the municipality	Do substantial positive fiscal effects on the municipality exist? Do municipality provide a subsidy to build a park (or a company) to reduce costs (for example, land grants, etc.)? Will there be project incentives and grants if the environment is good? Will local governments reduce taxes?
	Does the industrial park receive complaints from the neighborhood? Does the industrial park need to compensate damage to the

	environment? Does the industrial park have to pay fines to the municipality?
Infrastructure provision	Does the infrastructure provision consider sustainability criteria? Is there a comprehensive consideration of cost performance (all costs associated with the economy, the environment and society)?
Impacts on the regions	Has the regional economy increased in recent years and promoted regional development due to the industrial park influence?

Data collection

This study used multiple sources of data and information to shed light on the sustainability performance of EIPs. It draws on interviews conducted at all organizational levels, covering the local government, park-related departments, companies, employees, and surrounding residents. Since the assessment of sustainable development (i.e., governance context and sustainability index) includes a wide range of 50 major aspects, different methods were needed to address them, as follows: (i) firstly, we used questionnaires to receive answers on relatively clear data, such as promulgated policies and regulations, economic data, basic public transportation, etcetera; (ii) secondly, other questions were designed for in-depth interviews with key stakeholders, and; (iii) thirdly, desk research was used to validate the responses of the stakeholders. Various sources were used to obtain the required data or find additional elements to the answers given from questionnaires and interviews, particularly when the responses were not consistent or contradictory and to ensure the reliability of the data as much as possible. These included the official disclosure websites of each park case gave general information. Some economic indicators are derived from data disclosed on the official website of the National Bureau of Statistics of China. Other information is disclosed in formal documents and news reports on official websites and some information was acquired through search machine functions, such as Baidu or Google.

The researcher prepared questionnaires and interview outlines in advance and then carried out the field research with these two frameworks. Questionnaires

were distributed to all interviewees and in-depth communication conducted to gather the answers. Although interviewees might not be able to answer all of the questions listed on the questionnaire, we told them to respond to the questions as much as practically possible. The original questionnaire was then sent by post. Having investigated the five park cases, the governance context and sustainability results of each park were sorted out and written up. When missing data were found, the researcher would communicate with the interviewees for a second time through communication software (e.g., WeChat) or telephone to obtain data more accurately. During the writing, various sources were used to verify the answers given. Finally, we reviewed the results of the color code again by comparing the five park cases to ensure that the evaluation standards were consistent.

5. Case 1: Suzhou Industrial Park

5.1 Introduction

Suzhou Industrial Park (SIP) waves its banner of reform and innovation and is now ranked among the world's first-class high-tech parks. This section introduces SIP and the park's construction from geographical and environmental information, as well as briefly describing the development process.

5.1.1 Geographical and environmental information of SIP

SIP is located in the eastern Suzhou, Jiangsu Province, as shown in Figure 5.1. The yellow area is Suzhou and the orange label marks the SIP. It is 60 kilometers from Shanghai Hongqiao International Airport, 120 kilometers from Shanghai Pudong International Airport, and 40 kilometers from Sunan Shuofang International Airport (SIP, 2019a). From the railway station at Suzhou Park, it takes only 20 minutes to Shanghai, 60 minutes to Nanjing, and four and a half hours to Beijing (SIP, 2019b). Therefore, the location in terms of access by different means of transportation is very convenient. SIP is an important center in the Yangtze River Delta region for headquarters economy, commercial and cultural activities.

SIP covers a total jurisdiction area of 288 sq.km., of which, the China-Singapore Cooperation Zone covers 80 km² (SIP, 2011). This is an important cooperation project between the governments of China and Singapore. By March 2019, SIP had eight sub-districts with a resident population of about 807,800 (SIP, 2019c). The major industries - biomedicine, nanotechnology application, artificial intelligence, among others - have achieved rapid economic growth. In 2018, SIP achieved a regional GDP of 257 billion yuan; the total value of imports and exports was US\$103.57 billion; the total retail sales of social consumer goods was 49.37 billion yuan; the per

capita disposable income of urban residents was 7.1 thousand yuan (SIP, 2019d).

Figure 5.1: Geographical map of SIP. Source: SIP, 2019b.

SIP is divided into six areas for improved management according to the different functions and roles undertaken in its development process. Figure 5.2 gives an overview of the location of the six partitions. Further to its geographical location and transportation network connecting it to other regions, SIP takes advantage of the Suzhou topography and is surrounded by the Jinji and Yangcheng Lakes. This command a particular focus for biodiversity aspects in the region. In investigations carried out by Nanjing Forestry University in 2014, they registered more than 130 species of birds, 570 cultivated plants, 199 wild plants scattered around, and 328 aquatic organisms swam along the lakes (Huang, 2019).

Figure 5.2: Functional partition of SIP. Source: Wang et al., 2015b.

The establishment of SIP can be considered an efficient urban entity due to the combination of its location and the environmental advantages in relation to the existing city. Additionally, the park provides a good business and ecological environment for company development, balancing the development model of the region.

5.1.2 The historical process of SIP

The SIP Management Committee reports that in the nearly three decades of SIP development, the park has always adhered to the planning concept of ‘integration of industry and city’. The park managers have adjusted the development goals and plans several times. The four stages that the park has experienced are shown in Figure 5.3 (SIP, 2019e).

Figure 5.3: Development stage of SIP. Source: SIP, 2019e.

The foundation stage (1994-2000) was when the idea of SIP was ‘born’ in response to the speech of the China’s leader Deng Xiaoping’s, in which he explained how China could learn from Singapore’s experience. The Chinese leader was inspired during his tour to the Southern of China. The first phase of development and construction was officially launched in May 1994. In this stage, the establishment of basic facilities, such as roads, municipal and living service infrastructure, as well as standard factory buildings was completed. Moreover, the memorandum of understanding on the development of SIP was signed between China and Singapore, marking the formal start of cooperation between these two countries. **Across the development stage (2001-2005)**, SIP started the second and third phases of construction to achieve the goal of a *new industrial city*. Thus, in March 2001, the park entered a stage of major relocation, construction, investment and development. Subsequently, the park has launched a series of plans to upgrade the manufacturing industry, double the service industry and leap-forward science and technology; all this indicating that an international and modern industrial park has begun to take shape. **Then the transformation and upgrading stage (2006-2011)** started and the planned area of the China-Singapore Cooperation Zone was expanded by 10 km². This provided greater development space for SIP to promote the development of productive services, such as independent innovation and modern logistics. In addition, on the basis of the ‘three plans’ of transformation and upgrading in the previous stage, the ‘nine action plans’, such as ecological optimization, double-hundred talents in Jinji Lake, cultural prosperity and happy communities have been proposed, thereby forming a complete system of transformation and upgrading. SIP became one of China’s first eco-industrial demonstration parks in 2008. The fourth and current stage is **the high-quality development stage (2012-present)** when the park has become the concept of a comprehensive *new city* strengthening the functions of industry, production and life services. It has improved administrative, cultural, recreational and

community services and has become a relatively independent comprehensive urban area.

5.2 Assessment of governance context in SIP

During the fieldwork investigation, it was possible to identify some differences when SIP is compared with other EIPs. The interviews mention a diverse range of stakeholders, who seem to have clear responsibilities and influence regarding the strategies applied to the sustainable development goals and changes needed in the park. To assess the governance situation from different aspects, this study mainly conducted interviews at three levels, i.e., the local government, the park and individual companies. The information gathered from interviews from the three levels was analyzed and validated by using related disclosure documents. This approach sought to clarify the governance status of the park more comprehensively. The major reflections after interviews were that there are some differences in the two aspects of levels and scales, and strategies and instruments.

The author performed the governance assessment (GAT) as described (Table B.3) to question the four governance qualities (extent, coherence, flexibility and intensity) and their influence to support sustainable development within the park. The levels and scales of extent were somewhat weak, as it is easy to overlook the employee aspect. The actors and networks of coherence were strong because of the institutionalized and trusted cooperative relationship. In terms of flexibility, it was relatively weak in joining cooperation with new actors and combining different strategies and instruments. The intensity was also weak due to high power distances⁷ and differences in action and practice.

⁷ In high power distance cultures, the lower level person will unfailingly defer to the higher level person, and feel relatively ok with that as it is the natural order. The higher level person accepts this truth as well-or metes out consequences for failure to comply (Sweetman, 2012).

5.2.1 Extent

Extent was better than other governance criteria. SIP's sustainable development governance covers all levels of the local government, the park, companies, employees and surrounding communities. Although all are actively involved, there is still less consideration of the employee's perception. The two major actors in the policy-making process are the local government and the park managers who define the overall goals and make the related plans of the park to guide the broad direction. The costs associated to the entering companies to the park and their impacts on the living environment of local residents were highlighted. SIP has now evolved into a city-like industrial park, which has already shown positive support at all levels. However, the more levels involved, the broader the aspects that need to be considered and, therefore, some aspects may be overlooked. Interviews show that, because the company and employees are in the same organization, it is sometimes easy to equate the feelings and thoughts of the company with those of employees, thus causing confusion.

This governance quality (extent) was found to be positive in SIP interview responses. The park has involved all relevant actors, although, this does not mean that the formulation and selection of park policies also included all stakeholders. Theoretically, the local government seeks to promote the development of the park according to the goals and relevant needs of different actors. One example was observed in the early stage of the park's establishment (1999) when the local government issued the 'Interim Measures for Labor Management of Suzhou Industrial Park' to consider the salary and labor security of employees. Another example from the park's management department indicated they regularly disclose major goal-orientated information, such as personnel appointment and removal, environmental pollution data and monthly economic accountability. The regular reports are meant to better identify the goals success of stakeholders.

According to the interviewees, all strategies and instruments have been covered in the park's policies. An example was the promotion and development of private education strategy. Another example was the development of regulations to approve the investment of company projects. For instruments, there are penalties related to the discharge of water resources and sewage treatment by commercial users, and implementation details for safety involving production licenses for hazardous chemical manufacturers. Moreover, there is evidence of extensive policies and regulations, all facilitated by different functional units in the park, such as the supervision department, public resource transaction management department, among others. A clear set of responsibilities enables better allocation of resources and their full use, which might help to take further action on different topics. Over-all, the extent of governance is positive, but the assessment is a bit weaker regarding the levels and scales item, as it is impossible to cover all aspects of every level, and the employee aspect is sometimes overlooked after considering the company aspect.

5.2.2 Coherence

The interviews on the coherence aspect of the governance context seemed to be less supportive. This assessment depends primarily on the importance of further development and the position of decision-makers. Only in some major issues, such as the plan for the future development of the park, can the local government, relevant departments of the park and other major actors trust each other and join together in delivering their respective responsibilities and obligations. These interdependencies were fully recognized in the interviews. Chinese government's environmental policies appear to play an important role in delivering the sustainable development of the park in a coordinated way. To some extent, lower-level actors were seen as being usually more coherent than higher-level actors. The only factor displaying a positive degree of consistency was precisely because the higher the level, the more committed a person was to make decisions. All of these responsibilities are in the hands of the

highest-level actors in SIP, while other actors have different functions that may help institutionalize interactions and build stable trust relationships.

Although the interviews showed good trust and dependence among actors, in the event of a conflict of goals, executors indicated that they would still rely on the opinions of decision-makers and implementers. As a result, they have only the power to obey and perform. In the course of such development, there seems to be some problems with the consistency of instruments. For example, the proposed methods to control sewage discharge (e.g., the permit management method of urban sewage discharge into drainage network) may include strategies of constructing sewage pretreatment facilities. However, the actual implementation of these strategies was relatively vague, and most were only obtained from reported materials and data. Thus, it is true that the various functional departments and actors have promoted inter-agency cooperation, problems seem to remain. Even if problems are reported immediately, in some special cases the responsibility rests with the decision-maker, suggesting that the degree of interconnectedness between responsibility and resources of departments remains diffuse. While most coherence aspects are just neutral, nevertheless, the cohesion among actors is positive.

5.2.3 Flexibility

The evaluation of flexibility was scored at an intermediate level. However, the interviews suggested this will move to a more positive directions over time. It is worth noting that the park has done a great job upgrading in its levels and scales, and the scope of the goals. In conversations with interviewees, they indicated that SIP mainly focused on the construction of municipal infrastructure and factory buildings in the first decade. However, the rapid development has prompted more and more companies to settle in the park. This has created more social demands for education, community services and places for leisure activities. When these needs and problems arise, actors can

communicate freely according to their own views on the park, without being restricted to the relationship between superior and subordinate.

The National Environmental Protection Department of the park does consult employees on some special environmental protection issues in order to truly achieve environmental goals. Such flexible communication prompts the park to assign responsibilities to various departments in a pragmatic way and to quickly find relevant responsible departments, even individuals, if problems do arise. During interviews, one company employee said that the park provided subsidies for those who continued their education and, consequently, he took this opportunity to study a Master's program. In response, he only needed to bring relevant materials to the Labor and Social Security Department for their procedures. The SIP's sustainability goals are the subject of reformulation, and usually over one-year period or at project milestones. The updated goals will be disclosed in the White Paper of SIP. These flexible behaviors undoubtedly provide strong support to the ongoing rapid development of the park.

On the other hand, it cannot be said that the park is performing well in all areas of flexibility, but it seems that the park has related strategies and instruments to cope with unexpected situations. They do not recommend the use of a combination of different strategies or instruments. This is because when problems arise, it's relatively difficult to tell which strategy or instrument is more effective and efficient. As a result, a relatively conservative strategy or instrument enables decisions to be made faster. Additionally, the park management department said they normally invite companies that enter the park to collaborate after a month or so. Although most flexibility aspects are positive, the flexibility of actors and the combination of different strategies and instruments clearly show areas where needs could be improved.

5.2.4 Intensity

The evaluation of intensity was essentially similar to that of flexibility and was scored in the neutral position. The major problems mentioned are as follows.

All levels in SIP have a strong awareness of the sustainable development governance of the park, and high-level decision-makers still have absolute power when facing major development decisions and strategies. This can cause problems when implementing strategies or instruments because stakeholders have different perceptions of the decision-making process and outcomes and, also, most simply play the role of actors. Thus, while they agree with the implementation of the decision, their actions may be only slightly different from current practice. In addition, there are no instruments at the local government or park level to address issues with different stakeholders explicitly.

The continuous development and expansion of SIP has realized the original intention of establishing a comprehensive *new city*. Such success cannot be achieved without stakeholders who become directly involved in conflicts and transformations, whether they are high-level decision-makers or low-level actors. Interviews demonstrated that the establishment of commercial blocks, such as moonlight pier, was significantly influenced by people surrounding the strategy. This not only meets people's basic needs and urban functions, but also delivers the ecological aims under the construction of the park and long-term development goals. SIP (with its production, living, ecological and social characteristics) has achieved the development goals on an ongoing yearly basis. This can be seen not only in economic indicators, but also in terms of innovative resources and talents (i.e., those people with a high degree of education, technical proficiency and high comprehensive ability with capabilities that will bring value to the development of a company or the park).

The Jinji Lake Scenic Area and Yangcheng Lake Peninsula Tourism Resort also promote the development of the ecological environment and economic performance of the park. Although most intensity aspects are positive, due to China's special national conditions, the high levels have absolute power for strategy planning, while the actual implementation are different.

All these criteria are summarized in Table 5.1 in relation to the governance dimensions using the evaluation color code.

Table 5.1: The governance context of SIP

Governance Dimensions	Governance Criteria			
	Extent	Coherence	Flexibility	Intensity
Levels and scales	Yellow	Yellow	Green	Yellow
Actors and networks	Green	Green	Yellow	Green
Problem perspective and goal ambitions	Green	Yellow	Green	Green
Strategies and instruments	Green	Yellow	Yellow	Yellow
Responsibilities and resources	Green	Yellow	Green	Green
<i>Colors Red: Restrictive; Yellow: Neutral; Green: Supportive</i>				

5.3 Assessment of sustainability in SIP

SIP has become a demonstration park for sustainable development, especially in terms of the social and economic criteria. This study conducted interviews at all organizational levels and referred to multiple sources to obtain its results to shed light on the sustainability performance of SIP.

Sections 5.3.1, 5.3.2 and 5.3.3 describe the findings for the three pillars of sustainable development. As previously stated, the author adopts green, yellow and red to represent the high, medium and low levels of different dimensions in various aspects, respectively.

5.3.1 Social aspects

The evaluation of SIP's social aspects found most of them presented and scored at a green and high level. The only disappointing dimension was the influence of trade unions or NGOs. According to the 'Trade Union Law of the People's Republic of China', primary units, such as companies, institutions, agencies and other social organizations, ought to establish trade union organizations in accordance with law. Therefore, every organization at each level of SIP has a NGO-trade union, but most interviewees indicated that these seemed to have no

substantial influence. When talking with the staff of SIP General Union, in addition to caring and education activities, two particular aspects caught the attention of the interviewer, i.e., one of them was legal aid, the other was psychological counseling.

The park set up an online virtual legal aid center to provide legal assistance to employees and respond within three working days. Such assistance conveniently maintains employees' legitimate rights and protects their privacy. Chinese people are mostly relatively unfamiliar with psychological counseling. However, the interviewer witnessed two people who sought help via the psychological assistance platform during the half hour of the interview. According to the people in charge of the psychological counseling, consultations are not limited to personal relationships in the workplace. They also can cover many aspects of marriage, parent-child or love relationships, as can occur at large. This type of service broadens the idea about the traditional functions of a trade union. Although each union in the SIP does not have the power to make decisions or promote regulations, it is entitled to promote the process of sustainable development in indirect ways, such as enhancing the work confidence and caring for its employees.

The construction and provision of infrastructure in the park was considered generally positive by interviewees. Employees can use public transportation free of charge and the number of trips available provides a capacity that is sufficient. However, managers revealed that most employees live in the park and prefer to commute in an environmentally friendly way (e.g., biking or walking), even if the distance between their residential and industrial communities is longer. Park managers are assuming that the way of commuting to the park might be a waste of time and resources and already are considering how to improve this situation. At present, based on the China-Singapore Cooperation Zone, the park has expanded to the surrounding areas. It has built shared facilities with integrated urban functions, such as education, health, business and leisure, community services and other modern supporting

infrastructure. However, housing for the talented and child care needs to be improved. The employees interviewed reported that, due to inadequate purchasing policies, many housing agencies exist that hinder those who really want to buy a house.

There are 77 public and private kindergartens in the park (SIP, 2019f). The relevant actors indicated that this would create a relatively chaotic administration and also provide no subsidies. All the interviewed employees indicated that the park and companies provide irregular training programs and also hold regular safety education training courses. However, the park management departments found that the security measures of different companies were not uniform and needed to be improved.

During this interview, I went to a company specializing in the chemical industry to find out whether the park could guarantee the health and workplace's safety of employees in such hazardous sector. This investigation showed that the park carries out a series of supervision and inspections according to relevant laws and regulations (e.g., the implementation plan for comprehensive management of hazardous chemical safety in Suzhou Industrial Park) and in tune with the safety supervision department at the company. This strengthens the safety of production and emergency rescue capabilities, and also effectively prevents and curbs the occurrence of hazardous chemical safety accidents. Workplace comfort seemingly corresponds to international standards. Different public documents show the park has been at the forefront of economic growth (SIP, 2019d). All interviewed actors stated that the income of each family has indeed increased substantially. In addition to the talent introduction plan of Suzhou, the park issues an annual talent introduction announcement every year to match its development situation. The park also attracts high-level graduates at home and abroad by providing preferential policies, such as housing subsidies and salary subsidies, alongside access to the resources of foreign world-class universities. This has formed a chain linking up effect between the high-tech industries. The park values talent that helps

realize the development process of the evolving the 'industrial parks - industrial new city - comprehensive new city', which all accords with the initial planning concept. The disclosure of each implementation step itself promotes better development.

5.3.2 Environmental aspects

The evaluation of environmental aspects was relatively positive and there are strict environmental standards and emission reduction policies. The park stipulates that each company must have a basic environmental permit and ISO14001 or similar environmental management system certification, and regularly must issue project environmental assessment documents. SIP draws on Singapore's development experience, so park managers revealed that SIP from the start had considered key issues, such as pollutant monitoring. In the 1990s, monitoring equipment was set up in public areas. Subsequently, companies were required to carry out self-inspection and periodic spot inspection. Once problems are discovered, compulsory measures, such as deadline rectification and punishment, are immediately taken. For example, the park has installed an online monitoring system for water pollution sources. This consists of sewage pipe networks to remote monitor regional sewage treatment. Comprehensive water resources management projects have been carried out continuously, and network-type green space ecosystems and urban landscape water systems have been established. The park discloses groundwater test results every quarter. Soil environmental quality has been systematically tested since 2018. Both sets of results are published in the SIP's annual environmental quality report. Central wastewater is recycled sometimes. There are strict laws and regulations on greenhouse gas emissions and the park conducts training on greenhouse gas emissions reporting for key companies. The major greenhouse gas emissions data disclosed in 2018 found the annual average concentration of NO₂ was 45mg/m³, the annual average concentration of SO₂ was 8mg/m³, and O₃ was 172mg/m³ (SIP, 2019g). These indicate that climate change impacts have been effectively managed or mitigated.

Some projects took about two years to establish at the beginning of SIP, including the underground pipeline network, the gas distribution network and the ground engineering construction. This strategy established a relatively complete energy network that greatly improves the efficiency of urban development and construction. Company managers indicated that they would willingly exchange materials and energy to achieve zero waste. However, in order to achieve this, experience exchange and cooperation need to be strengthened.

The park attaches great importance to biodiversity. Relying on its unique geographical advantages of three major hydrophilic commercial districts (i.e., Jinji Lake, Dushu Lake, and Yangcheng Lake), the Dongsha Lake Ecological Park is well established and promotes the harmonious development of people and nature more effectively. The great importance afforded to ecological environment protection and adherence to the principle of ‘environment or ecological protection area’ is witnessed by the urban green coverage rate that stands now at 45%, and the natural wetland protection rate at 52.6% (Huang, 2019).

5.3.3 Economic aspects

SIP’s performance against the criteria to assess economic sustainability was all positive. By 2018, the park occupied 3.4% of Suzhou’s land and supported 7.6% of the population, whilst contributing to about 16.7% of the economy wealth. In the comprehensive evaluation of state-level economic development zones announced by the Ministry of Commerce, SIP ranked first for three consecutive years (2016, 2017, 2018). It also ranked high among the world’s first-class high-tech parks (SIP, 2019d). This performance shows the park’s income has had a positive impact on the region’s economy and increased employment opportunities.

In 2018, both GDP per capita and GDP energy consumption have basically reached the level of developed countries, suggesting that the operation of SIP

has not only promoted regional economic growth, but also achieved long-term development goals.

Figure 5.4 visualizes the SIP sustainability using color codes to contrast the different levels in each aspect.

Figure 5.4: The specific visualization of SIP sustainability

5.4 The influence of governance context on sustainability in SIP

The second and third sections have described the current status of governance context and sustainability. Now considering the park's development concept, geographical advantages and interview findings, this section studies the relationship between the governance context and sustainability performance. The analysis makes use of the specific evaluation index of the three aspects sustainability levels (social, environmental and economic).

The influence of governance context on social aspects. The park has a baseline set of goals and needs for stakeholders at all levels. The interview outputs were assessed against these and the results reflected positively for

public transportation, education, job training and income. Infrastructure, such as education, leisure and entertainment, have also been improved. It was also clear that, because stakeholders at all levels have been directly involved in both conflicts and transformations, the different zoning plans have also been successful.

In the four stages of SIP development, the local government and the park management department willingly formulated multiple goals. These were reformulated again afterwards as required to deal with relevant and critical aspects. The park promotes transparency by disclosing the updated goals in their White Paper. This governance strategy is conducive to realizing clear long-term development goals and directions for the park and, thereby, establishing a good approach to space layout and structure. Figure 5.5 illustrates the basic space layout alongside the goals of each stage.

Figure 5.5: Basic situation of space layout

Given the experience of the China-Singapore cooperation area, the local government and the park management department have established numerous policies and regulations and assigned responsibilities to different departments. These practices and behaviors can, theoretically, ensure the effective implementation of health standard, emergency services and talent introduction

programs from the regulation level. They can also involve relevant functional departments in solving any issues in a timely manner when problems do arise.

Trade unions were not found to be the substantial influential organs that they should be. This represents the only negative aspect of the social dimension and this cannot be separated from the governance context. High-level decision-makers, usually the local governments, have absolute power in China and, in the case of competition or conflict, the opinions of decision-makers (the local governments) and implementers (relevant departments of the park) are very important. These circumstances indicate that NGOs, at present, have no substantial influence in such decision processes. However, the SIP General Union was moving towards a more positive position. NGOs do undertake other social responsibilities besides providing activities, such as caring. The position of the unions in SIP mirrors China's national condition indirectly.

The impact of governance context on environment aspects. Local government and the park levels have clear environmental policies and regulations on different pollution phenomena, such as the 'Regulations on the Prevention and Control of Environmental Noise Pollution in Jiangsu Province' introduced in 2005. Thus, each company must have an environmental permit and deploy the ISO 14001 environmental management system.

The park has clear responsibilities and ability to make full use of resources. This has facilitated the establishment of a relatively complete energy network. At the same time, the functional departments can also strictly monitor different environmental pollutants. For example, the department of land and environment protection monitors relevant information, such as air quality and pollution sources and regularly publishes the results of environmental monitoring and posts announcements of polluters. This has a positive impact on the climate, water resources and other environmental aspects of SIP.

The park makes full use of Suzhou's geographical resources and its long-term goal is to build a comprehensive *new city*, so biodiversity enhancements can be

better achieved. The concept of long-term development promotes the exchange of materials and energy in the park to help achieve zero waste.

Although governance recorded no negative impact on any aspect of the environment, some areas still need to be improved. First, while regulations or policies may have been proposed at the decision management level, their actual implementation may be unsatisfactory. For example, the Suzhou Municipal Government promulgated the ‘Regulations on the Prevention and Control of Pollution by Hazardous Wastes (2003)’, SIP proposed ‘Standards for Hazardous Waste Storage Pollution Control (2001)’ and other policies and regulations to stipulate and publicize the standardized management of wastes. Policy makers believed that good communication and waste management could be achieved in this way, but the situation has not been ideal. This is because regulations and policies are only superficially supervised and need the real situation to be mutually supervised, as well as with information and coordinating exchanges between policy makers, implementers and actors. Second, different stakeholders’ perceptions can have a negative impact on the environment. Laws and regulations issued by the local government, for example, the experiences under the ‘Regulations on the Protection of Water Quality of Yangcheng Lake in Suzhou (2007)’, and the ‘Guidelines on Water Environment Management (2018)’ formulated by SIP. These strategies and instruments indicated the need for central wastewater treatment and senior management also believed that they have achieved it. In practice, however, there was no clear instruments to address this problem, and the behavior of actors (mainly companies) was not as planned and this slightly different. Therefore, it was unclear how and how often to carry out the central wastewater recycling, and no relevant information has been disclosed.

The impact of governance on economic aspects. The economic assessment of SIP generally is positive as can be seen in Figure 5.4. and is closely related to the governance situation. The rapid development of the regional economic level has been experienced because SIP set annual goals and had a desire for

long-term development, regional economic development and improved cost performance, among others. The park's information and resources also encourage the local governments to provide subsidy policies, thereby increasing employment opportunities.

5.5 Conclusion

We analyzed the governance and sustainability aspects of SIP using the results of field interviews combined with analysis of SIP's philosophy, policies, regulations and approach to open disclosure of information. Levels of governance and sustainability, in a broad sense, were positive. Some connections do exist between the two aspects; namely, that the governance context was supportive to the sustainable strategy of SIP. SIP has focused on integrated governance (i.e., extent, coherence, flexibility and intensity), and development towards a relatively independent comprehensive urban area. This strategy promotes the realization of all aspects of the park's sustainable development. This has embraced a range of social, environment and economic factors, rather than just focusing on only one or two aspects. SIP experience is worth learning from. Its governance context clearly promotes the social aspects of sustainability and emphasizes the environmental aspects of ecological diversity. However, although China's national conditions display the high power distance, it is hoped that the park can avoid related issues in the future and pay equal attention to all levels of different stakeholders. Such changes can promote the management and communication by the environmental departments and improve these environmental aspects.

6. Case 2: Wuxi National Hi-Tech District

6.1 Introduction

Located within the birthplace of Wu culture, the history of Wuxi National Hi-Tech District (WND) has a context dating back more than 3,300 years. WND has emphasized the spirit of Wu culture's focus on 'morality, culture, pragmatism, and innovation'. It has become the economic engine behind Wuxi's opening-up and brought prosperity and abundance to the region.

6.1.1 Geographical and environmental information of WND

WND was established in 1992 and was given administrative status and named Xinwu District in February, 2016 (WND, 2016). Xinwu District is located in the southeast of Wuxi, Jiangsu Province, bordering Suzhou to the east and Taihu Lake to the south. As displayed in Figure 6.1, the light blue area corresponds to WND. It is located about 10 kilometers away from Sunan Shuofang International Airport, which has opened up more than 40 direct routes to Hong Kong, Macao, Tokyo, Singapore, South Korea and other countries. The Shanghai-Nanjing Intercity Railway has three stations in Wuxi, one of which is located in WND. This has shortened the travel time to Shanghai to only 30 minutes, and a trip to Beijing in 4.5 hours (WND, 2019a). This network of the international airport, the intercity high-speed railway, the Beijing-Hangzhou Grand Canal and multiple expressways constitute a three-dimensional transportation system, making XWD an important exit point to the rest of the world.

Figure 6.1: Geographical map of WND. Source:
<http://www.wsip.com.cn/English/ContactSubUsEn/366.html>

WND covers a total administrative area of 220 square kilometers and, by December 2016, had jurisdiction over six sub-districts. The latest data displays the resident population to be 569,200 people (WND, 2019a). The major industries are: microelectronics, bio-pharmaceuticals, high-end equipment manufacturing, new materials and new energy, among others. All of these have registered rapid economic growth. In 2019, a regional GDP of WND grew 6.3% to 184.55 billion yuan (\$26.08 billion); the total industrial output value above designated size had reached 421.76 billion yuan, a year-on-year increase of 2.2%; the total import and export volume amounted to \$50.63 billion (WND, 2019a). The output value of strategic emerging industries, such as integrated circuits, biomedicine, new materials and new energy, have all achieved double-digit growth, and the output value of high-tech industries accounted for 64.6% of the total industrial output value above designated (WND, 2019a). The district is functional partitioned according to the type of industry. The district currently administrates Wuxi (National) Software Park, WND VLSI Industrial

Park, Wuxi Hi-Tech Park, Wuxi MEMS Park, Wuxi Life Science Park, WND Free Trade Zone, WND New Energy Industrial Park, Wuxi-Singapore Industrial Park and University Tech Park of Sensing Network (WND, a), as shown in Figure 6.2. Such a partition cannot distinguish clearly between living and industrial production areas, so it is relatively chaotic. Apart from its geographical and transportation advantages, WND also hosts the Taihu Lake scenic area and Hongshan mountain. Over 10,000 mu (667 hectares) of farmland weaves through the district that show off a different kind of tranquility (WND, 2019a). The district is the historic birthplace of Jiangnan civilization and Wu culture that make it attractive for a number of cultural and ecological resource scenic spots. The Hongshan Site Museum, Meicun Erhu Industrial Park, and China Stone Garden are among the most well-known. This perfect combination of history and natural environment has helped create a modern agricultural tourism sector.

Figure 6.2: Functional partition of WND. Source: WND, a.

WND combines unique historical resources, environment and urban location advantages attracting high-level talents who come for innovation and entrepreneurship. This is complemented by the convenient transportation and a good ecological environment for the development of companies.

6.1.2 The historical process of WND

WND's development has evolved over some thirty years and the district has gone through several development changes without clear stage nodes. According to documentation found on this topic, a timeline of four development stages is suggested (Figure 6.3).

Figure 6.3: Development stage of WND

The **first stage** was the initial establishment stage (1992-1995) and started with the wish to rapidly develop the economy. Therefore, the Wuxi National High-Tech Zone was established in 1992 with the approval of the State Council (WND, 2016). In 1993, the government of Jiangsu Province approved the establishment of Wuxi-Singapore industrial park (WND, b). The rapid development of high-tech zone and Wuxi-Singapore Industrial Park saw Wuxi New District finally established in 1995 that includes Wuxi national high-tech industrial development zone, Wuxi export processing zone, Wuxi xingzhou industrial park, Taihu international science and technology park, among others. Since then, industrial parks established with different industry types have formed the Wuxi New District.

The **second stage** (high-speed propulsion stage) took place from 1996 until 2009. First, Wuxi adjusted its administrative divisions, thus expanding the scope of any regular new district. Eventually, the jurisdiction over six sub-districts, namely Wangzhuang, Shuofang, Jiangxi, Meicun and Hongshan,

and the Xin'an sub-districts, was realized (WND, 2019). Second, since the development concept of circular economy, new district has optimized the industrial structure and promoted the strategy of 'reinforcing the chain' and a path for 'environmental harmony'. This established the small cycle with the company, the middle cycle with the ecological park and the large cycle with the green new area. The park was designated as an eco-industrial demonstration park in 2010 (Ministry of Ecology and Environment of the People's Republic of China, 2014).

The **third stage** (industrial development stage) occurred between 2010 and 2016 when the industrial economy developed steadily and the new district changed its strategy to promote advantages by continuously expanding the scale of its core pillar industries. Some landmarks were constructed, such as the Sunan innovation demonstration zone. This accelerated the introduction and concentration of scientific and technological resources, and basically achieved full coverage of company R&D institutions. In February 2016, it was renamed Xinwu District (WND, 2016).

The **current and fourth stage** corresponds to the high-quality development stage (2017-present) when the region has been guided by high-quality development and strives to achieve 'two regions and three highlands'; meaning the WND aims to become the new highland of modern industry, technological innovation and open to the outside world, the pilot region of industrial integration, and the liveable new urban region (Management Committee of Wuxi National High-tech District, 2016).

6.2 Assessment of governance context in WND

Using the GAT (Bressers et al. 2013a, b), this section presents the findings regarding the four qualities of governance: extent, coherence, flexibility and intensity. WND has a positive assessment for only three dimensions (i.e., the extent of actors and networks and responsibilities and resources items, as well as the coherence of actors and networks item), but most were neutral

assessments indicating that, to some extent, the district's quality of governance context is neither supportive, nor restrictive, but rather modest.

6.2.1 Extent

Extent was assessed as a relatively strong quality of the governance context. Only two out of five dimensions indicated a positive assessment. All stakeholders were considered in the WND's sustainable development. This involves the high-level stakeholders formulating or implementing policies (i.e., the local government and the district), together with other low-level and medium-level stakeholders.

During the interviews, local government officers and the relevant managers of the district said that WND has considered multiple aspects involving different stakeholders. The district has established a complete public cultural service system. A standardized version of this system has been included in a demonstration project by the Ministry of Culture to meet residents' expectations and, as a result, equality and high quality of education, modernization, balance, wisdom and internationalization of education have been greatly improved.

The one that impressed me most was on social security. Interviewers revealed that WND's minimum living security⁸ had 100% coverage by 2018, as well as there are eight nursing homes in this district to guarantee minimum living standards for local residents and to provide temporary assistance to needy families (WND, 2019b). These examples show how all stakeholders have been involved in the construction and development of the district and that sufficient resources have been made available for appropriate allocation. The district also

⁸ The minimum living security refers to the social security system in which the state provides certain cash assistance to the population whose per capita income is lower than the minimum living standard announced by the local government to ensure the basic living of the family members (People's Daily Online, 2013).

has different functional departments, such as the development and reform commission, the agriculture and rural department and the urban administration department. Their responsibilities relate to the various stakeholders involved.

With the exception of the above two dimensions (i.e., actors and networks, responsibilities and resources), the other dimensions of extent were assessed as ‘neutral’. This means that, even though all levels are involved in the construction and development of WND, there are still relatively few considerations for companies and employees. WND is the only development zone in Jiangsu that was selected as the national ‘thousand talents plan’ innovation and entrepreneurship base. It has been successfully approved as the national sensor network innovation demonstration zone, national innovation park, and national intellectual property pilot park. Therefore, it attaches great importance to the construction of education and talent cultivation. As a result, they have given this more consideration to the development at company and employees levels.

The district also follows the concept of circular economy, rather than the traditional comprehensive (linear) development. Disclosures are only made for major goals (e.g., strategic direction, environmental pollution data and overall economic conditions). These goals usually consider most stakeholders. Some examples include: the building of a systematic three-level medical consortium and a smart medical system to provide most stakeholders with comprehensive and full-cycle health services; and constructing ‘10 minutes park green space service circle’ to strengthen ecological protection. In terms of strategies and instruments, all strategies are covered in the park’s policies. However, relevant district managers have expressed that they lack some instruments, such as a punishment system.

In summary, actors and networks and responsibilities and resources were positive, while levels and scales, problem perspectives and goal ambitions, as well as strategies and instruments, were neutral.

6.2.2 Coherence

Only the dimension of actors and networks was evaluated as positive by respondents. Although currently there are few actions that solve sustainability governance at the Wuxi local government level, there seems to be a ‘culture of coordination’ of policy or decision-making among different functional departments. Other levels seem to aspire to coherence. Thus, higher levels are mainly responsible for decision-making on actions conveyed down through the lower organizational levels. Different roles in connection to the level of the function go from superior (decision-maker) to subordinate (implementer and actor). This reflects the stable institutional order of the interactive process.

Interviews reported that the local government would hold meetings for environmental development goals and future policy orientation. The finance department also holds meetings on related economic development and, according to the concerns and types of issues, different functional departments will hold separate meetings. As a result, there are already multi-level discussions on issues that are comprehensive, such as development strategies. This reflects basic mutual trust and dependence.

Strategies and instruments were found to be neutral in terms of coherence. The analysis of interview answers and several online documents found that related strategies and instruments did produce synergy, but that such synergy was based on the interpretation of policies by officers of relevant functional departments. For example, the natural resources planning department had interpreted comments on the ‘regulations of natural resources normative documents’ in detail, but some level of conflict was detected between the literal interpretation and the actual implementation process of the actors.

Problem perspectives and goal ambitions, as well as responsibilities and resources, were assessed as neutral in terms of coherence. Each actor had some responsibility for certain aspects of district development. However, it is unclear whether an actor had the responsibility to link all the knowledge about different

aspects, and to outline the goals of the district's sustainable development and whether all aspects were balanced. Therefore, because the sustainable development of the district has indeed realized a high value, this had encouraged stakeholders at all levels and relevant functional departments to participate in. Although they can participate in and have their own unique insights, their influence was still different; namely, the less the influence, the less the responsibility of relevant stakeholders. Hence, in the case of conflicts among stakeholders, the goals of decision-makers and implementers are relatively important because of the greater burden of responsibility. While the overall situation for the coherence of governance was neutral, the assessment was positive regarding the actors and networks item. The reason for the positive assessment is that all stakeholders were willing to engage in institutionalized interactions based on different roles.

6.2.3 Flexibility

All dimensions of flexibility were evaluated as neutral. This was reflected in the attitudes of relevant decision-makers when stakeholders put forward ideas or suggestions. For example, improving the quality of the education system was originally proposed by the surrounding residents. However, the local government was focused then on improving the economy. Therefore, residents failed to persuade policymakers to achieve the goal of improving the education quality. There does not seem to be much flexibility in moving up and down levels when dealing with such issues or suggestions, when key decisions are mostly taken by senior managers in a one-way flow that can only move from a high-level to a low-level and not the other way around. This type of communication pattern requires time to reformulate goals or standards during the development process. For example, the district took the lead in formulating the 'manufacturing project evaluation method', which limits the entry or rectification of companies with high resource consumption, high pollution level and poor environmental behavior according to eight criteria. Hence, this sets a detailed and sophisticated set of rules that are difficult to reformulate. However,

as the development continues to change, the district has modified in tune with the actual situation and historical data, as well as after disclosing major decisions in the White Paper of the district.

Because goals and plans are difficult and slow to change, most actors believe that responsibilities should be assigned according to different tasks and that it is problematic to assume new responsibilities, even if changes occur. However, the implementation system suggests remarkable flexibility at the small-scale in terms of overall long-term development goals and planning thinking. There is a cooperation culture among actors and the stakeholders interviewed generally agreed that their interests were considered as much as possible. In the participation process, the district managers stated that, if new actors joined in, requirements and suggestions would be made on various aspects, such as land and environment, when the project was approved. However, companies interviewed believed that this was not the case and that the time they did join in the district's work process was uncertain. Our interviews suggested it is possible to adjust the distribution of responsibilities. As mentioned above, all flexibility aspects were neutral and need to be strengthened.

6.2.4 Intensity

All dimensions of intensity were also neutral. The local government or the highest management department of the district seems to constitute the most relevant level in the decision-making chain related to sustainable development. Although companies cannot develop new strategies and directions to deal with new issues under the changing environment conditions, they still have the right to act. At the provincial and the local levels, activities for the improvement and control of VOC emissions have been initiated, but are limited to the communication of policies and regulations. The local government reported that such strategies have little effect on their daily behavior, because they are too broad to specify the needed concrete behavior of actors. As a result, actors

(mainly companies) will adjust their strategies or instruments according to their own experience and strategy.

This suggests that, in most cases, only the top decision-makers or implementers have an impact on reform or behavior change given their responsibilities and obligations for sustainability goals and environmental issues. Although they realize the importance of some issues or goals, they are not able to deal with them. Accordingly, individual actors make minor modifications to achieve desired goals. In such cases, the relevant actors, especially the lower-level actors, believe that their responsibilities have been basically the same. The advantages of geography, transportation and historical resources have indeed promoted WND to achieve the sustainability goal embracing a development model combining circular economy with innovation and entrepreneurship. However, there are other factors that affect development, such as the economic context. Hence, the overall assessment of intensity of governance context was neutral.

Table 6.1 summarizes the evaluations done by interviewees for each governance criteria in relation to the governance dimension.

Table 6.1: The governance context of WND

Governance Dimensions	Governance Criteria			
	Extent	Coherence	Flexibility	Intensity
Levels and scales				
Actors and networks				
Problem perspective and goal ambitions				
Strategies and instruments				
Responsibilities and resources				
Colors <i>Red:</i> Restrictive; <i>Yellow:</i> Neutral; <i>Green:</i> Supportive				

6.3 Assessment of sustainability in WND

WND has worked hard to create a new ground of high modern industry and technological innovation. The economic aspect is relatively positive when

compared to the social and environmental aspects of sustainable development. This section describes the three sustainability aspects again using color code to display the different levels of various aspect.

6.3.1 Social aspects

The fieldwork found that nearly 80% of the social criteria qualified as either neutral or negative. Hence, the overall social assessment was considered weak. 70% of respondents said that they had never used public transportation, so the relevant transportation information was not clear for them and they could not answer this question. The remaining interviewees reported that basic public transportation was rarely used, as there are few stops and shifts. Managers revealed that the public transportation was suspended at that time because the roads in the district were being upgraded, and they considered to hand over the services to the bus companies.

In addition to no longer providing public transportation services, the district does not provide housing and child care, and there is clearly no subsidy for that. However, the local government actually has subsidy policies for talent introduction. Unfortunately, policies seem restricted to official documents and are not clearly explained or regulated. Shared facilities, such as catering and entertainment, also are not provided centrally by the district. Medical services are provided by various companies with medical insurance, and the first hospital in the district, Xinrui Hospital, opened in 2019 (WND, c). Thus, people often need to travel further afield for medical treatment. The district management did say they had started to pay more attention to these issues.

Interviewees said that they focused on the constructing education-related infrastructure and achieved excellent results. With the development of WND, stakeholders' demand for other aspects had increased dramatically. For example, they plan to build the Changqiao Ocean Kingdom Scenic Area to increase entertainment infrastructure.

The social aspect shows three positive criteria that were evaluated positively as follows. Each company has a comprehensive emergency rescue plans and, for some special and common events, such as trapped elevators or fires, held emergency rescue drills. The district regularly releases emergency scientific knowledge and conducts emergency management training courses, as does the trade union. The district has always adhered to the development concept of circular economy. Since 2010, it has evolved its main development strategy to expand the scale of pillar industries to promote the continued leading of innovation and entrepreneurship. This strategy works with the local government, research institutes and top universities and, as a result, the industrial economy has achieved considerable development, especially in manufacturing, relevant economic data and development information. This economic data are also openly disclosed.

Other social criteria listed in Table B.4 were considered neutral by interviewees. However, the district's managers proudly pointed out that there are undoubtedly many talented people willing to work here given the considerable job opportunities available offered by the top 500 companies and foreign companies. Even so, there is no obvious evidence (i.e., data) of any improvement in household income. Similarly, the district has basic regulations and policies, for example, on gender policy, security measures and workplace health standards, but there is no systematic and detailed explanation of these regulations. Each company will conduct pre-job and post-learning in line with its own requirements, as well as the law and regulations, and incorporate these into a learning plan in their annual program. However, the district level will not provide similar services. Apparently, the performance of trade unions or non-governmental organizations is very modest. Their activities include safety knowledge training, caring activities and holding commendation meetings. The district managers indicated that the trade union will also participate in mediation and coordination work, such as the need to negotiate with the unit's trade union or employee representatives to determine the reduction of

employee's income standards, but this has little influence on the park managerial processes.

6.3.2 Environmental aspects

The performance of the environmental criteria was assessed neutral. The positive evaluation reported by interviewees was that every company must adhere with having any strict required environmental permits, such as the hazardous waste permit. In addition to the company's own environmental reports, the district also regularly issues environmental impact reports, formulates rectification plans for adverse impacts using its own resources and economic goals, and provides inspection reports.

Two criteria showed up negative as follows. First, although the district pays attention to the establishment of an ecological civilization and the improvement of ecological environment, these all only focus on the development planning of ecological tourism. As a result, measures related to biodiversity are rarely considered and implemented. Second, since the establishment in 1992, the district has planned land use according to the functional layout requirements of different parks. This is a good way to plan land use for a single function park. However, the local government and WND's managers have never planned land use according to the wider development needs and limited use only on regulations, plans, and conditions. Overall, such implementation cannot effectively use land resources.

On the neutral side, the majority of companies in the district use the ISO14001 standard as a management method and adhere to clean production principles. This provides the relevant environmental departments (e.g., judicial department and civil affairs and health department) with the norms to monitor for regulated contaminants. However, according to the data provided by the relevant departments, only periodic and random inspections are conducted on the emissions of hazardous wastes and volatile organic compounds. When emissions are found to exceed the standards, functional departments will order

them to make improvements. The companies take basic actions to respond to inspections. The interviewed district managers said they comply with laws and regulations on protecting water resources and soil promulgated by the state and the local government, and properly manage wastewater. Unfortunately, no specific implementation measures were disclosed. While the disclosure of the report that ‘the reuse of recycled water (reclaimed water) has achieved a virtuous cycle of water ecology’ is public, the frequency and implementation effects are unclear. The relevant emission regulatory standards stated the following: particulate matter $\leq 1.0\text{mg}/\text{m}^3$; VOCS emission concentration $\leq 50\text{mg}/\text{m}^3$; total non-methane hydrocarbon emission concentration $\leq 120\text{mg}/\text{m}^3$. However, this only discloses emissions standards and no relevant monitoring data. So, there is no actual scientific evidence that air quality has improved. As different stakeholders have different perceptions of the concept of waste management and less exchange of experience, zero waste is achieved to a certain extent.

In summary, the reason why the environment criteria qualified neutral through the criteria applied here is because the laws and regulations seem to concentrate on macro aspects that lack specific implementation rules and measurement procedures. As a result, this situation achieves only a certain influence on implementers and actors.

6.3.3 Economic aspects

With three of the WND’s five economic criteria being positive, the overall assessment was relatively good compared to other aspects of sustainability. The social results stated that the district has comprehensively considered all aspects of cost in the sustainable development process.

Usually, relevant functional departments provide maintenance for their economic infrastructure facilities. By 2018, the district occupied 4.8% of Wuxi’s land, while 8.7% of the population created about 15.7% of the economic wealth. Such data revealed that WND does have a positive impact on

the region's economy, while strengthening environmental protection and ecological construction, including establishing an *ecological city* in the southeast. It achieves economic development by optimizing industrial structure and allocating resources rationally to enable a pathway to an 'harmonious environment' in the district.

The environmental protection departments indicated that WND will not be flooded by rain. An example of ecological economic infrastructure is the 'sponge city' project. This is a recently completed demonstration project that provides an ecological amusement park on the surface, but is, in fact, hides a huge rainwater drainage system underneath. It incorporates 'green' measures, such as ecological grass planted ditches and concave green spaces to allow rainwater to seep and drain, and to be purified and reused through these 'sponge bodies'. Finally, the runoff is drained through a pipe network. Overall, this all effectively improves the standard of the drainage system and alleviates the waterlogging pressure.

The other dimensions of economic aspects recorded neutral results. The district creates employment opportunities, directly and indirectly. Local government and the district also propose to provide incentives or subsidies based on income levels. However, it is unclear which companies or what kinds of companies can obtain tax subsidies, let alone tax exemption standards. A similar situation is reflected in the online complaint mailbox. These emails can display the content, timing and progress of the complaint, but the results of the investigation and processing of the relevant complainant are not disclosed. The effects of such an opaque and non-public operating mechanism are unsatisfactory, even though they might comply with private regulations.

The WND sustainability results are displayed in Figure 6.4 using the comparable color code histogram.

Figure 6.4: The specific visualization of WND sustainability

6.4 The influence of governance context on sustainability in WND

This section explores how the governance context influences sustainability performance drawing on the detailed description of the interview results in sections two and three. In the following sections, the social, environmental and economic criteria will be independently related to the governance context.

The influence of the governance context on social aspects has many diverse angles. On the one hand, I will start with the development concept of circular economy and the development goals of innovation and entrepreneurship because these are the oldest in the XWD establishment. The district formulates different strategies and multiple goals at each stage to achieve such development. For example, the initial establishment stage was to establish high-tech parks of different industry types. The high-speed propulsion stage gradually implemented the strategy of harmonious environmental development using industrial development, combined with local historical resources. The local government and the relevant functional departments of the district might

adjust to reformulate and disclose the goals of each stage according to the development needs. This is conducive to the formation of a clear development strategy and promote the coordinated development of economy and industry. On the other hand, although different levels of stakeholders have different functional powers, they all have a strong ‘culture of coordination’, especially with regard to emergency situations. Thus, both the district and the company levels have a systematic emergency rescue plan, and relevant courses and practical exercises associated with them.

In addition to the positive impacts, some aspects of the governance context have neutral effects on social aspects. Although the local government and the district cover a wide range of policies, interviewers noted a lack of instruments for punishment or remediation. Such policies do prompt the district to establish basic safety and environmental regulations, employee education and training regulations and health and safety standards. But the performance of instruments, as implemented at present, appear incomplete and unclear. Some company interviewees indicated that, to facilitate the implementation and save costs, they simply meet the basic legal and regulatory requirements to deal with inspections, and gave the lack of specific details of the punishment instruments as another reason.

The negative effects cannot be overlooked. Although all levels of the district and its stakeholders are involved, the district as a whole only meets the goals and needs of most stakeholders and the perceptions of companies and employees are less considered. The district has realized, and gradually paid attention to, this problem, but the focus of strategies remains on the development of industrial structure and innovation. As a result, the emphasis on public transportation, housing and child care remains weak. Since only high-level decision-makers or implementers play an important role in conflicts and changes, little attention is paid to the construction of social infrastructure. Also, trade unions have little substantial influence on employee’s income standard, mainly because of the absolute power of China’s high-level

authorities and the decision-making power of the local government and relevant departments in the district.

While the governance context has a positive influence on the environmental aspects, this also needs to be improved in some areas.

First, the local government clearly stipulates that every company must have an environmental permit that correspond with environmental policies and regulations at the district level. These include proposed regulations on solid waste discharge and noise pollution control of construction projects.

Second, although the state or local government has issued many laws and regulations on environmental protection, the relevant functional departments of the district simply copied and interpreted them literally. In other words, the district has not introduced detailed rules and regulations at the park level to accord with its own development situation and relevant policies and regulations. As such, this may not be conducive to the implementers and actors who have to undertake any measures. Hence, only a majority of companies in the district have the IOS14001 environmental management system. This may lead to companies performing pollutant emission monitoring in a permissive way. The lack of disclosure of relevant information on wastewater treatment and recycling of central wastewater makes it unclear how and how long these activities will be conducted.

Third, the district's long-term development goals cover various aspects, such as economy and industrial structure, but it lacks the inclusion of development beliefs related to environmental protection. As a result, only basic waste management can be achieved. Zero waste is expected in the future.

Some aspects of the governance context also have a negative influence on the environmental aspects. WND has achieved its desired development goals relying on geographical, transportation and historical resources. However, with regard to the environment, it is mainly associated to ecotourism development planning. This suggests that less consideration has been given to the

environmental status and biodiversity in the development process of the district. When interviewing environmental protection personnel, they said they have begun to pay attention to the development of ecological environment, such as the establishment of ecological agriculture in the east of the region, and will pay attention to biodiversity in the future. The natural advantages of Taihu lake and Hongshan mountain could be utilized fully to realize the harmonious development of man and nature. So, the district needs to modify some goals to achieve the desired strategy or development vision. Land use is an example that highlights the negative performance of this governance context. This suggests that the local government or district managers need to change their strategies to effectively realize the use of land resources through comprehensive and overall planning of the land use in the district.

The governance context has a positive and neutral influence on economic aspects. First, the economic data disclosed by WND (see sections 6.1 and 6.3.3) shows it has promoted the development of the regional economy. The district has clear functional departments and makes full use of local education resources, which is conducive to achieving the long-term development goals of combining circular economy with innovation and entrepreneurship. Second, in the process of sustainable development, the local government and the district management department realize that some problems or aspects need to be slightly modified to achieve the desired goals or effects. Even if the district has a positive impact on the region's economy, other economic-related aspects, such as the details of incentive and subsidy policies and tax incentives, need to be considered. Third, due to the rigid nature of the communication from high-level to low-level, this makes the complaint procedure awkward so that it does not produce the desired effect.

6.5 Conclusion

This section provided a comprehensive assessment of WND using the influence of the governance context on the three aspects of sustainability described in

sections 6.2 to 6.4. First, the field interview results indicate that both governance aspects and sustainability were generally neutral, while the flexibility and intensity of governance context and social aspects were relatively weak. Second, the weaker social aspects were mainly affected by the two governance aspects of extent and intensity. This was because the social dimensions were more involved in the decision-making and influence the degree and goal-setting of various levels of different stakeholders. WND generally only considered the perceptions and goals of the most obvious stakeholders who made decisions. The district lacks instruments to carry out practical activities that needs modifications if they are to achieve the expected goals. Third, environmental aspect was neutral and was mainly affected by the two governance aspects of coherence and flexibility. This was because the district has all actors working together in the important ecological environment, while those at the low-level need to obey the decisions and goals of high-level managers. This made it difficult to monitor and disclose environmental data in a flexible and cooperative manner to these data and practices could form a systematic environmental protection policy to improve environmental performance. Fourth, the economic aspect was relatively strong, mainly because of the flexibility and intensity of the governance context. Since WND reformulates goals according to the actual situation (although it is relatively difficult), and establishes development strategies that rely on its advantages (e.g., geographical location, historical resources), such behaviors help improve the economic situation of the district and positively affect the level of regional economic development.

7. Case 3: Nanjing Economic and Technological Development Zone

7.1 Introduction

Since its establishment in 1992, Nanjing Economic and Technological Development Zone (NET) has adhered to the concept of ‘innovation-driven, endogenous growth, and green development’. Subsequently, according to the division of sub-districts, the industrial function layout was improved to achieve intensive and efficient development of the industry. In recent years, NTE has focused on national strategies, such as the ‘The Belt and Road’ and the ‘Yangtze River Economic Belt’, to deepen the transformation and development and accelerate the improvement of the quality of urban functions to build a complex *industrial new city* suitable for business, living and travel.

7.1.1 Geographical and environmental information of NET

NET is located in the northeast of Nanjing, Jiangsu Province. It is bordered by Zhongshan in the south, the second bridge of Nanjing Yangtze River in the west, with the Foreign Trade Port and Longtan Port in the north (Public Business Information Service of the Ministry of Commerce, 2012). The Figure 7.1 shows the urban area of Nanjing and the red area is the NET surface (Microsoft Technology, 2018). In addition to being adjacent to the two largest foreign trade ports and container ports of China’s inland rivers, NET is about 40 kilometers away from Nanjing Lukou International Airport that has opened more than 100 domestic, and international passenger and cargo routes directly to United States, Germany, Japan, South Korea, Singapore and other countries. It is situated about 15 minutes away from Nanjing Railway Station and 25 minutes from Nanjing High-speed Railway South Station. There are also metro stations around the development zone (Public Business Information Service of the Ministry of Commerce, 2012). NET has formed a three-dimensional intersection of modern land transportation network. This zone is an important transportation hub of Nanjing that can effectively complete the convenient

2002 created a zone divided into three major areas: Xingang in the west, Qixia in the middle and Longtan in the east (NET, 2018). Subsequently, a liquid crystal valley area was established below (south) as shown in Figure 7.2. NET has four functional areas: industry, bonded warehouses, financial trade and comprehensive services (China Daily, 2018). In addition to its geographical location and transportation advantages, NET relies on the advantages of scientific research in universities to vigorously develop high-tech companies with independent intellectual property rights, strengthen the introduction and cultivation of core technologies and promote the transformation and upgrading of leading industries. Nearly two million square meters of science and technology innovation carriers have been constructed, more than 450 well-known technology companies have been introduced, with 21 new R&D institutions and seven high-end public service platforms have been established (NET, 2018).

Figure 7.2: Major sections of NET. Source: Nanjing Daily, 2012; NET, 2017.

The establishment of NET mainly depends on the advantages of existing urban location and scientific and educational resources, attracting more and more domestic and foreign leading companies, as well as universities and research

institutes to set up industrial bases. This provides the ideal platform for the realization of high-tech *industrial new city*.

7.1.2 The historical process of NET

NET has experienced multiple expansions, resource integration and development changes in the past thirty years of development without clear stage divisions. Hence, we divide the development process into four stages based on relevant openly disclosed documentation (Figure 7.3).

Figure 7.3: Development stage of NET

The first initial establishment stage (1992-1996) came in response to the country's call for vigorous economic development. The Nanjing Municipal Government decided to establish the Xingang Industrial Zone in 1992. It was in 1993 when the Jiangsu Provincial Government approved the industrial zone as a provincial development zone. With the rapid development of the industrial zone, it was officially renamed as 'Nanjing Economic and Technological Development Zone' in 1995 (Xixia District People's Government of Nanjing, 2019).

In the second stage (1997-2011), the construction zone was rapidly developed and infrastructure was perfected. This promoted the rapid growth of the economic aggregate. In 1997, the 'Nanjing Xingang' was officially listed on the Shanghai Stock Exchange (now renamed as 'Nanjing Hi-Tech'), as well as NET became a national economic and technological development zone in 2002 (China Daily, 2018). NET insists on innovation-driven development. It has continuously introduced and established technology industry and industrial parks, such as Xingang National High-tech Industrial Park, National Cross-Strait Science and Technology Industrial Park, and National (Nanjing)

Display Device Industrial Park. As a result, NET has become a high-tech industry cluster.

The third stage was transformation and upgrading stage (2012-2016). (1) This stage took place in 2012 when NET was designated as the national eco-industrial demonstration park in Nanjing (Ministry of Ecology and Environment of the People's Republic of China, 2014); (2) Since its establishment over 20 years, the development zone has realized the annual industrial output value of leading industries exceeding 100 billion yuan, as well as high-tech output value, major R&D institutions and talent introduction have ranked among the top of the city (Ministry of Industry and Information Technology of the People's Republic of China, 2012). The development zone relying on the advantages of high-tech industrial parks and scientific research resources and begun to focus on the advance of industries such as biomedicine, high-end equipment, modern logistics, and scientific and technological services. This has promoted its transformation into an international high-tech *industrial new city*; (3) The management of three sub-districts was realized in 2012.

The current fourth stage corresponds to the high-quality development stage (2017-present) as the development zone formed three major industrial clusters of optoelectronic display, high-end equipment and biomedicine (NET, 2018). Subsequently, it continuously promotes the integrated development of industry and city, focusing on the construction of an *industrial new city*, with a view to become another industrial landmark in the future.

7.2 Assessment of governance context in NET

The quality of governance context and way actors deal with their context is a significant factor in NET achieving its sustainable development goals. The author used a mix-research method approach as previously described to evaluate the governance context, namely relevant disclosed documents (examination of secondary data and information) and interviews to key stakeholders, against the four governance criteria of extent, coherence,

flexibility and intensity. The assessment of the criteria was relatively good and the detailed description is elaborated in the following section.

7.2.1 Extent

The situation regarding the extent criteria of the governance context was considered positive by interviewees. The only neutral assessment was on the dimension of levels and scales as follows. All management levels are directly involved in the governance of NET's sustainable development. The local government (Nanjing Municipal Government), to a certain extent, is in a state of decoupling. This is mainly because it provides development goals and plans. Relevant departments will also establish preliminary visions and specific implementation plans. The other two important stakeholders are implementers (the development zone level) and actors (mainly companies and employees), who can ensure, in principle, the effective implementation of governance plans. A negative point was the relatively little consideration given to the surrounding environment and residents. Because the relevant actors in the zone believed these to be less relevant to the governance goals related to sustainable development. The next development views and measures proposed by the zone at the end of 2018 focused on four aspects: improving comprehensive economic strength, advancing industrial upgrading, promoting technological innovation and entrepreneurship, and developing the integration of production and a city (NET, 2018). Although the last aspect is related to urban construction, it is mainly aimed at solving the problem of having industries without a city. Therefore, the destination is still rooted in the industry.

When focusing on the actors and networks, a positive evaluation of the extent criterion could be appreciated and all stakeholders are involved, whether they like it or not. This means that all actors take part in the governance context of NET; albeit with some restrictions to do with actor involvement. Lower-level actors, such as employees and surrounding organizations, have a less of a voice than higher-level actors. The local government and development zone

management stated that they are constantly working towards greater interaction and collaboration. Therefore, when faced with relevant governance issues and making decisions, they will consider the goals of all stakeholders and disclose major decisions, in the hope of getting more feedback from all stakeholders. In fact, the stakeholders interviewed also suggested the problem perspectives and goal ambitions were positive in the sense they did show a good sense of stakeholders' participation.

The local government and the relevant functional departments have issued and implemented some policies and experience in consultation processes with stakeholders for the development zone. These have included human resources and social security work points, hazardous chemicals operating permits and a compulsory pollution reduction work plan for improving air quality. A wide range of strategies and instruments also exists. NET has different functional departments with clear responsibilities to better implement these policies and instruments, such as: economic development department, scientific and technological personnel department, land planning and environmental protection department. They can carry out governance work according to their functions. The development zone will also allocate resources according to the different departments to save resources and achieve effective utilization. While over-all the situation regarding the extent of governance was positive, the assessment was a bit weaker regarding the levels and scales item. This is because some aspects are rarely considered including issues in the surrounding environment and residents and these are seen as being less relevant to the goals of sustainable development.

7.2.2 Coherence

The assessment for coherence in the governance context could be classified as generally neutral. All levels, such as the local government, the zone and the company levels, shoulder their tasks equally on some major issues. The basic mutual trust and dependence among the representatives of those levels were

fully recognized by the individuals interviewed. Those at the company and employee levels said that the lower level actors (such as them) are further away from the decision-making and formulation process. Their opinions on this were also quite neutral as it is normal for low-level actors to participate only in implementation. To a certain extent, the coordination of the lower level seems to be more coherent than at a higher level. For example, regular meetings are sufficient for the lower level actors. As a result, different levels of stakeholders have different functions and, in most cases, are willing to interact in an institutionalized way.

Notwithstanding this, the researcher could identify potential conflicts that might arise in special situations involving diverse interests when the views of decision-makers are more important and when there appears to be a conflict of interest between the more powerful decision-makers and certain other actors. This means that decision-makers rarely consider the actual situation of actors. An example is that NET would issue a notice on the prevention and control of air pollution every six months. This notice might most likely disclose some air pollution control problems within some companies, such as the renovation of boiler and industrial furnaces are not qualified for reform, and coal reduction is insufficient. In practices, companies also know that such measures might bring a positive effect on the environment, but high-power decision-makers force them to complete renovations within a timeframe to avoid production suspension. This type of pressure puts some companies in uncomfortable situations and they seem to lack positive coherence in terms of responsibilities and resources. In particular, there is a shortage of funds currently, as well as in the foreseeable future, to meet the tasks.

The only dimension that showed positive coherence was that of strategies and instruments. This was concluded drawn from the interviews, even though the local government or the zone considered relatively few low-level views and ideas on some key issues and strategies, all actors interviewed were satisfied with this type of cooperation. All in all, trust-based collaboration generates

value, which enables positive progress over the years. In addition, the relevant departments of the zone will also formulate strategies and instruments coordinating development to accord with the laws and regulations promulgated by the local government in line with their own development needs, so there is no overlap or conflict. While most coherence aspects were just neutral, the strategies and instruments were positive. This was because the zone developed these in accordance with its own development situation to achieve synergy between them.

7.2.3 Flexibility

The local government arrangements indicated positive flexibility in levels and scales, which is inherent in the system when dealing with problems. For example, the relevant departments regularly carry out non-structured questionnaires on some issues (e.g., business environment satisfaction surveys) and at a range of levels. The survey results get proposed to subsequent meetings with the local government to revise or formulate relevant policies and regulations. This is mainly manifested in the communication process between the lower level and the local government while there is still a relationship between superiors and subordinates in this way. Another example shows is when a problem arises and all levels can freely express their opinions and suggestions that does not depend on subordinate relationships. The employees indicated that relevant management departments had begun to pay attention to their social needs. For example, they can express their desire to increase the site or time given to the relevant departments through various methods (e.g., online suggestions in the mailbox, regular meetings). Thus, the high involvement and reflective issues of actors in the processes, with both formal and informal contacts, were positive, which encouraged all relevant actors to be part of planning processes.

The analysis suggests that most dimensions of the governance context have a neutral degree of flexibility. The local government and the development zone

have developed and implemented a series of strategies and instruments based on development goals and governance needs, but only some instruments have shown flexibility, namely the combined use of instruments by different actors. The development goals are usually phased and diverse, with appropriate changes made according to environmental or policy directions. However, only major transformations are disclosed in the White Paper that also change the responsibility of stakeholders. Interviewees indicated that the development zone has begun to shift its focus to building an ecological civilization. Hence, the responsibilities of relevant departments, such as the environmental protection department, the safety supervision and the management department and urban management department, will become relatively more important. Apart from the positive assessment of levels and scales where different levels can communicate freely from top to bottom if problems arise, other flexibility criteria of the governance context were considered neutral.

7.2.4 Intensity

The intensity of the local government in NET or the high-level management of the zone is important in the government context as they have decision-making power. This is consistent with China's special culture of high power distance and resulted in a neutral assessment of the levels and scales item. Although strategies and instruments for governance-related concepts are clearly defined at the local government or development zone level, there is actually a lack of surveys of low-level opinions or perceptions about policies and instruments. Therefore, even if all basic policies and regulations are promulgated, there have been some problems in the implementation process, which hinders any rapid progress in delivering the strategy.

The other dimensions of GAT in relation to the intensity criteria proved positive. Most actors collectively drive the relationship network associated with the governance context. They participated in the relevant management strategies and made suggestions, meaning that actors and managers were

organically linked throughout the governance process in NET. This includes most stakeholders, except the surrounding residents. The degree of participation only involved management or behavior changes, other than policies and regulations. Actors at different levels were satisfied with this performance and were willing to accept it. Thus, actors believed that the existing policies could achieve the established development goals, with local government and relevant departments providing support with information and resources. For example, knowledge resources provided by industrial bases helped establish universities and research institutes, as well as the resources specifically mentioned by interviewees for investment promotion.

The findings from subsections 7.2.1, 7.2.2, 7.2.3 and 7.2.4 are summarized in Table 7.1.

Table 7.1: The governance context of NET

Governance Dimensions	Governance Criteria			
	Extent	Coherence	Flexibility	Intensity
Levels and scales				
Actors and networks				
Problem perspective and goal ambitions				
Strategies and instruments				
Responsibilities and resources				
<i>Colors Red: Restrictive; Yellow: Neutral; Green: Supportive</i>				

7.3 Assessment of sustainability in NET

The development of the past 26 years has witnessed NET is mainly focused on implementing innovation-driven development strategies and successfully form industrial clusters. It has achieved remarkable scientific and technological innovations that have enhanced industrial development. This development directions provided an important base for export-oriented economic development and innovation.

This section elaborates on each of the social, environmental and economic aspects of sustainability to understand the sustainability performance.

7.3.1 Social aspects

In the assessment of social aspects, the development zone had five positive dimensions, six neutral dimensions and three negative dimensions. Such a comprehensive assessment was classified as ‘neutral’. This description would start with the three negative social dimensions. Each level has its own independent trade union. They do not have any substantial influence and are mainly responsible for organizing annual meetings and holiday care, among other activities. The federation of trade union in the development zone also sets up various awards and holds colorful theme competitions, such as labor competitions. Low-level interviewees indicated they had minimal contact with trade unions and, therefore, had little information to learn from them.

Although NET attaches great importance to talent introduction and technological innovation, it mainly targets high-level universities, scientific and research institutions. As an example, the adjacent Xianlin University City provides strong talents and intellectual support for the development zone. There is little apparent attention given to child care or social services (similar to kindergartens) for employees or surrounding residents. Given NET’s focus on job creation for innovative talents, there are no policies or regulations for gender employment at any level, whether at the development zone or company level.

The positive social dimensions relate strongly to the development zone’s strategy of achieving an innovative city. By late 2013, the total number of talents in the development zone had reached 100,000. This included nine academicians who had started their own businesses and 108 talents who were selected as ‘leading talents in science and technology innovation’ (China Jiangsu Net, 2014). The development zone has also promoted the establishment of more than 450 well-known domestic and foreign technology companies,

such as JD.com and Ecovacs robotics, as well as 21 new research and development institutions, such as the Intelligent Manufacturing Research Institute of Tsinghua University and the Artificial Intelligence Innovation Research Institute of Nanjing University (NET, 2018). These successful introductions have increased employments and improved household incomes. With such strategies, the high-tech companies often value employee education, whether it is pre-job or post-learning. The zone formulates relevant training policies to urge companies to carry out training activities and conduct regular training (usually half yearly or annually) according to the recruitment situation. Each company also provides employees with special training programs to promote innovation.

The assessment of emergency services was positive as all companies had emergency rescue plans. The development zone has plans to deal with emergency situations and also conducts regular special emergency drills, such as the comprehensive emergency drill for benzene leakage.

The social dimensions of NET qualified as neutral. Although management departments indicated they provided sufficient basic public transportation for employees, the results were not satisfactory according to the interviews and online documentation. The number of stops were insufficient and the number of shuttle buses need to be increased.

The development zone does not provide housing and there is no clear housing subsidy policy, but different companies have different subsidy standards that may change over time. For example, a company provides college students with a three-year housing subsidy at a subsidy rate of 50%, and talent introduction can provide for three years of rent. Interviewees stated that the zone has no social infrastructure for entertainment and medical care, apart from basic services, such as catering and a small number of pharmacies.

The development zone has basic safety and environmental protection laws, regularly safety training, and safety activities for special matters (e.g., fire

safety knowledge and drills). However, this is still not formal and systematic. Although workplace health standards comply with local laws, there are some safety standards for specific types of industries in the zone, such as instructions on the production, management, storage and transportation of hazardous chemicals.

7.3.2 Environmental aspects

The over-all assessment of the NET's environmental aspects was relatively weak and only two dimensions were evaluated positive.

First, the local government and the development zone required each company to have an environmental permit. According to the type of industry and the pollution situation to apply for the corresponding permits, such as related photoelectric display, companies generally have the hazardous chemical business permit. The status of clean production of all companies was reviewed by the development zone and reports submitted each year. Emissions testing covers VOCS exhaust gas monitoring, water environment pollution source monitoring, comprehensive utilization and disposal of solid waste. There is a special aspect of supervision and inspection. Since 2019, the development zone requires the implementation of compulsory classification measures for domestic waste, as well as regular inspections and disclosure of related environmental issues. NET, via the relevant environmental and supervision departments, will randomly select companies for investigation and disclosure.

Second, most dimensions manifested as neutral (seven dimensions). Although the management committee of the development zone has passed ISO14001 certification, interviewees from relevant departments and companies indicated that there is no law or regulation requiring such certification. Thus, only some companies have it. Some companies had ISO50001 or energy management certification. The basic energy network has formed from the continuous effort in the later stages of the development zone. Electricity services have three 35KV substations and one 110KV electricity station in the zone. Drainage is

carried out by rain and sewage diversion systems. A thermal power plant provides sufficient and stable heat sources for the companies. Water, telecommunications, gas and other energy supplies are also provided. The coordinated development of resources and economy is based around structural characteristics of the industry and companies are encouraged to apply energy-saving equipment and technologies to reduce operational costs. The environmental quality of water and the comprehensive utilization of solid wastes receive particular attention and the development zone has implemented sewage treatment and renovation projects to improve the sewage collection system. The underground pipelines are inspected annually and missing, damaged and blocked pipelines repaired accordingly. Efforts are made to improve the comprehensive utilization and disposal capacity of hazardous solids. The management department of the zone claimed that the central wastewater treatment and recycling were not satisfactory as the recycling rate were too low and the treatment only accorded with relevant laws and regulations. The greenhouse gas emissions situations found the zone had always complied with the 'Integrated Emission Standard of Air Pollutants (GB16297-1996)' promulgated by the State Environmental Protection Administration, as well as the 'Emission Control Standard for Industrial Enterprises Volatile Organic Compounds (DB12/524-2014)' formulated by the local government.

Third, the aspects assessed negatively have three dimensions. Instead of focusing on biodiversity, the development zone mainly concentrated on constructing ecological measures to improve air pollution and reduce emissions of hazardous chemicals. NET's managers are aware of this issue and proposed that one of the next development directions would be to build an *industrial new city* to develop in a more positive direction. The development zone is divided into four major areas that started in 2002 with some areas established later. As a result, there was no reasonable land use planning at the initial stage of establishment and only basic laws were met. Interviewees from both companies

and the development zone indicated that they hardly ever exchanged materials and energy, which may be related to their special industrial structure, and made it difficult for them to tackle the goal of zero waste.

7.3.3 Economic aspects

Two economic dimensions of NET assessed positive, while three dimensions were assessed neutral; a strong overall performance compared to social and environmental aspects. According to the economic data disclosed by the development zone in 2018 (NET, 2018), the author calculates that the zone accounted for 3.3% of Nanjing's land, creating about 7.9% of the economy. During the 'Twelfth Five-Year Plan' period (2011-2015), the total foreign trade import and export value was US \$62.2 billion, and the use of foreign capital was nearly US \$3 billion, accounting for 22.3% and 16.5% of the Nanjing city, respectively (Green Manufacturing Association of China, 2018). This indicates that the development zone has had a positive economic impact on the region.

The zone has strived to build itself into a modern, multifunctional, environmentally friendly new industrial port and an open economic center. According to data from 2017, the added value of green industry accounts for more than 30% of the added value of industry, and the green coverage rate was 20% (Green Manufacturing Association of China, 2018). The development zone has gradually built green industries to achieve a low-carbon circular industrial chain and comprehensively promotes the development of new energy demonstration applications and emerging industries to improve the efficiency of resource utilization. NET has achieved the intensive development goal of the region through industrial agglomeration configuration.

The neutral dimensions were mainly manifested by the fact that, although the local government and the development zone have income incentives and compensation policies, there is no evidence they have been implemented. For complaints, there is a dedicated leadership mailbox on the website. Through interviews (especially low-level) and online information disclosure, it was

found that fewer people used this and the results were not displayed yet. It is usually just a message stating the following: “Hello, your letter has been forwarded to the relevant departments, and the staff will contact you to reply!”.

The environmental and social costs of the development zone need to be improved. The next development measure is to build a modern *industrial city* suitable for industry and life, and to create a new situation conducive for green ecology to solve the situation of industries operating outside of a city. They continue to improve the industrial level and to perfect the supporting functions to create a production-city integration pilot zone that integrates scientific research, education and housing.

The social, environmental and economic aspects of sustainability are shown in Figure 7.4.

Figure 7.4: The specific visualization of NET sustainability

7.4 The influence of governance context on sustainability in NET

The second and third sections have explained the specific assessment of governance context and sustainability, respectively. This section explores the influence of governance aspects on sustainability by combining the results of the interviews in the previous two sections with the development purpose of the development zone.

Governance aspects have negative effects on some social dimensions. In addition to realizing industrial transformation and adhering to the development goals of technological innovation and entrepreneurship, NET also has an important development goal to strive to build a modern *industrial city* suitable for living. The development zone currently pays too much attention to the industrial development goals. Even if some supporting facilities or social services are provided, such as catering and staff training, it focuses on the main economic actors of the sustainable development strategies. Interviewees of the zone stated that they are unaware of other social concerns (e.g., child care) that needed attention. Thus, to realize the transformation from ‘production workshop’ to urban living home, they will need to consider the needs of all levels through field surveys in the future to improve supporting functions and completely solve the situation of operating without a city.

The special high-power distance and the strong role of decision-makers in conflicts or competitions mean that trade unions and other non-governmental organizations have no actual influence. The absence of relevant governance aspects also is related to the clear absence of a gender policy. Respondents from the local government and the development zone said that, although they did not make relevant laws and regulations to limit gender discrimination, they believe that such concerns do not exist, for the following reasons. (1) So far, they have not found that any companies or recruitment of the zone set up special positions. (2) As the focus is on the practical ability of innovative talents, gender considerations can be ignored.

Some governance aspects have a positive influence on other social dimensions. First, the development zone does consider the needs of all stakeholders for the economic aspects and this is conducive to increasing household income. However, the lack of consideration of surrounding residents and the restrictions on the low-level impact means the development zone needs to improve public transportation, housing subsidy policies and infrastructure construction. Second, although the needs of surrounding residents are considered less, all stakeholders were involved in important issues, such as emergency services. These aspects are closely related not only to all stakeholders in the zone, but also affect the surrounding residents, for example, in the case of any leakage of hazardous chemicals. Third, the development zone formulates multiple goals and reformulates them according to the changing development situation. Unlike other industrial parks, the goals of the zone have always adhered to the general purpose of industrial development and technological innovation regardless of changes. The zone's development goals attach great importance to the education and training of employees, and actively cooperates with the adjacent university concentrated area to promote the common development of industry and economy. Fourth, the local government and the development zone lack relevant investigations of low-level views and opinions on policies and regulations. So, they do not clearly recognize the issues. Employees who work in chemical companies indicated that they are sometimes exposed to highly hazardous chemicals and while workplace health and safety standards only meet local legal requirements, this is a cause for some concern. However, the relevant high-level departments are neither aware of this problem, nor recognize the need to modify their degree of monitoring and enforcement. Security measures are similar.

The influence of governance aspects on environmental dimensions has a number of elements.

First, the extensive environmental policies and regulations of the local government and the development zone require companies to have

corresponding environmental permits. For example, the ‘Environmental Measures for Emission Permits (Trial)’ was adopted by its environmental protection department in 2018. There are other types of permits, such as hazardous chemicals permit and hazardous waste permit. Relevant functional departments not only regularly check permits, but also monitor companies’ emissions and disclose selected results.

Second, although the development zone forces companies to have permits and meet pollution requirements, there is no clear regulation for ISO14001. This may be related to the less systematic consideration of the governance aspects of environmental management. Therefore, only the two aspects of resources and economy have been coordinated.

Third, each company must take corresponding measures to treat wastewater in accordance with the provisions of the ‘Integrated Wastewater Discharge Standards (GB8978-1996)’. The local government and the development zone have proposed corresponding instruments based on different types of wastewater. For example, urban and industrial wastewater or sewage treatment and recycling technology, integrated control technology of river basin water pollution treatment and eutrophication, and drinking water safety protection technology. The relevant environmental protection departments suggested that they discouraged companies to treat wastewater by combining different instruments. Instead, they expect the regulations on wastewater treatment to be strictly enforced. Generally, companies carry out wastewater treatment by themselves. Therefore, the development zone may recycle central wastewater under special circumstances.

Fourth, the rapid development of the development zone enabled it to make full use of resources to establish a basic energy network. However, this development needs to continue to form a more advanced energy network system in the future.

Finally, some governance aspects have negative influences on certain environmental dimensions. The current focus on the means to construction measures for ecological management makes it impossible to pay attention to biodiversity. Also, the high-tech companies' emphasis on scientific and technological innovation means there is little exchange of materials. Company-related interviewees indicated that, in many cases, the innovation process requires experimentation. This is inherently risky and no one knows for sure whether it will succeed, making it hard to come up with the idea of zero waste.

The influence of governance aspects on economic dimensions was relatively strong and positive.

First, NET has always adhered to the long-term development goals of export-oriented economic development and scientific and technological innovation achieved via phased annual goals. This means it has played a positive role in promoting the regional economy.

Second, the development zone has made full use of educational resources to achieve an innovation-driven development strategy and, thereby, considering economic costs. The construction of green ecological parks was mainly to upgrade and transform the situation into one of green industries, which involved environmental costs. However, less consideration has been given to social costs.

Third, although the development zone communicates in a relatively free way, it pays less attention to social aspects and the way in which complaints are dealt with and responded to needs to be improved.

7.5 Conclusion

This section conducted a comprehensive assessment of the sustainable development of the development zone. First, for the governance context, except for the relatively strong results for extent and intensity, the performance of

other criteria was similar and just neutral. In terms of sustainability, the economic dimension performed best, while the environmental dimension was relatively weak. Second, the sustainability of the development zone was affected by the varied governance context. The social aspect was more or less affected by the extent, flexibility and intensity. The negative social dimension aspects were mainly related to the development zone's focus on scientific and technological innovation, while ignoring social concerns, as well as governance criteria of intensity (i.e., the surrounding residents rarely participated directly in change). The three governance criteria of extent, coherence and flexibility had an impact on the environment. Surprisingly, the negative aspects were mainly related to the industrial structure and the governance criterion of extent where the high-level actors took little account of the surrounding environment and the particular situations of high-tech industries. The economic performance was relatively strong and greatly affected by governance situations on flexibility and intensity, while the extent criterion has a slight impact. The good thing is that the constant change of the goals at each stage have promoted its rapid development. The long-term development goals and flexible use of the surrounding educational resources have aided a continuous improvement in the region's economic development level.

8. Case 4: Kunshan Economic and Technological Development Zone

8.1 Introduction

Kunshan Economic and Technological Development Zone (KETD) has always focused on the theme of expanding and opening up reform and innovation. Nowadays, it has become an important base for China's foreign trade processing, imports and exports, as well as a gathering place for global capital, technology and talents. This section briefly introduces KETD from three aspects: its location, comprehensive development and historical development process.

8.1.1 Geographical and environmental information of KETD

KETD is located to the east of Kunshan, Jiangsu Province in the Yangtze River Delta as shown in Figure 8.1 (Kunshan Municipal People's Government, 2020). The zone is 50 kilometers west of Shanghai and 37 kilometers east of Suzhou. It takes only half an hour to travel from the zone to Suzhou or Shanghai. The zone is only 45 kilometers from Shanghai Hongqiao Airport and 100 kilometers from Shanghai Pudong Airport. Shanghai Port, China's largest port for container traffic, is 60 kilometers away from the zone, while Zhangjiagang Port and Taicang Port, two of the 25 major coastal ports in China, are only 100 kilometers and 35 kilometers away, respectively (China Daily, 2006). The Beijing-Shanghai Railway, the Shanghai-Nanjing Expressway and National Highway 312 traverse across the zone, further improving its accessibility.

Figure 8.1: Geographical map of KETD. Source: Kunshan Release, 2016.

KETD is home to 660,000 people and covers an area of 108 sq. km with five sub-districts (Kunshan Municipal People's Government, 2020). The five economic pillars are electronics, optoelectronic displays, precision machinery, equipment manufacturing and household goods that have combined to form a modern comprehensive park. In 2018, KETD achieved industrial output value of 530 billion yuan (\$78.07 billion), 500 billion yuan of which was from industrial companies or state-owned industries, whose main income was more than 20 million yuan. The added value of the service industry was 54.5 billion yuan; an increase of 11.0%; the total value of imports and exports was \$70 billion, an increase of 6.5%; the general public budget revenue was 14 billion yuan, an increase of 9.4% (China Daily, 2019; Suzhou Economy, 2019). At the same time, in 2018, the development zone ranked 5th in the comprehensive development level assessment of national development zones (Ministry of Commerce of the People's Republic of China, 2018a).

KETD is the first development zone with self-financed development as its starting point and it continues to deepen reform and open up. It has successively established a number of national-level functional parks, such as the Export Processing Zone, Business Incubator for Overseas Chinese Talent, Optoelectronics Industrial Park and Free Trade Zone (Kunshan Municipal People's Government, 2020). Figure 8.2 shows the specific partitioning.

Figure 8.2: Functional partition of KETD. Source: Plainvim International Co., Ltd, 2016.

In addition to its geographical location and transportation advantages, Qingyang Port runs through the north and south from the middle of the KETD, and Taicang Tang passes by the zone in the north. This unique natural environment provides the basis for the zone's focus on biodiversity. In addition, the zone also attaches great importance to the construction of infrastructure and social services. There are a number of cultural and sports facilities, such as public libraries, archives, Kunqu Ppera Museum, stadiums, swimming pools and civic activity centers, as well as three international standard golf courses.

The zone has medical and health institutions and has opened health wards to foreign businessmen.

KETD has modernization and nationalization as the overall goal, and innovation and development as the means to make new contributions to expanding, opening up and accelerating economic development. The zone attaches importance to and improves supporting services, as well as making full use of superior natural resources to create a comprehensive ecological industrial park.

8.1.2 The historical process of KETD

KETD has undergone multiple expansions and transformation over the past 35 years. It has always adhered to the purpose of ‘scientific development, safety first, environmental priority and ecological development’. Since there is no clear stage division in the zone, the author divides the development into four stages according to major events and turning points as shown in Figure 8.3.

Figure 8.3: Development stage of KETD

First, the initial development stage (1984-1997). In 1985, Kunshan developed a new industrial zone of 3.75 square kilometers at its own expense (Ministry of Commerce of the People’s Republic of China, 2018b), and the requirements of transportation, electricity, communication, water supply and drainage were quickly realized. Subsequently, the first batch of companies settled in to lay the industrial foundation. After development, it became one of the national development zones in 1992 (KETD). Following the conception and implementation of ‘combination of industry and community’, the functional innovation and effect of KETD became further amplified.

Second, the secondary entrepreneurial stage (1998-2006). The zone increased infrastructure construction to improve supporting functions, and constructed

new urban areas to meet the higher social requirements. The establishment of industrial parks also achieved two firsts, namely: the first national Business Incubator for Overseas Chinese Talent was created in 1998, and the first high-tech Export Processing Zone in Chinese history was established in 2000 (People's Daily, 2012). Hence, KETD has formed a development zone pattern with rigorous planning, reasonable layout and complete functions, thus creating a special road of Kunshan development.

Third, the transformation and upgrading stage (2007-2012). (1) KETD was designated as a national eco-industrial demonstration park in 2010 (Ministry of Ecology and Environment of the People's Republic of China, 2014). (2) The industrial development path was mainly divided into two: one was from the processing zone to the pilot construction of the comprehensive free trade zone (established in 2009); and the other one was from the entrepreneurial park to exploring and establishing a test zone. Through a series of system reforms, the development zone has broadened its industrial depth and has embarked on a road to new industrialization, transformation and upgrading in line with its actual conditions.

Fourth, comprehensively upgrade the development stage (2013-present). Committing to a new starting point, the zone promoted industrial agglomeration with a chain layout, becoming the only professional optoelectronic park planned, constructed and developed in accordance with the layout of the optoelectronic industry chain in China. Technological upgrading and development adapted to the rapid changes in market demand and promoted continuous improvement at an industrial level and technological content. It adheres to science and technology research and development as an innovation driver. This especially applies to the long-term adherence to the innovative development model of 'government - industry - university - research' that realizes a perfect combination of technology and industry. Thus, KETD has formed a competitive eco-industrial industrial park with high quality, better structure and more efficiency.

8.2 Assessment of governance context in KETD

The following section analyses the governance context for sustainable development in the KETD. It then presents the interview results and observations on the four qualities of the GAT, namely: extent, coherence, flexibility and intensity. These are assessed in the five governance dimensions of the matrix that forms the framework of the GAT (Bressers et al., 2013a, b). The differences in perception between high-level and low-level means the levels and scales dimension of the extent aspect showed a negative assessment. The problems perspectives and goal ambitions were relatively weak, since they only considered most stakeholders' goals. Coherence of actors and networks and strategies and instruments performed positive. The flexibility and intensity aspects of the strategies and instruments dimension were also positive. Overall, the dimension of strategies and instruments in the zone had a positive assessment.

8.2.1 Extent

Although most extent dimensions were considered positive, the levels and scales had a negative assessment. There are significant differences in the answers given to this dimension between the high management level (focusing on the development zone level) and the low level (focusing on the company level). The local government only formulates relevant laws and regulations, while the development zone has a clearer understanding of whether all levels and aspects are covered in the decision-making and governance process. Interviewees from relevant management departments indicated they had provided a good investment environment for settled companies. For example, the zone has invested more than 19 billion yuan in the construction of infrastructure, such as transportation, telecommunications, water supply, energy and environmental protection, as well as having realized the means for land, water and air transportation to expand and open up opportunities. At the same time, international schools and foreign hospitals have been established,

foreign banks introduced and land ports opened. These examples indicate that the company, as well as the employees, are fully considered. However, companies and employees have different ideas. Despite the establishment of kindergartens and international schools, resources are still scarce to meet the needs of numerous employees.

In addition, the companies interviewed believed that the relevant departments of the development zone have considered little whether they can strictly implement the requirements of their superiors and their feelings about policies and regulations. Taken together, the main negative reason is that the high level considered all levels, but some ignored the real feelings of the low level.

The dimension of problems perspectives and goal ambitions received a neutral assessment as the development zone listened to the views, suggestions and goals put forward by most stakeholders and considered what could be adopted and disclosed in light of the actual development of the zone.

The other dimensions were powerful and got a positive assessment. For actors and networks, the development zone involved all actors in formal and informal meetings to discuss development-related issues. None of the interviewed actors reported the feeling of being excluded from any governance development process. Therefore, KETD has established a strong network that involves all stakeholders in the zone. It is worth emphasizing that zone's managers have considered the needs of surrounding communities and the layout of future development. The local government formulated a range of laws and regulations covering multiple fields, such as energy consumption, environmental management, price subsidies and resource conservation and development. According to laws and regulations, the relevant departments of the zone will supervise and inspect related issues to urge the problem companies to rectify problem works. The development zone has sufficient resources. These are scientifically coordinated and reasonably distributed to various functional departments (e.g., the comprehensive coordination department, the supervision

department, and the public resources transaction management department) within the zone. There are different departments with clearly defined responsibilities. Although the overall situation regarding the extent was positive, high-level managers needed to pay attention to various aspects to eliminate the negative performance of levels and scales. Involving all stakeholders goals in the governance process will improve the dimension of problem perspectives and goal ambitions.

8.2.2 Coherence

Coherence had a degree of support in the KETD's governance context. The relevant departments play a key role in terms of cohesion among stakeholders. All actors interviewed believed that the dialogue and development can be promoted, as long as the relevant departments carry out decision-making based on the incidents. The role of other stakeholders cannot be ignored. For example, if the company cannot implement air pollution control decisions well, then everything is empty talk. Hence, promoting an interactive process can help establish a stable relationship network. Interviewees in the companies said they trusted the decisions made by decision-makers as only the existence of trust relationship can achieve the coordination of governance. Moreover, stakeholders were satisfied that the local government considered most relevant aspects and the actual situation of all stakeholders when proposing laws and regulations. This provides a strong guarantee for the coordination and cohesion of strategies and instruments. They mentioned also that, due to the certain value of the trust-based and stable collaborative relationship, there would not be any conflict or overlap between these instruments over time. This indicates that positive progress has been made in terms of cohesion.

The neutral dimensions shown in coherence were mostly due to high-level decision authority. At present, there was basic mutual trust and dependence showing at all levels in the zone. When discussing major issues, only high-level decision-makers can make decisions and their opinions were more important.

Although the low-level stakeholders interviewed indicated that the management and decision-making departments of the development zone have made better decision plans and goals, the cohesion performance may not be as effective when the decision goes wrong and when they think profits are more important.

An emphasis on the coherence of responsibilities and resources is needed because of the different views of the stakeholders interviewed. The higher the level, the more responsibilities that can be performed in a cooperative manner (positive), while the lower the level, the more the functions were considered to perform their respective work because coordination and cooperation were more difficult to achieve (negative). This may be due to different perspectives and ways of looking at the same issue. For example, in the process of environmental protection improvement of electroplating industry, the development zone needed to cooperate with relevant departments with different responsibilities, such as the safety and environmental protection department and the supervision department, to achieve the transformation and upgrading of environmental protection and safety. However, in such a governance process, the company may only need to carry out rectification work by environmental protection-related departments.

Using this, this dimension received a neutral assessment. While most coherence aspects were neutral, the cohesion between actors and between instruments was deemed positive. This is because all actors could interact through a stable network and related strategies and instruments also could produce synergistic effects.

8.2.3 Flexibility

For the KETD, there is some flexibility of strategies and instruments. A specific example is the solid waste resources utilization need to form a closed-cycle industrial chain. When we interviewed a company in the electronic information industry, they pointed out that, although the government

has issued relevant regulations in 2013, namely, the ‘Notice of Circular Economy Development Planning’, the framework and content of how to carry out the solid waste resources utilization are relatively vague. This greatly restricts the progress of the solid waste resources utilization when the penalties for violations of laws and regulations are small that result in low costs of any violations. This company proposed that all solid waste resource utilization, including solid waste from construction, should form a closed-cycle industrial chain. Only in this way, could the development of this type of company go more smoothly. In fact, the creation of this new instrument seems to be more flexible than the government policy as stakeholders (especially companies) use different strategies and instruments in combination to fit with particular situations.

Other dimensions lack a degree of flexibility. The interviewed management department described how various levels usually communicate from the superior to the subordinate through formal agreements. Some special and urgent circumstances are not ruled out, and China hosts a nepotistic society. For example, once a major water pollution situation is discovered, solutions and measures can be taken at any level. In this case, the development zone is more willing to listen to the advice of companies since they know more about the composition of pollutants and the harm they can cause. Moreover, the zone and companies interviewed indicated that it usually takes about three months to invite relevant new actors, especially companies, to participate in the governance of the zone and put forward suggestions. The goals in the zone will be reformulated based on developments and recommendations and significant changes disclosed in the White Paper. The relevant responsibilities for resource allocation will also be adjusted. Under normal conditions, when there is no crisis, the situation regarding the flexibility of governance was deemed neutral and the assessment was positive for the strategies and instruments dimension as stakeholders can freely combine and use related instruments according to the actual situation.

8.2.4 Intensity

The intensity of the strategies and instruments dimension was positive. The stakeholders interviewed said that their different environments, status and cognitions meant the difficulties and conditions required for different stakeholders to achieve their goals were also different. This meant that the behavior of actors would be slightly different and this would vary according to changes in the environment. The development zone interviews found it was still necessary to comply with the written documents for minor issues that affect stakeholders in the strategies and instruments process. However, once an issue expanded and started to involve a wider range of stakeholders or cause serious losses, they would organize a meeting to solve the issue through collective negotiation.

All other dimensions were assessed neutral. At present, whether it involves major decisions related to development strategies and directions, or minor proposals related to specific implementation measures and methods, the local government or the management department of the zone constituted the most relevant level. In the environment of China, companies or surrounding residents generally have the power to act and make suggestions. Managers of the development zone indicated that only some stakeholders participate in the management reform or conflict. This is because they decide what kind of stakeholders need to participate. They believed that, with only a few changes or modifications, the goals could be achieved better and faster. At the same time, resources and information also play significant roles, and resource allocation promotes cooperation among stakeholders and, thereby, improving efficiency. Generally speaking, the overall assessment of the intensity was neutral, while the positive assessment of the intensity of strategies and instruments was because they have the same influence on stakeholders, no matter how the situation changes.

Table 8.1 summarizes the color-coded results of the KETD's governance context.

Table 8.1: The governance context of KETD

Governance Dimensions	Governance Criteria			
	Extent	Coherence	Flexibility	Intensity
Levels and scales				
Actors and networks				
Problem perspective and goal ambitions				
Strategies and instruments				
Responsibilities and resources				
<i>Colors Red: Restrictive; Yellow: Neutral; Green: Supportive</i>				

8.3 Assessment of sustainability in KETD

KETD's 35 years of development has accomplished remarkable achievements in attracting investment, industrial transformation and upgrading, scientific and technological innovation capabilities, as well as has increasingly optimized the quality of urban functions. This section details the actual status of the sustainability. The color code is then used to represent the level of each criterion.

8.3.1 Social aspects

Nearly half of the social criteria were positive. KETD attached great importance to the comprehensive development of social and livelihood undertakings, which optimized the quality of urban functions. The zone provided social supporting facilities to all actors who work in the zone and surrounding residents. Surrounding residents mainly benefit by social welfare related to leisure and entertainment vis a vis their interaction with KETD. The representative of the development zone indicated they have established green belts, city squares, a series of theme parks and urban ecological forests based on their geographical and natural environmental advantages. This adds a strong sense of beauty and also allows residents to exercise and relax. Housing,

medical care, education, training and catering are provided to actors in the zone, which are closely related to their social needs. The actors interviewed gave two examples to illustrate. (1) Housing was provided in the zone, and different subsidy standards given to talents with different skills or education, such as low as 1000 yuan per month or as high as 50,000-100,000 yuan for highly educated talents. If no housing was provided under special circumstances, the rent would be fully subsidized. (2) There are about 30 hospitals and community health stations providing medical services. To attract foreign investment, it also opened foreign card medical service.

The zone has formal and systematic safety and environmental regulations, as well as good quality security measures, such as access control, cameras and identity cards. The zone has established a website for project quality and safety supervision, including important notices of annual production safety meetings, disclosure of negative behaviors and the importance of publicity and monitoring. Emergency service provisions also performed well as there are emergency rescue plans and reports. The actors interviewed expressed that they have clear measures and treatment steps for the special events most likely to occur, such as fire safety and prevention of high-altitude fall accidents. KETD has an obvious development goal and direction and has opened up a new industrialization strategy and established a development zone with integrated urban functions highlighting people's livelihood.

Other criteria need to be improved including the performance of basic public transport that is relatively unstable. Managers indicated that there are also differences in shifts due to different routes in the zone. Some of the larger communities of employees have about a 30-minute commute, while others have fewer shifts. There are subsidies in place of 1-2 yuan for those traveling long-distance roads and free rides for shorter roads. The zone's subsidy policy for kindergartens is 1,000 yuan per semester per employee, but the number of child care and kindergartens is small.

Only the development zone has formulated the policy of ‘Urban and Rural Employment and Entrepreneurship Planning’ to support equal employment opportunities, but does not want special jobs for men or women. Employee training and workplace health standards of companies in the zone meet the requirements of domestic laws. The trade union has a certain influence only on employee welfare and union construction, but this does not mean that it has great substantive influence.

For the dimension of job creation and labor, the interviewed management department said that the development zone regards project development as a lifeline and seeks to continuously increase the intensity of investment promotion. So far, more than 2,360 foreign-funded companies from 51 countries and regions, including Europe, the United States, Japan, South Korea, Hong Kong, and Macao, have been introduced, with a total investment of \$39.6 billion, and nearly 25,000 registered domestic-funded companies (Suzhou Economy, 2019). Such a strategy increased employment. KETD has achieved more than 40% of Wuxi’s total regional GDP and 50% of its industrial output value, showing a high level of economic development (Kunshan Audiovisual, 2018). However, there is no direct evidence from the economic data to show a specific increase in labor income. The science and technology innovative companies and the overseas talents entrepreneurship park attract talents to join. The government and the management department also put forward relevant subsidy policies mostly limited to the purchase of houses. Therefore, the scope of the subsidies needs to be expanded and the standards need to be refined.

8.3.2 Environmental aspects

KETD’s overall environmental assessment was relatively strong and no criteria were evaluated negatively.

First, there are clear environmental standards and emission reduction policies for various types of pollutants in the zone, so each company should have a corresponding environmental permit (e.g., a pollutant discharge permit) before

taking measures. This was confirmed by the representative of the company's environmental protection department who reported that each industry needs to develop a unique eco-industrial system based on its own situation, such as action plans for the production and application of green building materials.

Second, KETD has achieved intensive land use, which is one highlight of realizing an EIP. Since its establishment, the development zone has expanded on the strategic perspective of sustainable development and adhered to the land supply principle of control of the total amount, strictness, as well as economy and intensification. It regulates the demand for land scientifically to optimize the structure of land. In 2011, a set of data was disclosed to show that it had achieved gratifying results in terms of intensive land use. This meant that in the original export processing zone of 1.86 km², the land investment per mu¹⁰ was as high as \$751,000, and the total industrial output value exceeded 260 billion yuan (Chen, 2017).

Third, the development zone requires all companies to implement integrated waste management and establish a public information service platform for circular economy. Each company displays its waste on the platform for exchange or purchase with other companies. It also needs to carry out industrial waste recycling, establish and improve the recycling chain of waste separation, recovery and reuse. Companies are required also to carry out internal cleaner production to promote material circulation and waste metabolism on the basis of resource utilization and waste minimization.

The other criteria were neutrally assessed. First, only some companies are certified by ISO14001 because the zone has no mandatory regulations in this respect, while others have their own environmental management systems without any certification. Similarly, a number of companies have passed ISO50001 certification, or have implemented energy management procedures, indicating how the basic energy network has been formed.

¹⁰ mu: a units for measuring land area in China (=0.0667 hectares).

Second, according to the industry characteristics of the zone, the emissions of air pollutants, wastewater streams, electronic waste and construction waste are mainly monitored and inspected regularly (every half a year). Once regulators find that emissions exceed standards, they conduct an orderly inspection and then take corresponding measures. There are policies and regulations on greenhouse gas emissions, such as the notification of the work plan for controlling greenhouse gas emissions. These only comply with national regulations on atmospheric emissions. The surrounding residents indicated that they felt little change in the environmental quality, perhaps because the environment in the zone has always been good. In fact, this indirectly proved that the relevant environmental policies and regulations have produced good results. Moreover, in order to improve the water supply environment, sewage treatment plants have been built in the east and west respectively. Wastewater and water supply comply with all relevant laws and regulations and the development zone sometimes cooperates with companies to recycle central wastewater. To protect soil, the zone has always strictly complied with the 'Measures for Soil Environmental Management in Contaminated Land' formulated by the State in 2016. The zone also occasionally carries out additional activities, such as monitoring soil and water conditions and reporting discharge status.

Third, KETD has established many parks and modern tourist attractions within natural environments and cultural landscapes, adding new scenery to the development zone. Such construction only shows that it pays attention to basic biodiversity and the wider needs to be improved in the future. Fourth, as mentioned previously, the zone encourages and advocates waste supply and by-product exchange among companies. However, the outcomes were not so good. Sometimes the products displayed on the platform were left unattended and occupied the inventory for a long time. Hence, it can only be said that the zone is working towards achieving zero waste.

8.3.3 Economic aspects

The assessment of economic criteria turned out to be neutral, with some quite positive aspects. Although the development zone occupies only one-ninth of the land area of Kunshan city (Suzhou Economy, 2019), its economic growth has promoted the region's economic development. The data indicated that, by 2018, the zone has achieved more than 40% of Wuxi's total regional GDP and 50% of its industrial output value, contributed more than 60% of the foreign investment, more than 70% of Taiwan-funded output, and more than 80% of the total imports and exports (Kunshan Audiovisual, 2018). In addition to the rapid economic growth and its radiating effects, environmental development also played an important role in the regional development. During the field survey, we found no chimneys in the zone. The data showed the gasification rate is 87% and the green coverage rate is 41.6% (KETD, 2020). At the same time, it achieved central heating and gas supply targets and drinking water quality met the national secondary water standards. Thus, the zone is clearly paying more attention to the comprehensive, coordinated and sustainable development of the economy, environment and society, and making continuous efforts to build an ecological comprehensive development zone with modern atmosphere.

While the above sounds positive, there are some aspects that were just neutral. For participatory procedures to improve park operations, there is no relevant place to accept complaints, either online or in reality. Even so, the development zone regularly inspects and monitors the companies involved and discloses their results. If needed, they will be required to rectify that which does not comply with regulatory standards and, in the meantime, pay pollution fines. The relevant departments mentioned they give certain subsidies to industries, such as intelligent equipment manufacturing and integrated circuits, but related policies and documents have not been made public. The local government issues corresponding policies to support and provide cash rewards for some industries in need of transformation and upgrading. For example, in early 2019,

Kunshan city issued a notice to shut down the electroplating section of four electroplating companies. Since Xinhua Electronics had shut down and removed the electroplating section, they were given a one-time reward of two million yuan. Simultaneously, the management departments of the zone stated that they had carried out much basic infrastructure construction and provided maintenance services. However, such ‘excessive’ infrastructure maintenance does affect the social costs, and they need to think about this issue and propose solutions in the future.

Figure 8.4 depicts the results of the assessment of the KETD’s sustainability aspects.

Figure 8.4: The specific visualization of KETD sustainability

8.4 The influence of governance context on sustainability in KETD

The previous two sections have assessed the governance context and sustainability. However, the results of its social, environmental and economic dimensions are often affected by multiple criteria and the zone’s development

strategy and direction, rather than by a single governance criterion. Thus, this section explores how the governance context affects sustainability in this case.

The governance context has a certain restricting influence on some social aspects.

The development zone reports insisted they covered the feelings and needs of all levels and disclosed relevant information. The performance on talent policy was actually not satisfactory. Many policies and regulations (e.g., talent introduction policies and incentives, related subsidy policies), as well as disclosures have certain problems, as follows: (1) The view of establishing policies and regulations is unclear, the content is not specific, and the supporting legal measures are incomplete; (2) Only major information or content issues that are considered by the high level (i.e., the local government and the management department of the zone) will be disclosed, because of the absolute power of the high level. As a result, the high-level, especially the development zone level, does not consider the low-level real thoughts on the policies and regulations and the effect of disclosure on the actual implementation. There are no transparent means to give access to the specific content of the talent introduction plan. This is the perception of many companies and employees who do not know the specific contents of the talent introduction plan and also fail to obtain specific economic indicators from the disclosed data, such as labor income. The functional departments said that, due to their limited resources, they could only listen to and meet the goals of most stakeholders according to the development needs. Even so, they provided companies and employees with a relatively comfortable and safe social environment as much as was possible. For example, in 2019, the joint law enforcement department of the development zone rectified 72 off-school training institutions and closed 54 unlicensed kindergartens. The interviewed development zone actors showed there was indeed a lack of consideration of child care, but said efforts will be made to improve the situation in the future. At the same time, companies currently implement and enforce their behaviors

in accordance with disclosed legal norms, while the employee training and workplace health standards only meet basic domestic legal requirements. For some aspects that have little impact and already have relevant regulations in the zone, companies will no longer formulate their own similar rules and regulations. Gender policy is an example.

Through field interviews, we realize that the governance context in the zone promotes the realization of some (other) social aspects.

First, the development zone did seek the opinions of all actors through formal and informal meetings, which increased their positive feelings of participation. Such behavior was manifested in the provision of public transportation, housing and large subsidies, medical care and catering. The zone emphasized that the needs of surrounding communities could not be ignored, because they were the guarantee in delivering the long-term development goals and were the backing force of the main actors. Hence, infrastructures such as exhibition halls, gymnasiums and grand theaters have been established in the zone to meet leisure and entertainment needs. The establishment of these infrastructures also promotes the enthusiasm and vitality of all actors.

Second, three key R&D carriers have been established in the zone, many of which are technology-driven companies and, therefore, security measures are very important. It also includes potentially dangerous company types, such as chemical industry, manufacturing and logistics. So, it is necessary to establish systematic emergency measures.

Third, because the zone sets multiple goals and reformulates them to accommodate changes in the development, this is conducive to regional economic development. The development zone has adhered to the innovative development model of ‘government - industry - university - research’, which has achieved a clear strategy of cooperating with the local institutions.

The influence of the governance context on environmental aspects.

First, clear environmental policies and regulations make it necessary for companies to have corresponding environmental permits, such as the provisional regulations on pollution permit management issued in 2016. However, for ISO14001 and the establishment of an energy network, there are no mandatory requirements, nor clear regulations. Moreover, because the development zone developed as a new industrial zone at its own expense, the limited funds and lack of experience at the outset made it necessary to formulate a series of coordinated policies and strategies in a timely manner. For example, ‘rich planning, poor development’, ‘relying on the old city, developing a new city’ and so on. As a result, the local government and the zone carried forward the fine tradition of self-reliance and hard work, implemented the land supply principle of strict, economical and intensive, scientifically controlled and optimized land use structure, and realized intensive land use. The relevant departments of land and resources reported that they have always adhered to the land use purpose and have even more clearly recognized the importance of land resources, even though the zone has achieved significant results. In 2016, a relatively formal guideline on ‘Environmental Soil Management Method for Contaminated Land’ was introduced.

Second, the development zone provided a platform for companies to implement integrated waste management, and required them to comply with it and strictly implement it, which reflects that different actors have different functions. Hence, the realization of integrated waste management activities was facilitated by the institutionalized and stable interactive approach involving all actors.

Third, the environmental development in the zone mainly relies on the location. Many theme parks were subsequently established to further improve the environmental level. The managers interviewed indicated that they will pay more attention to biodiversity in the future to achieve the goal of creating a real EIP.

Fourth, the zone mainly communicates issues from high-level to low-level through formal agreements (e.g., laws and regulations). The time interval is relatively long, even if the opinions of companies or new actors are heard. Therefore, only some activities have been carried out for pollution monitoring, wastewater treatment and soil protection. The formats for these are also relatively simple and rigid.

Finally, according to the characteristics of the industry and economic development goals, the development zone has set up a circular economy public information service platform to encourage the exchange of materials and waste supply among companies. Due to the lack of continuous follow-up in the later stage and weak supervision, this has made such a platform ineffective in playing a good role to realize zero waste.

The influence of governance context on economic aspects.

First, KETD always adheres to the innovative spirit of ‘striving for the first place and creating the only one’ and strives to break down the development barriers with institutional innovation as the driving force. This has achieved remarkable results in economic development. At the same time, the development zone has achieved the role of a leader in driving economic development through the use of overseas talents entrepreneurship park and the scientific research achievements reached in cooperation with universities, such as Peking University and Tsinghua University, thereby promoting the development of the region.

Second, the high level of the development zone rarely considers the immediate interests or real needs of companies and employees. So, it does not pay attention to the importance of complaints.

Third, consistent with the reasons for the neutral influence of relevant social policies and regulations, only some relatively important subsidy policies have been formulated and disclosed.

8.5 Conclusion

This section conducted a comprehensive assessment of the sustainable development of the development zone. First, the performance in terms of governance context were relatively positive, except for the weaker results of flexibility and intensity. While most of the extent criteria were assessed positively, the levels and scales dimension had a negative assessment. The other dimensions of coherence criteria had a neutral assessment, except for the positive dimensions of actors and networks and strategies and instruments. In terms of sustainability, the assessment results of the social, environmental and economic aspects are basically the same and were neutral. Second, the social aspects of the development zone were affected by the governance criteria of extent, flexibility and intensity. The main reason for the social aspect of the neutral dimensions was that the development zone had decision-making power of high-level that took less account of the true feelings of the company level and the actual implementation of policies. Third, the environmental aspects were largely positively affected by extent and coherence. Although the strategies and instruments dimension of intensity criteria had a positive assessment, this had no positive influence on the environmental aspects of waste, materials and by-products exchange. The researchers found that the development zone had relatively comprehensive strategies and instruments for waste, materials and by-product exchange among companies. However, the unexpected result about not achieving zero waste surprised us. By recalling the experience of the interview, we realized that the zone believed a formal and systematic exchange platform could have a positive effect on all stakeholders, but ignored the need to realize these goals through proper supervision and negotiation in the later stage, thus zero waste was not achieved. Fourth, the economic aspects were mainly affected by the extent and intensity of the governance context. In the future, more consideration should be given to low-level needs, while all relevant policies and regulations need to be formulated and disclosed better than at present.

9. Case 5: Yangzhou Economic Development Zone

9.1 Introduction

This section outlines the development of Yangzhou Economic Development Zone (YEDZ) from multiple aspects, such as location, transportation and environmental construction, to support the subsequent analysis of the governance context and sustainability.

9.1.1 Geographical and environmental information of YEDZ

YEDZ is located in the southwestern part of Yangzhou, Jiangsu Province, as shown in Figure 9.1. The development zone is only 30 minutes to Yangzhou Taizhou Airport, one hour to Nanjing Lukou Airport, and three hours to Shanghai Pudong Airport (YEDZ, 2019a). Although there are no train stations in the zone, the Ningqi Station of Yangzhou Railway has been opened and is connected to the national railway network. At the same time, the Jinghu Expressway (Beijing-Shanghai), Ningtong Expressway (Nanjing-Nantong) and Yangjing Expressway (Yangzhou-Liyang) run through Yangzhou city, forming a highly developed expressway network. Yangzhou is the only city in Jiangsu Province that has an expressway around the city. It only takes 10 minutes to get on the expressway from any part of the development zone. Moreover, with the Yangtze River in the south, the development zone has built a first-class national opening port-Yangzhou Port. There are currently eight berths, three of which are 10,000-ton cargo terminals and one for passenger berth (China Ports Association, 2008). Therefore, YEDZ has become an important node of the Shanghai economic circle and of the Nanjing metropolitan area.

Figure 9.1 Geographical map of YEDZ. Source: Chinese Research Academy of Environmental Sciences, 2006.

YEDZ covers a total jurisdiction area of 133 km². It has three towns and two sub-districts with a resident population of around 200,000 (YEDZ, 2019b). The key industries are electronic information, solar photovoltaic, automotive equipment and port logistics. In 2018, KEDZ's industrial added value above designated size¹¹ was 133.445 billion yuan, an increase of 8.19% over the previous year; public fiscal budget revenues reached 14.979 billion yuan, an increase of 10.44% over the previous year; the treasury revenue tax of industries above designated size reached 13.609 billion yuan, an increase of 11.87% over the previous year (Yangzhou Municipal Bureau of Commerce, 2019). YEDZ is bold in its approach to innovation and reform and has formed the overall industrial layout of 'one city, one zone and four parks', i.e., Lingang New City, Export Processing Zone and four major industrial parks with specific characteristics, i.e., green optoelectronic industrial park, equipment

¹¹ Industrial companies above designated size: Industrial companies or state-owned industries whose main income is more than 20 million yuan.

manufacturing industrial park, high-end light industrial park and port logistics industrial park (YEDZ, 2019c). The specific zoning and industrial pattern are shown in Figure 9.2.

Figure 9.2: Functional partition of YEDZ. Source: YEDZ, 2019c.

In addition to the transportation and location advantages afforded by its connections to the river and sea, YEDZ, has the good ecological environment of Yangzhou (e.g., Yangzhou has been awarded the National Forest City, National Environmental Protection Model City) and has vigorously launched the park system construction to achieve the continuous optimization of the ecological environment. The development zone has established the Yangzijin Science and Education Park with its abundant human resources. The zone has complete commercial functions and a rich ecological diversity with six large shopping centers, ancient canal scenery and commercial blocks in Lingang

New City, which has become a livable place for ‘meeting, leisure, tourism and shopping’ (YEDZ, 2019d).

YEDZ is clearly partitioned according to different functions and has realized an industrial pattern of relatively concentrated, prominent characteristics, complete with supporting facilities and intensive development. The zone has deepened the concept of ‘close business, security business and wealthy business’ to provide investors with high-quality services. This makes it the preferred place for investment and development in the Yangtze River Delta.

9.1.2 The historical process of YEDZ

YEDZ has gone through multiple expansions and industrial reforms over two decades. Its economic and social development has continued to accelerate, presenting distinctive characteristics. The time period nodes are relatively vague, so there is no clear stage division. We have divided the development into four stages according to several important turning points, as shown in Figure 9.3.

Figure 9.3: Development stage of YEDZ

The first initial establishment stage (1992-2001). YEDZ was established in May 1992 (YEDZ, 2019b). Subsequently, it was approved as a provincial economic development zone by the government of Jiangsu Province in October 1993 (Investment Promotion Agency of MOFCOM, 2017).

The second rapid propulsion stage (2002-2008). Since January 2002, the development zone has successively taken over Shiqiao town, Bali town, Puxi town, and Wenhui and Yangzijin streets. The jurisdiction of three towns and two sub-districts was finally achieved in 2008. The zone’s industries have gradually established. In June 2005, Yangzhou Export Processing Zone was established with the approval of the State Council (YEDZ, 2019b). Then, the

Export Processing Zone officially passed the joint inspection of national ministries in October 2006.

The third industrial cluster stage (2009-2015). (1) The development zone was upgraded to the state-level Economic and Technological Development Zone in 2009 (Investment Promotion Agency of Ministry of Commerce, 2008) and named as a national eco-industrial demonstration park in 2010 (Ministry of Ecology and Environment of the People's Republic of China, 2014). (2) The development zone adhered to scientific and technological innovation and speeded up the development of various industries to establish the industrial cluster. The green optoelectronics industry expanded to downstream terminal applications, the auto parts industry expanded to high-end R&D and design fields, the upstream and downstream supporting facilities of the high-end light industry were improved. The software and internet industries also gradually emerged. YEDZ has five national-level industrialization bases of green new energy, semiconductor lighting, smart grid, auto parts and digital publishing (YEDZ, 2019b).

The fourth high-speed development stage (2016-present). (1) Yangzhou Export Processing Zone was upgraded to Yangzhou Comprehensive Free Trade Zone in 2016 (YEDZ, 2019b). (2) The construction of zone - road - network has been fully opened, city landmarks are rising and social undertakings have formed brands, which speeds up the development of a multifunctional, modern *new city zone*. The zone has achieved the joint promotion and coordinated development of economic and ecological benefits by constantly optimizing the environment and constructing the industrial chain of circular economy.

9.2 Assessment of governance context in YEDZ

The following section analyzes the four qualities (i.e., extent, coherence, flexibility and intensity) of the GAT-tool for the YEDZ for the governance context as a whole and not only a single actor. There was a negative performance for the levels and scales dimension; a neutral performance for the

strategies and instruments dimension and the other dimensions showed positive results for the extent criteria. This was due to the lack of attention to specific aspects of scales. Also, the zone had no environmental-related policies and instruments. For coherence, the development zone attaches great importance to the public surveys of actors and was willing to listen to their opinions to achieve cooperation. All relevant strategies and instruments were clearly distinguished and can produce synergy, so the evaluation of this dimension was positive. All assessments of flexibility were neutral. The actors and networks dimension displayed a positive assessment of intensity because, in the governance process, the management reform and strategy of the development zone were supported by most actors.

9.2.1 Extent

The extent aspects of the governance context were mostly positive. The levels and scales dimension proved more limited as, in most cases, it is constrained to the macro aspects and overall strategic planning that were of high-level concern. Thus, some aspects of concern remained unconsidered. For water resources management, the high level only provides tax incentives for related energy-saving and water-saving equipment, but implementation methods and measures were unclear. There was no focus on biodiversity. Similarly, clear industrial zoning was absent indicating little values were placed with land use. The assessment of the strategies and instruments dimension was neutral as, although the local government included most strategies and instruments, the development zone itself had no separate policy on the environment and the penalties were unclear. The managers of the zone stated that there was only one '263' project, in which YEDZ proposed policies and instruments for immediate rectification given serious dust exposure on the road.

Extent's other three dimensions were positive. The local government said they considered the goals of all stakeholders through different types of incentives and subsidies. For example, by adopting special funding to support key

industries (i.e., advanced manufacturing, software and internet, machinery and special high-end equipment industry and automotive industry); providing incentives and financial subsidies for upgrades, such as incentives of electric boiler replacement and comprehensive awards for technical upgrading of industrial companies; financial support for related environmental protection, such as subsidies for green manufacturing system integration projects, financial subsidies for energy conservation and emission reduction; and, income tax incentives for energy-saving and water-saving special equipment. The stakeholders interviewed stated that these incentives and subsidies virtually covered all their goals, such as the environmental issues surrounding residents were concerned about, and the government support conditions considered by companies.

The same positive extent was appreciated when focusing on the actors. In addition to the relevant incentives and subsidies policies, the development zone also publicly implements online public opinion collection. The surrounding communities interviewed indicated that to better realize cultural construction in 2018, 28 comprehensive cultural service centers were proposed and publicized to solicit their opinions. Such behavior makes them feel strongly involved. Another example was to improve the black odor phenomenon of urban rivers and the deficient condition of the sewage network (e.g., stagnant water of urban roads and sewage discharge), the zone renovated the black odor river channels and water network in 2016. Once projects were proposed, the zone asked for the opinions of all actors, such as whether the construction of the project has an impact on your work and life; requirements of dust and noise during construction; the impact of planning on local traffic. Taken together, these are evidence of measures that increase actors' motivation.

The zone has sufficient resources to enable its different functional departments, such as market supervision department, construction department and China merchant's department, to perform different responsibilities. While the overall extent situation was positive, the assessment was weaker for the levels and

scales item because the focus on scale was not broad enough. The development of more environmental policies and punishment methods in the zone would help improve the assessment of the strategies and instruments dimension.

9.2.2 Coherence

The assessment of the governance context's coherence was also quite neutral. The interviews showed a sense of basic trust and mutual dependency between the actors. Since the development zone attaches great importance to public opinion surveys before implementing relevant policies and regulations, most of the goals are formulated with mutual support. However, China's special environment means that relevant decisions were still made by the local government or zone's administrative departments, regardless of conflicts. Therefore, the opinions of decision-makers were relatively important as they could consider issues in a comprehensive way. Because of this, there was also a question about coherence in regard to the responsibilities and resources to deal with the cooperative relationship among stakeholders in the zone. The final formulation of policies and regulations belongs to the stakeholders at a high level. So, the cooperative relationship among stakeholders was reflected in the process of implementation and action. Similarly, resource allocation rights were also decided at the high-level. The difference is that each level is owned by a relatively high-level stakeholder. The interviews indicated that the local government provides relevant resources to the development zone, then the zone allocates them according to specific conditions. When resources were available to the company, arrangements and adjustments would be made.

Although the coherence criteria were neutral, actors gave a positive evaluation of participatory approaches being used in governance management. All actors interviewed were satisfied by the way they worked together and considered the actor's perspective when proposing measures. Such satisfaction was included in effective legal relationships, as well as in partnerships. This is because the interactive form of combining the solicitation of opinions and relative

decision-making power can consider the opinions and ideas of all actors in an equal manner, while the decisions can better guide the development direction and consider the overall situation. The local government and the development zone have developed a series of strategies and instruments according to different classification approaches. These express no overlap or conflict among strategies or instruments because the distinction is clear. While the overall situation for the coherence of the governance context was neutral, the assessment of two dimensions (i.e., actors and networks, and strategies and instruments) was positive given the active cooperation of all actors and different types of strategies and instruments according to the classification.

9.2.3 Flexibility

The overall assessment of flexibility of the governance context was only intermediate, with some dimensions turning positive over time. YEDZ formed the ‘Compendium of Company Development Policies Summary’ in the zone based on the local government document ‘Opinions on the Joint Innovation to Further Optimize the Development Environment of Companies (No.2, 2017)’. The forms, contents and standards of fund support were mainly compiled in the form of tables. Such targeted documents created a favorable development environment for companies and encouraged them to use and combine corresponding strategies and instruments. However, the companies interviewed indicated that they rarely combined as the policy was more targeted to industries or events. There were no comprehensive rules related to accountability in the development zone and, basically, they followed laws and regulations issued by the local government. Hence, the zone does not have a clear intent to explain the legal liability caused by non-compliance. It only offers some vague statements urging companies to rectify mistakes within a certain deadline and to respond to undealt with ones so they accord with the laws and regulations. Nonetheless, relevant actors said they would not violate legal responsibilities given the strong incentive to obtain financial subsidies. This is also a special approach of combining responsibilities with parts of the

accountability mechanism. With the continuous changes of the external and regional environment, the multiple goals are also changing gradually, showing a situation of flexibility. However, the relevant functional departments interviewed stated that they would only reveal some of the changes.

Flexibility can also be demonstrated in the way that stakeholders-driven topics have been handled by the local government or the development zone. There does not seem to be much flexibility to move up and down levels to detect problems and the emergence of crisis situations. This is because the main decisions to deal with such situations still moves from high-level to low-level. However, the managers interviewed indicated that, in the future, they will follow the same method of soliciting public opinions to deal with problems more effectively and quickly in a flexible way. The ‘assembly’ of the development zone appears fixed. Although the management departments interviewed said that new actors’ (mainly companies) proposals would be considered before entering the zone, the ability to incorporate them into formal structures of responsibility seems questionable. In this regard, informal communication relationships were seen to be effective to resolve the participation of new actors within six months. It seems possible to adjust the distributions of responsibility and, as a result, the overall the situation regarding the flexibility of the governance context was neutral.

9.2.4 Intensity

There was a positive intensity of the various actors, but all other dimensions had a neutral assessment. The positive state of actors and networks was seen in all cases except decision-making. All stakeholders were contributing to the governance of sustainable development. So, most stakeholders were directly involved in most processes of management reform or behavior change. Although China has a high-power distance, levels and scales still had a positive performance on intensity. This reflects the fact that, in addition to the high level, some other levels (e.g., the company level) were also directly involved in

management activities when problems and conflicts arose, thereby pushing in the direction of a more sustainable industrial park. Thus, the evaluation of this dimension was neutral.

For strategies and instruments, the disclosure of environmental policies and monitoring data needs to be clarified. Although environmental authorities stated they were monitoring pollution waste, there was no data to prove this. The official implementation of policies by actors in the development zone was slightly different from the current practice. Hence, the zone needs to make some changes in order to meet the requirements of the goals. The different actors interviewed indicated that for responsibilities and resources, the responsibility for promoting sustainable development did take on most of the resources, but other factors also had an impact, such as the tendency of the local government to formulate relevant laws and regulations and the development trend of the zone. There was also a special factor is the implementation of incentives and subsidies as the main attraction for investment. The over-all situation for the intensity of the governance context was neutral. The assessment was positive for the actors and networks item because the management of the zone believed that most stakeholders involved in the management reform were conducive to achieving the zone's sustainable development.

Table 9.1 details all dimensions of the governance context by adopting color code.

Table 9.1: The governance context of YEDZ

Governance Dimensions	Governance Criteria			
	Extent	Coherence	Flexibility	Intensity
Levels and scales				
Actors and networks				
Problem perspective and goal ambitions				
Strategies and instruments				
Responsibilities and resources				
<i>Colors</i> <i>Red:</i> <i>Restrictive;</i> <i>Yellow:</i> <i>Neutral;</i> <i>Green:</i> <i>Supportive</i>				

9.3 Assessment of sustainability in YEDZ

YEDZ will have celebrated 28 years of existence in May 2020. The industrial cluster has been initially established, mainly in the green optoelectronic industry, auto parts industry, high-end light industry, as well as software and internet industry. Three major science and technology innovation sectors, namely the Zhigu science and technology complex, Xi'an Jiaotong University science and technology park and Military-civilian integration industrial park, have achieved development effects. This section describes the sustainability of the development zone from their social, environmental and economic aspects.

9.3.1 Social aspects

The development zone was basically weak in most supporting social facilities. First, there is no basic public transportation and no subsidies in the zone. However, the actors interviewed indicated that it is convenient to go anywhere in the zone because of the buses in Yangzhou. Second, the zone itself does not provide housing nor subsidies. However, for talent introduction, there are different subsidies standards for renting and purchasing houses. For example, for renting, a monthly subsidy of 4,000 yuan for those with a doctorate or advanced professional qualification; a monthly subsidy of 1,500 yuan for those with a master's degree or sub-senior professional qualification; and, a monthly subsidy of 600 yuan for those with a bachelor's degree or technician

professional qualification. Third, child care or kindergarten facilities are near, but not in the development zone. The last aspect considered in our interviews was gender policy. Interviewees from the management department suggested that neither the zone nor the company had the relevant employment equality policy, but they admitted that there are indeed some special positions designed only for women or men.

The zone is more positive in other social aspects related to development plans and measures. First, all actors believed that the rapid development of technology innovation and industrial clusters in the zone had increased job creation and income. Since 2019, YEDZ has had a comprehensive talent introduction policy, including detailed rules, conditions and subsidy standards, which can better attract talented people to work here. Second, the zone has safety and environmental regulations, as well as systematic security measures. Moreover, it also organizes training courses for production safety management personnel of the company from time to time. Inspections of companies stimulate them to carry out production safety standardization and rectify in accord with the non-compliance deadlines. Third, according to development needs and economic costs, all companies provided special training programs for employees and included such programs in their development strategies. The development zone also provided corresponding training. This is usually held once a year because they can only introduce basic information and situations. Fourth, the development zone has a systematic emergency management plan, namely APELL, to respond to environmental emergencies caused by industrial accidents. They also have clear prevention and treatment measures. Fifth, YEDZ emphasizes the principles of anti-corruption and anti-competition. All levels interviewed stated that they value both aspects. There is a special column about the construction of incorrupt government on the website of the development zone. This discloses the relevant anti-corruption activities carried out in the zone, such as the educational activities to publicize “12•9” international anti-corruption day, and the thematic conference on the

construction of the party conduct. Finally, like most parks that focus on scientific and technological innovation, YEDZ also had a clear strategic plan for industrial clusters and innovation-driven development. It makes full use of the surrounding and even national educational resources to carry out scientific and technological innovation activities, which promotes its cooperation strategy with the local institutions.

Various aspects appeared to be neutral. First, the zone mainly provides entertainment and carting, such as leisure sports parks, shopping malls and commercial blocks, for all stakeholders to use. Although there are no large hospitals in the zone, two top-three hospitals are nearby, namely Wuxi People's Hospital and Subei People's Hospital. Each company provides medical insurance separately. Second, regarding workplace health standards, actors of companies stated that each industry has its own standards. Container manufacturing, for example, has its own standards for wastewater discharge and recycling of industrial water. Finally, there are trade unions at all levels, and their advice and opinions were only listened to when it comes to employee benefits. As a result, the trade union personnel interviewed indicated that they had little substantial influence.

9.3.2 Environmental aspects

YEDZ does have a focus on the dimensions of environmental development and energy management.

First, the zone requires each company to have a basic environmental permit. The companies interviewed indicated that the zone also requires various industries to develop unique eco-industrial systems based on their development characteristics and conditions. These include environmental impacts and countermeasures taken to prevent or mitigate adverse impacts.

Second, the zone requires that every company must establish an environmental management system, whether it is ISO14000 or a similar certification, in order to promote the development of clean production and ecological environment.

Third, the relevant functional departments interviewed showed that YEDZ has established a complete energy network. There are three electricity plants in the zone and Yangzhou has four water plants that are sufficient to provide water resources for the zone. There are two hot stream supply centers in the zone. There is a sewage treatment plant with a capacity of 200,000 tons/day. The zone is located in the natural gas pipeline node area of ‘West-to-East Gas Transmission’. While, in terms of logistics, the world’s leading logistics companies have been settled in the development zone, facilitating the smooth implementation of bonded logistics in Export Processing Zone (YEDZ, 2019d). Thus, the development zone has realized an integrated energy concept that includes a network, energy efficiency and renewable energy integration.

Fourth, relying on the favorable environment, industry and cultural foundation of the region and surrounding areas, the zone has gradually formed an interactive system of green technology and resources, as well as an ecological industry system with strong anti-risk capabilities, which maximizes the efficiency of resource utilization. Hence, the zone has considered the coordinated development of the environment, resources and economy.

In addition, two dimensions of environmental aspects were weaker. First, although the zone has built a park system based on its location and environmental advantages, it still lacks attention to biodiversity preservation. Second, due to limited land and port resources, the zone has only appropriately utilized and developed land and port resources in accordance with the requirements of the local government regulations.

The other dimensions of the environment were considered neutral.

First, the environmental protection departments of the development zone stated that they mainly monitor the pollution level of discharged wastewater, water resources recycling, air pollutants and solid waste recycling. These are checked quarterly and reported in real time or once a week. However, the researcher could not access the relevant data disclosed or reported. The environmental

protection departments interviewed stated that the air pollutants are mainly composed of sulfur dioxide and soot. After desulfurization and electrostatic dedusting in the circulating fluidized bed, the annual emission of atmospheric pollutants SO₂ is approximately 313.5 tons/year, and the annual emission of soot is about 180 tons/year (Chinese Research Academy of Environmental Sciences, 2006). Such air pollutant emission values are controlled within the limits of atmosphere's environmental capacity. Therefore, it is assumed that those emissions might not contribute to climate change. YEDZ also focuses on greenhouse gas emissions and has always complied with the discharge standards of 'Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution', and the 'Integrated Emission Standard of Air Pollutants (GB16297-1996)' issued by the State Environmental Protection Administration. There is no disclosure report of relevant data.

Second, the zone has taken further measures than the laws to protect groundwater and soil and prevent their destruction, while controlling the quality of surface water and sealing the soil. For example, some simple control schemes have been developed for the power generation industry with high waste water volume and heavy pollution.

Third, both the development zone and companies were working hard to strengthen measures of water pollution prevention and improve the efficiency of water recycling. The zone has cooperated with companies to treat wastewater in accordance with relevant laws, but sometimes do recycle central wastewater.

Fourth, YEDZ does undertake some activities to guide companies in waste management. For example, the zone will inspect and publicize the standardization of waste management, and carry out industrial waste recycling to establish a relatively complete waste recycling chain. Only some companies have implemented waste management, and sometimes exchange experiences.

Similarly, this zone encourages and promotes the exchange of materials to help achieve zero waste in the future.

9.3.3 Economic aspects

The establishment of YEDZ relied on the advantages of location, education level of local population and environmental properties to promote its positive economic results. In 2017, the development zone achieved a regional GDP of 60 billion yuan, an increase of 6.9% (Yangzhou People's Government, 2018). This shows that the zone improved the level of regional economic development. The environment also has been improved, with urban green coverage reaching 48% (YEDZ, 2019d). The ecological industry makes reasonable use of material resources to minimize the impact of economic activities on the natural environment in line with the principle of sustainable development. The zone pays more attention to the comprehensive, coordinated and sustainable development of economy, environment and society to realize a development process that delivers quantitative change and qualitative change. The development zone staff interviewed indicated that the industrial economy boosts local taxes and employment. Since 2017, the local government has provided incentives and subsidy policies tailored to different types of industries and implemented tax reduction or exemption policies for some foreign-funded companies. These policies and related information are public and the subsidy data are recorded in the disclosure report of the zone.

There is a mailbox of work opinions in the development zone and relevant personnel need to fill in the working consultation and related opinions and suggestions by the way of signature, but the system does not accept complaints. The functional departments stated that all complaints and relevant evidence materials should be sent by post, and marked 'government information disclosure' in the lower left corner of the envelope. Due to the lack of infrastructure, it can be concluded that YEDZ has less consideration and provision of societal-related costs.

All the sustainability criteria are summarized in Figure 9.4, and a color code histogram is used to show the level of each aspect.

Figure 9.4: The specific visualization of YEDZ sustainability

9.4 The influence of governance context on sustainability in YEDZ

This section details the links between the governance context and the three aspects of sustainability (social, environmental, and economic) to clarify the extent to which YEDZ's governance context affects sustainability.

The negative evaluation of multiple social aspects may be due to the higher organizational levels of YEDZ concerned with major policies compliance, so less consideration of compliance is given to the social infrastructures. The zone management department indicated that, although they did not provide shuttle-like services, there was good municipal transportation in the zone. There are also institutions, such as kindergartens, nearby. YEDZ does not need to use additional resources to establish such infrastructures. Simultaneously, the zone has formulated a relatively comprehensive talent introduction policy, which includes detailed rent and housing subsidies, so there is no need to

provide housing. The zone managers indicated that recruitment is a matter for companies to implement according to their needs. Therefore, they do not need to formulate relevant policies and regulations to interfere too much. So, even if there was a special position, but it was a job that need doing, then this has nothing to do with gender discrimination, particularly when there are more suitable female candidates to cover the job vacancy, for instance.

Thus, from this analysis, some aspects of the governance context and the development strategy of the zone have a positive social impact. Some examples are described here. First, YEDZ has always pursued the purpose of ‘serving investors and making investors profitable’, as well as striving to create a ‘whole-process, all-directional and all-day’ service brand and an investment environment of ‘close business, security business and wealthy business’. The goals and requirements of all stakeholders are included and such strategies promote the development zone to have clear development goals and directions, and increase jobs and income levels. Second, the local government and the development zone have formulated comprehensive policies and regulations, and different functional departments have clear responsibilities. This is, in principle, conducive to the better implementation of relevant measures and principles in the zone, such as security and emergency measures and anti-corruption principles. At the same time, the relevant functional departments can also attach importance to employee training and include it in their relevant plans to match the development needs of high-tech industries in the zone.

The governance context also promotes the realization of social aspects to some extent. First, the zone has only established some community medical institutions after considering the needs of stakeholders at the bequest of the high-level’s role in decision-making and formulation. Second, clear policies and regulations urge companies to have relevant workplace health standards. Although the high level of power controls decision-making, cooperation is always required, whether this be spontaneous or forced. This makes the quality

criterion of coherence so important. As such, each industry may formulate corresponding health standards for different office locations according to the special circumstances of its own development. This is conducive to the rapid development of companies in combination with the actual situation. Third, most stakeholders here are directly involved in managing changes or conflicts. However, there was a difference in the intensity of the impact. Combined with the culture of high power distance in China, trade unions only have influence for a special event, such as employee compensation, and they have almost no substantial influence on other aspects.

Governance context has a positive influence on the environmental aspects. First, this is because clear environmental policies and regulations of the local government require companies to have corresponding environmental permits. Even institutions providing related social services (e.g., cinemas, hotels) must have a public place health permit. Second, because the high-level is making decisions and planning to reduce environmental impacts, the zone requires companies to have relevant environmental management systems, such as ISO14000 certification process. Third, the zone considers the development needs of all actors, and makes better use of surrounding resources and related advantages (e.g., ports and gas nodes). This has established a systematic and comprehensive energy network, especially in terms of steam and logistics. Such resources and advantages are conducive to the sustainable development of companies, as well as promoting the coordinated development of resources, environment and economy in the development zone.

There are also some intensity aspects of the governance context that play a role in promoting.

First, some differences exist between the policy implementation and practices in the development zone. Although the actors interviewed indicated they disclosed the monitoring data, no relevant evidence was found to support this claim. At the same time, all actors stated that they have implemented relevant

environmental protection actions (e.g., soil and water conservation, and central wastewater treatment) in accordance with the law, but the actual implementation situation may need to be confirmed.

Second, the actors concerned believed that some goals could only be achieved with minor improvements. According to the particularity of the industry, the zone recognized the importance of integrated waste management, and hoped to guide companies to carry out corresponding activities by disclosing relevant information. Although the safety and environmental announcements were all related to the inspection and acceptance of projects carried out by companies on solid waste pollution prevention and control facilities, the disclosure of implementation and the exchanges between companies were relatively rare. Therefore, in the future, the local government or the development zone could improve measures to conduct waste management and material exchange, so as to achieve zero waste.

Other governance dimensions of extent have a negative influence on the environment. There are no clear current policies and regulations on environmental protection, and most only pay attention to environmental pollution, so biodiversity has not been covered. Limited land resources and unsystematic land use principles and strategies have made the planning and use of land in the zone only in compliance with relevant laws and regulations. Hence, effective land use has not been effectively carried out.

The influence of governance context on economic aspects has been relatively positive. First, YEDZ established multiple goals in the development process that do change with the internal and external environments. So far, the development zone has achieved the following four development goals: attaching importance to and improving the investment environment to make industrial initially achieve clustering; technological innovation industrial parks and institutions are established by using surrounding education resources; regional construction and improvement of urban appearance to promote the

development of multi-functional, modern new urban areas; taking advantage of the location advantage of the environment and vigorously implementing the construction of the park system to promote the optimization of the ecological environment. Thus, the economic level of the zone has been improved and is conducive to the overall development of the region. Second, comprehensive industrial subsidies and tax policies have promoted the settlement of companies, thus increasing employment. Third, when problems arise, the development zone still tend to shift from high-level to low-level. As a result, the workers' opinion mailbox adopts the communication method of non-public information, so it is difficult for other lower-level actors to obtain the information and obtain feedback.

9.5 Conclusion

This section provided an assessment of YEDZ's governance context and sustainability aspects.

First, flexibility was relatively weak in terms of the governance context. There were fewer dimensions for sustainability where the environmental aspect was positive.

Second, the development zone should pay more attention to the negative influence of extent on social aspects because the higher-level has less consideration for the social requirements of lower-level. The system also needs to improve the construction of social infrastructures to provide them with a better life guarantee.

Third, the development zone could formulate policies and norms in line with their own development conditions to match local laws and regulations, especially environmental ones. By paying more attention to the environment-related aspects, achievements would be realized in issues similar to biodiversity that are currently neglected. Some differences exist between actual practice and theoretical policy implementation. So, it is necessary to strengthen the disclosure of relevant monitoring data.

Finally, the improvement of flexibility in some governance dimensions might contribute to making the economic aspects stronger. In other words, the high level might appropriately change the way of communicating with the low level to solve the problem more quickly and prevent the occurrence of undesirable phenomena.

10. Case comparison and conclusions on eco-industrial parks

10.1 Comparison of the various dimensions of the five cases governance context

This section summarizes the five cases relevant to the various dimensions of the governance context. It illustrates and compares the performance arising out of the differences and similarities among them. The different causes and possible consequences of these performances are analyzed in detail to explain their potential influence on sustainability. The specific situations are shown in Tables 10.1-10.5.

The levels and scales dimension is introduced first. The comparison of the five park cases is shown in Table 10.1.

Table 10.1: Comparison of levels and scales

Governance Dimensions	Governance Criteria	SIP	WND	NET	KETD	YEDZ
Levels and scales	Extent					
	Coherence					
	Flexibility					
	Intensity					

Comparing the four criteria of levels and scales dimension to the coherence and intensity assessment results showed them to be neutral, while the performance of the other two criteria, namely extent and flexibility, were slightly different.

Coherence and intensity criteria performed as neutral in all five cases. This assessment result is largely related to the special national conditions and high-power distance that operates in China. All levels within the parks are willing to accept cooperation in a manner of basic trust and interdependence. Multi-level cooperation only takes place when discussing major events (e.g., future development plans) or special circumstances (e.g., leakage of polluting

chemicals or threats to employee safety). In other cases, decisions and strategies are generally made at high levels, while compliance and implementation are performed at low levels showing that the high level has absolute power.

For the extent criterion, the five cases are from the same province and so the levels involved and the aspects considered were basically the same. So, the process of sustainable development finds the primary involvement again of the high levels (i.e., provincial, local and park levels) that focus on those aspects to which they each attach importance. However, the different performances of different cases in this dimension are closely related to each park level. The assessment of SIP, WND and NET were relatively good because the management of these three parks involved all levels, except the high-level, but there is still less focus on the low-level (i.e., companies, employees and surrounding residents). KETD and YEDZ were negative assessed because both the levels involved in the governance process and in its considerations are mostly limited to the high-level. This may ignore their infrastructure construction and reduce the low-level satisfaction.

The flexibility of the governance context, in the background of China, finds communication and exchange from high level to low level having better flexibility. This is the case because, unlike the Netherlands, China has a strong sense of hierarchy and, therefore, WND, KETD and YEDZ had neutral evaluations. Although SIP and NET could communicate freely when problems did arise, this situation displayed good flexibility of superiors and subordinates. If such a communication method can be realized regardless of any problems in the future, more effective governance strategies could be brought to the management department of the park through, for instance, brainstorming sessions.

The reasons for the illustrative comparison between China and the Netherlands in this study are twofold: (1) European countries are quite different in many

aspects when compared to China, including such areas as the regime, communication methods and work systems. This promotes differences in the assessment performance within the governance context and, thus, increases the contrast; (2) The university where the researcher is currently studying is situated in the Netherlands. This allows a better understanding of the situation in this region and enables one to describe and explain different governance situations.

Second, to introduce the actors and networks dimension, the results of the comparison are displayed in Table 10.2.

Table 10.2: Comparison of actors and networks

Governance Dimensions	Governance Criteria	SIP	WND	NET	KETD	YEDZ
Actors and networks	Extent					
	Coherence					
	Flexibility					
	Intensity					

The actors and networks dimension of the governance context were the most positive of all the dimensions. In all park cases, the extent was expressed as a positive assessment. This suggests that in order to achieve the park's development goals and governance strategies more quickly, they prefer to involve all actors, whether they like it or not. However, the degree of this influence is still different due to China's special power background. In regard to the flexibility, all cases were assessed as neutral assessment. This is because, in general, the appointment of members or actors of various organizations in China is conducted in a strict and standardized manner. For example, the leading group of the park is established by the State or the local government through field inspections, public opinion surveys and democratic elections. As a result, it is not easy for new actors to join in. Even though some parks stated that they would solicit opinions from new actors before entering the park, in

fact they started to formally participate in the governance process only after they entered some time later.

There was a need to improve coherence of the governance context in NET. There were also other cases that were positive in terms of actors and networks. The main explanation for this is that, in NET, only the major events could summon the mutual cooperation of all actors. In other cases, the high-level actors shoulder more responsibilities related to decision-making and governance plans. Therefore, its coordination was weaker than that of lower-level actors. SIP, NET and YEDZ all performed well for intensity, while WND and KETD were somewhat inadequate. This is mainly because the park decided what types of stakeholders could participate given the *core elements* involved in the management reform and behavior conflict. At both WND and KETD, decision-makers or implementers were usually involved meaning it may not have been possible to conduct governance planning from a holistic perspective, leading to a tendency to consider issues separately.

Third, the comparison of the problems perspective and goal ambitions dimension is shown in Table 10.3.

Table 10.3: Comparison of problems perspective and goal ambitions

Governance Dimensions	Governance Criteria	SIP	WND	NET	KETD	YEDZ
Problems perspective and goal ambitions	Extent					
	Coherence					
	Flexibility					
	Intensity					

By comparing the five cases, I found that the problems perspective and goal ambitions dimension in all cases received a neutral assessment in terms of coherence. This is related to China's special power background and the high level of intensity with high authority. Hence, the opinions of decision-makers were more important in the case of conflict. In addition, sometimes the

opinions of the implementers could not be ignored. This is because unexpected situations do occur in the governance process. This is also because the implementers were always involved and most familiar with the causes and processes of the situation, so their suggestions could play an important role.

The assessment of the extent of the governance context found SIP, NET and YEDZ focused on the goals of all stakeholders and disclosed them. However, park managers in WND stated that they typically concentrated on the goals of most stakeholders, considering resource costs and development needs. The reason for KETD getting a neutral assessment is slightly different, mainly because the management of KETD considered the suggestions and goals of various stakeholders (not all stakeholder levels) around the actual development situation and strategic goals at different stages.

I believe that focusing on the goals of all stakeholders may not always produce good results and sometimes can lead to a waste of resources. Therefore, it is good to know that each park can achieve sustainable development, regardless of whether it pays attention to the goals of all stakeholders. Only SIP shown positive flexibility as the governance process evolved. This was primarily because SIP disclosed all goals after changing multiple goals to match the evolving development strategy and implementation. In the other four cases, the revised goals were disclosed only when the decision-maker considered them significant or critical. This may have prevented actors from providing a macro and comprehensive understanding of the modification direction and subtle changes. Although the interviews revealed that all five parks revised their goals, only the actors interviewed in SIP and NET believed that the existing policies could achieve the stated development goals. The actors involved in the other three cases indicated that certain changes were still needed to achieve their goals because of the difference between the actual implementation and the expectation during the governance process.

Fourth, the comparison of the strategies and instruments dimension is shown in Table 10.4.

Table 10.4: Comparison of strategies and instruments

Governance Dimensions	Governance Criteria	SIP	WND	NET	KETD	YEDZ
Strategies and instruments	Extent					
	Coherence					
	Flexibility					
	Intensity					

Assessing the extent of strategies and instruments dimension found that WND and YEDZ lacked specific details of sanction instruments and independent policies and penalties for environmental protection, respectively. Such a situation brought difficulties to the governance activities of the park. The unclear sanction methods also led to the abuse of actors' behaviors, especially those related to environmental protection. Other cases included a wide range of strategies and instruments. In terms of coherence, in the process of sustainable development governance of SIP, the synergy of strategy and instrument implementation mainly came from the reports presented by various actors. However, the actual situation was relatively vague, so there was a problem with the consistency. Similarly, WND performed neutral in terms of strategies and instruments, because the synergy perceived by actors was based on the park's understanding of policy interpretations. In fact, there was little conflict with the implementation process. Whether it was SIP or WND, clarifying the synergy in this way may not have truly recognized which strategies and instruments created conflicts in the use process of implementers or actors, so as enable them to change or adjust them to become better.

KETD produced a positive evaluation in terms of flexibility and intensity, but other cases needed to be improved in both aspects. Flexibility's neutral performance was largely attributable to the following reasons. (1) When

problems occur, it might have been better to distinguish which related strategies and instruments were more effective by not combining them, which may also have saved time. (2) The relevant strategies and instruments formulated by the park were too specific and targeted to the industry or events and, therefore, they were not easy to combine. Based on the above, we believe that both reasons are reasonable, as Chinese managers are more willing to take measures in accordance with corresponding specific policies and guidelines. Therefore, even if strategies and instruments were not combined in the park, as long as they were suitable for and could promote the sustainable development of the park, they were positive. However, the evaluation results were still somewhat neutral. The neutral assessment of intensity was because the park management departments lacked understanding of the views or feelings of the implementers on the strategies and instruments. As a consequence, sometimes they ignored the provisions of strategies and instruments during the implementation process, resulting in slightly different actual behaviors.

Finally, the comparison of the responsibilities and resources dimension is shown in Table 10.5.

Table 10.5: Comparison of responsibilities and resources

Governance Dimensions	Governance Criteria	SIP	WND	NET	KETD	YEDZ
Responsibilities and resources	Extent					
	Coherence					
	Flexibility					
	Intensity					

Table 10.5 shows that the five cases displayed positive and neutral evaluations in terms of extent and coherence of responsibilities and resources dimension, respectively. Extent was assessed as high, which is closely related to the different functional departments of various organizations in China. At present, China implements the policy of position and individual responsibility. Such

strategies and behaviors contribute to accountability. Coherence received a neutral evaluation for different reasons in each park. SIP showed that it is still the responsibility of the decision-maker in special circumstances, such as formulating regulations and determining development strategies, and when resource distribution might be uneven. NET was due to a lack of coherence in terms of responsibilities and resources when funding was scarce. The other three cases (i.e., WND, KETD and YEDZ) were mainly due to the difference in high-level and low-level responsibilities, so there were cognitive differences in whether responsibilities were carried out in a cooperative manner.

The positive performance of SIP for the flexibility criterion was because the industrial park could better adopt flexible communication methods between superiors and subordinates. This was conducive to pragmatically allocating responsibilities and resources to various departments to find the responsible personnel rapidly that would accord with the problems. In the case of the other four parks, it was sometimes difficult to assign responsibility without clearly allocating or changing resources. In terms of intensity, SIP and NET were more positive, as all actors in both industrial parks believed that they had sufficient resources to promote the park to achieve development goals. In the other three parks, resources only played a certain role in promoting development and there are other factors that would have an influence, such as economic environment, development trend and the implementation of awards and subsidies.

10.2 Comparison of the various dimensions of the five cases sustainability

This section has summarized and compared the five cases, as seen in Figures 10.1, 10.2 and 10.3 for the social, environmental, and economic aspects of sustainability. The comparison of the results, the special performance and differences of the five cases can now be comprehensively elaborated.

The comparison of social aspects of the five park cases is as shown in Figure 10.1.

Figure 10.1: Comparison of social aspects

Comparing the five cases, we found that the overall social performance of SIP and KETD was relatively good. In SIP, about 64% (nine out of a total of 14 social dimensions) of the social aspects showed a good status. The only negative dimension was the influence of trade unions or non-governmental organizations. Such a negative performance may be related to China's special positioning of trade unions. In most cases, they can only organize some activities, such as annual meetings and caring activities, among others. At KETD, although the high-level social dimensions did not account for a large proportion (six dimensions), there were no low-level dimensions. This indicates that the relevant management departments of KETD have paid attention to and considered the social aspects comprehensively. WND performed relatively weaker. In addition to providing systematic positive measures, anti-competitive principles and clear development strategies and goals, other aspects, especially infrastructure construction (e.g., public transportation, housing, kindergartens and supporting facilities), require more attention to achieve work-life complementarity.

Some social aspects were relatively unconsidered in all five cases. Firstly, for basic public transportation, most parks seldom provided shuttle services, such as fewer stops or shifts, with the exception of SIP. YEDZ was a special case as the park mainly relied on the city to provide bus services that can cover all places. Secondly, almost none of the parks exhibited a positive status in terms of providing housing (except for KETD) or taking care of children (or kindergartens). There may well be a correlation between these two dimensions. At present, the local government or the park management believed that the park was still dominated by working activities, so the distinction between work and life was obvious. As a result, most parks did not provide housing, but some subsidies may have been given. For cases where families live far away from the park, there seemed to be need for institutions, such as the kindergartens, to exist within the park. Most parks focused on high-tech training on how to improve their innovation capabilities. Thirdly, apart from SIP, there was no gender policy. In China, many recruitment people said special positions only for men or women may have existed in the past. Therefore, few recruitment agencies were aware of this problem, as it is a common phenomenon. As China opens to the outside world and connects with it, it has gradually realized the need to recruit fairly without too much consideration of gender issues. Such ingrained thinking takes time to adapt and change. As a result, most parks do not have a gender policy and they try to avoid special positions. Finally, all five park cases suggested that they should have systematic and completed emergency measures and formulate development strategies suitable for different stages, so that the parks have clear development goals and directions.

A comparison of the five park cases for environmental aspects is displayed in Figure 10.2.

Figure 10.2: Comparison of environmental aspects

Figure 10.2 shows the performance of SIP and KETD performed relatively well in terms of environmental aspects. None of the dimensions showed up as a low level. These findings can play a role of reference and learning for other parks. All these five cases performed strongly in their possession of environmental permits by the companies. This provided the basic guarantee for them to strive to implement and achieve better environmental performance.

Comparing the five cases, biodiversity and effective land use were the environmental aspects which performed relatively weakly. In terms of biodiversity, SIP was still the best performing park. Most of the other parks only focused on fostering the concept of the ecological civilization and circular economy advocated by the current government to establish the respect for nature, to conform to nature, and to protect nature. As a result, this deep focus can achieve sustainable development and ensure the harmonious development of people and nature.

Only KETD focused on effective land use, as the park was initially established at its own expense. The other parks were established with the approval of the

State or the local government and who gave some support in the early stages. So, their land use planning complied with the provisions and plans of relevant laws and regulations. The other dimensions of environmental aspects were maintained at a medium level; the main reason being that most of the environmental measures implemented only complied with the laws and regulations and the specific conditions required for public monitoring, such as how frequently to monitor and report and what methods to use for monitoring. However, in all cases these requirements were relatively vague. In most cases, the accessibility of information dealt with by information disclosure was neither timely, nor comprehensive. It was sometimes impossible to verify what environmental behaviors and measures had been applied as mentioned by actors. This highlights an area that can serve as a point for improvement. These neutral performances, to some extent, indicated that the local government, the park and relevant actors did not form an effective means to show a strong environmental awareness and show they fully valued environmental protection. Undoubtedly, this characteristic hinders the development of the park achieving a status as a true EIP.

The comparison of economic aspects is shown in Figure 10.3.

Figure 10.3: Comparison of economic aspects

Of the three aspects of sustainability, the economic aspects performed the best, while no dimensions in any park showed a low level. SIP was very positive. I found two dimensions of the economic aspect that were assessed positive. All the parks had a positive influence on the region's economy that also promoted sustainable development. The reason for this is that each park aimed to improve its economic level and to gradually realize the coordinated development of economy, society and the environment.

The other three dimensions of the economic aspects had different levels in each park. WND, NET and KETD have deficiencies in terms of their subsidies and tax policies, for example, the specific details were unclear and there was poor disclosure of related information (e.g., WND and KETD), and uncertain implementation (e.g., NET). The less satisfactory performance that led to complaints are discussed below. (1) The investigation and processing results were not public, and only the relevant complainants would be notified (WND and NET). (2) There was no place in the park where complaints could be lodged, either online or manually. However, the park conducted regular

inspections and disclosed relevant companies according to the monitoring results. Also, certain measures, such as rectification and fines (KETD), were taken. (3) Related complaints and reports could only be made in a unwieldy way, such as being sent by post and when the response results became unknown (YEDZ). Finally, NET, KETD and YEDZ were weak in terms of any comprehensive consideration of all the costs of sustainable development, which are mainly related to social costs.

Thus, for the three sustainability aspects outlined above, SIP performed best, followed by KETD. This is consistent with the results of the comprehensive development level assessment of China's national development zones in 2018, where SIP ranked 1st and KETD ranked 5th (Ministry of Commerce of the People's Republic of China, 2018a). These results show that sustainability does play an important role in the development of these parks.

10.3 Results of the eco-industrial parks' sustainable development: The relationship between governance quality and sustainability performance

10.3.1 Overall comparison of the five park cases

Drawing on the interview results, this enabled comparison and analysis of governance context and sustainability descriptions as given in sections 10.1 and 10.2. This section compares the governance context and sustainability results of each EIP to highlight the influences between them (positive or negative) and to analyze the situation of sustainable development in governance context. To create an overall picture, we counted the number of green items and subtracted the number of red items for both the governance context and the sustainability aspects. This processing of the results enabled us to derive an indicator of whether the governance context promoted or hindered sustainability, i.e., providing an insight into the main purpose of the study. In this calculation process, the neutral dimensions were ignored. Thus, the formulas used were as follows and the results obtained are shown in Table 10.6.

- Governance Context = the green governance items minus the red governance items (Unit: number)
- Sustainability = the percentages of green sustainability scores minus the percentages of red sustainability scores (Unit: %)

Table 10.6: Comparisons of the governance context and sustainability of each EIP

	Governance Context	Sustainability (%)
SIP	11	223
WND	3	53
NET	9	46
KETD	6	108
YEDZ	5	106

To more clearly reflect the sustainable development of the five EIP cases, I drew a two-dimensional graph using the above data, as displayed in Figure 10.4, which incorporates a basic trend line to illustrate the overall picture of the EIPs.

Figure 10.4: The general overall picture of five EIP cases

This combination of results shows that the score of the governance context correlated to the sustainability of the park, indicating that the governance

context does play a positive role in the sustainability of EIPs and likely helps them achieve sustainable development. This result basically verifies that, with the exception of NET, the better the governance context was, the better the sustainability performance would be. The trend line shows that the overall scores of the EIPs are nicely aligned, with the exception of NET, which is the outlier.

The comparative perspective reveals that SIP achieved the best scores for both governance and sustainable development and that, for NET and WND, the sustainable development was weak.

If I focus on the special results of NET, the above chart shows that, while NET seems to have excellent governance, including a high intensity of pressure to move towards a more sustainable status of the industrial park, it has a very mediocre sustainable performance in all three categories. There might be some explanations why NET's sustainability performance is relatively weak.

First of all, the sustainability performance of NET actually might not be so weak. The green assessment was relatively small, but most dimensions had neutral assessments. Therefore, the sustainability performance appeared low because of the way our formula accounted it. For instance, YEDZ had almost as much red aspects in its sustainability performance, but had much greener ones than NET. Secondly, other possible reasons emerged from factors and arguments in the field survey of NET and how we drew conclusions.

(1) Nanjing, as the provincial capital of Jiangsu, had more concerns and responsibilities in both resource allocation and development construction. When I arrived at the NET, the managers of the park told me that there are currently three national EIPs in Nanjing: the Nanjing Economic and Technological Development Zone (NET); the Nanjing High-Tech Industrial Development Zone; and, the Nanjing Jiangning Economic and Technological Development Zone. Hence, the local government's attention to the NET was diluted and support for some aspects may have been reduced. While NET is

indeed the first national EIP in Nanjing to be accepted and named as such, it is possible that the more recent parks received more attention in practice.

(2) The results of this study are based on efforts to acquire comprehensive information. However, it was difficult to find supporting evidence for the assessment of aspects of the governance context and when the assessment was usually determined by just interviewees' responses. Thus, some governance intentions reported as being good could not be verified by the implementation phase reporting. Nonetheless, some hard evidence of (disappointing) assessment results could be found on sustainability aspects.

(3) Even when NET more recently focused on improving governance, it is clear that trying to achieve good sustainability is a lengthy process. They have worked hard to adopt various governance measures to promote the realization of sustainability and many are currently in the improvement stage. This suggests that other aspects of sustainability, such as the environmental aspects of energy management and energy networks, are still to be gradually improved and, therefore, their current performance is marked up as mostly neutral.

(4) One dimension of sustainability can sometimes be divided into two aspects or cross over between two boundary conditions. Since NET remains in the development and improvement stage (as mentioned above), NET is not able to fully implement all aspects. Thus, if they have implemented only one aspect that is marked as being neutral, this mark is effectively applied across the whole dimension. For example, in the social aspect of providing basic public transportation, NET provided shuttle bus services that, according to some interviewees, had too few stops. In terms of housing, companies in the park have their own housing subsidy policies, but the park does not provide housing. NET mainly depends on the advantages of existing urban location and scientific and educational resources of the provincial capital. Even when this provision functions well, it leads to lower scores as the park itself does not provide these services.

(5) Finally, there is a special situation in China where institutions and policies are always proposed early, but their implementation starts relatively slowly. Many aspects of NET have been recognized and addressed in the policy, but have not yet been implemented. So, the sustainability performance appears to have been not sufficiently positive. Among these reasons, even if NET has a well-developed governance context, it may not yet be able to achieve a positive performance of sustainability.

All in all, the special position of NET could be clarified by it having the disadvantage of being the first to be recognized, which turned it into a sort of ‘retraining lead’. Meanwhile, newer parks have been able to start with improved sustainability from the outset. The governance choices are now improved, but the full implementation and the effects on sustainability will take more time. The close proximity of NET to the big provincial capital city of Nanjing means the park relying on these services, rather than offering them itself. This situation was often assessed as being just neutral in the sustainability assessment index.

10.3.2 Based on the detailed comparison of the five park cases

Based on the detailed description of the development of the EIP in the previous chapters and the overall comparison of the section 10.3.1, this section explains explicitly which governance items have an influence on which sustainability aspects. Although it is impossible to attach correspondences from each governance item to each sustainability aspect, this study does draw out the general and major influences between the two through the analysis and summary of the five EIP cases. Therefore, this section does not distinguish between the various aspects of governance and sustainability that were positive, neutral, or negative.

The influence of governance context on social aspects, as shown in Table 10.7.

Table 10.7: The influence of governance context on social aspects

Governance context	Social aspects
The goals of all levels (Extent of levels and scales) The needs of all stakeholders (Extent of actors and networks)	Basic public transportation
	Housing infrastructure and standards
	Child care
The direct participation of various stakeholders in conflicts and development changes (Intensity of actors and networks)	Social infrastructure
The multiple development goals and re-establish them after a period of time (Flexibility of problems perspective and goal ambitions)	Clear goals and directions
The extensive laws and regulations (Extent of strategies and instruments)	Security Practices
	Health standard
Stakeholders assume different responsibilities and cooperate with each other (Coherence of responsibility and resources) The extensive laws and regulations (Extent of strategies and instruments)	Emergency service

Table 10.7 shows that governance items mainly have an influence on social items as follow. First, in addition to all levels being involved in the governance process, the EIP data suggests that it is equally important to consider the concerns and goals of each level, as well as the needs of stakeholders. These governance items have an influence on the park's public transportation, housing and child care. What needs explaining here is that the performance and attention of child care in China and the Netherlands are different. In China, children do not need to go to kindergarten until they are three years old. Generally, looking after younger children is taken care of by grandparents. Possibly the child goes to institutions, such as agencies for early childhood

education, when parents want to train their child early. As such, the park does not pay much attention to this aspect and, therefore, it only provides subsidies. Second, the direct participation of various stakeholders may promote infrastructure construction, such as catering, leisure and entertainment. Unlike the Netherlands, medical insurance in China is provided by companies or organizations. Third, each park formulates multiple development goals and re-formulates them as and when required according to changing development needs and long-term goals. Such a situation would facilitate the establishment of clear goals and directions at each stage to achieve long-term development strategies. The difference is that, in the special context of China, regardless of whether it is a company, a park or the government, the development strategy for the second year was formulated in advance according to the development situation of that year. Consequently, the modification or reformulation were basically specific implementation methods or strategies, and the overall strategy and goal may not have changed. Finally, extensive laws and regulations provide the park with systematic security measures and enable it to comply strictly with workplace health standards. A wide range of laws and regulations mean stakeholders at different levels have varying responsibilities and cooperate with each other to deal with emergencies and systematically implement relevant emergency measures.

In summary, Table 10.7 reveals the four criteria and five dimensions of governance context that have an influence on the social aspects. Therefore, an emphasis on governance management is essential to achieve sustainability of the social aspects.

I found two special social aspects that had little to do with governance criteria and were mainly related to the actual development of the EIPs and the Chinese background. *One aspect was employee training.* Generally, the training work and plans of employees were not restricted by relevant policies or high-level requirements and were specifically related to the development needs and strategic goals of companies or the park. Thus, even the use of resources for

special training activities was voluntary, which was conducive to the promotion of related topics. At the same time, we found that the five EIPs were all closely tied into the surrounding universities or educational resources. As a result, this situation may have been very helpful to carry out the training and also save on costs. *On the other hand, in China, NGOs or trade unions have no substantial influence, which may be related to their functional positioning.* The background of the high-power distance suggests that the high level requires the trade union to carry out and organize some basic activities, such as annual meetings, caring activities and competitions. Therefore, the trade union is more likely to assume the role of executor or event organizer.

The influence of governance context on environmental aspects is shown in Table 10.8.

Table 10.8: The influence of governance context on environmental aspects

Governance context	Environmental aspects
Clear environmental regulations and instruments (Extent of strategies and instruments) Strict enforcement at all levels (Intensity of levels and scales)	Stewardship for environmental laws and standards
	Environmental management systems
The synergy of environmental strategies or instruments (Coherence of strategies and instruments) The relevant policies put the same pressure on actors (Intensity of strategies and instruments)	Monitoring and control of emissions
	Water and soil protection
	Climate change mitigation and adaptation
Clear functions of different departments and full use of resources (Extent of responsibilities and resources)	Energy consumption, generation and distribution

Table 10.8 shows that the governance context had an influence on environmental items in three aspects. First, clear environmental regulations and instruments and strict enforcement at all levels could promote companies to have environmental permits and certification of environmental management systems, such as ISO14001. In China, laws and regulations are promulgated by the State. If necessary, the provincial or municipal government can formulate relevant policies and measures according to the development situation. At the same time, the implementation of the companies determines the performance of the park in the two aspects mentioned above. Second, the synergy of environmental strategies or instruments plays an important role in monitoring pollutants, protecting groundwater and soil, and controlling greenhouse gas emissions. This is conducive to rapid problem detection and resolution. We found that, only when the relevant environmental policies impose the same degree of pressure on actors, could the park fundamentally increase the environmental awareness of actors and urge all levels (e.g., the local government, the park and companies) to implement environmentally friendly measures. Finally, in China, any organization, no matter how small, can establish an organizational structure with clear functions and be good at making full use of surrounding resources, such as natural gas nodes. Therefore, these various functional organizational structures were good at utilizing surrounding resources and establishing their own advantages in obtaining energy. This was conducive to establishing an energy network based on regional advantages and relationships.

The environmental aspects were particularly affected by three other criteria (i.e., extent, coherence and intensity) besides flexibility, as well as strategies and instruments dimension. These results may be due to the fact that China is increasingly attaching greater importance to environmental protection, so it is relatively comprehensive with respect to relevant environmental protection systems, measures, and construction, and hopes that the various functional departments can improve the level of environmental quality through

cooperation under the compulsory requirements (as China is a centralized country). In addition, the strategies and instruments dimension had an important connection with the environment.

I also indicated that waste management and material exchange were primarily related to development concepts and environmental awareness of actors. If the park had adhered to the concepts of ecological construction and circular economy since its establishment, it could have definitely adopted relevant waste management measures or exchange activities in order to achieve zero waste. Furthermore, the more that the actors recognized achieving zero waste was better for the park's ecological environment, the more likely they were to exchange materials or energy. However, to the contrary, they paid less attention to these aspects. Another special environmental aspect involved biodiversity. I found that China's development in the biodiversity aspect is still in an early initial stage. Actually, each park would promote its environmental development by taking advantage of its geographical advantages, location characteristics and attention to major policies that China currently advocates the creation of an ecological civilization (Xinhua, 2017). Nevertheless, the managers in the parks have realized that the harmonious development of people and nature is the goal to be pursued in the future.

Table 10.9 shows *the influence of governance context on economic aspects*.

Table 10.9: The influence of governance context on economic aspects

Governance context	Economic aspects
The goals of all levels (Extent of problems perspectives and goal ambitions)	Infrastructure provision
Sufficient resources and full utilization (Extent of responsibility and resources)	
Communicate in a free manner (Flexibility of levels and scales)	Complaints and payment of compensation or fines
Multi-level discussions (Coherence of levels and scales)	

Table 10.9 shows that the cost performance of sustainable development has a lot to do with the local government and the park concentrating on the goals of all stakeholders and having sufficient resources and full utilization. The government will pay attention to the situation of the surrounding area (resources) when planning the construction of the park and expect to reduce the cost performance by using these resources. At the same time, the goals of all stakeholders considered by the park should involve the social, environmental and economic aspects of sustainability. As such, these two governance items facilitated a comprehensive consideration of all costs associated with society, the environment and the economy. In addition, communicating in a relatively free manner and conducting multi-level discussions, regardless of whether it is a major event or issue, could make all stakeholders feel involved. This way of communication may increase their reluctance to make a complaint for fear of retaliation from the high-level. So, all stakeholders, especially low-level actors, could participate equally to better solve the development problems of the park. Also, organization is involved in the complaints process may reduce the possibility of opportunistic behavior by paying compensation and fines.

I found that the intensity had little effect on the economic aspects. This may be because no matter in which country, the construction of the park is essentially

to obtain economic benefits. Accordingly, economic respects do not need any governance policy to undertake mandatory provision or requirement.

The special performance of the economic aspects lies in the influence of EIP on the development of the region. This mainly includes the effect on the economy and environment. Since the parks developed relevant development plans every year and strive to achieve them, this was conducive to the sustainable development of the region. At the same time, the parks had both long-term development goals and short-term development goals. These goals must consider the economic situation, which inevitably promotes the region's economic performance level.

11. General summary and conclusions

11.1 Introduction

China has faced an ongoing series of challenges in its efforts to achieve the long-term targets of sustainable development strategy. According to the report of the 19th National Congress in 2017, China has entered a new era of socialism with Chinese characteristics (Xinhua, 2017). This new era is to demonstrate that China can correctly grasp its relationship with ecological and environmental protection, while maintaining sustained and healthy economic development, whilst also attaching importance to people's social needs to benefit more people in a fair way (Zheng, 2018). China could attach importance to the transformation and structural optimization of the industry to achieve sustainable development. This means addressing the challenges facing industry from the two aspects of manufacturing and EIPs. As a major manufacturing country, green supply chain management has become the focus of companies in the process of China's transition to a powerful manufacturing country. EIPs are an effective way of industrial agglomeration and conducive to the realization of industrial structure and production mode with high technological content, low resource consumption and less environmental pollution. This can foster the strategy of sustainable industrial development (Chertow and Ehrenfeld, 2012; Song and Shen, 2015).

One practical barrier that companies face in adopting green supply chain management is that few companies can use their own resources or capabilities to deal with environmental issues (Du et al., 2018; Lai et al., 2013). Most companies need to implement environmental cooperation with their suppliers to achieve green supplier integration and to achieve economic competitiveness, while, at the same time, reducing the environmental damage caused by production activities (Green et al., 2012; Kühne et al., 2013 Yeung et al., 2009). In order to better realize the impact of green supplier integration on company performance means identifying those factors can motivate suppliers to

participate actively in the green practices of companies, so as to smoothly implement green supplier integration (Berthon et al., 2003 Chae et al., 2017; Genovese et al., 2017).

Another challenge is how to turn a traditional industrial park into an EIP and how to adopt appropriate governance measures to involve all stakeholders to achieve sustainable development better and faster. Stakeholders at various levels have different roles and responsibilities, and the needs of different stakeholders are also relatively different. Thus, governance measures might be not only ‘both soft and hard’, but also may need to cover many aspects of governance that need attention (Bressers et al., 2016). Only in this way can all levels or all stakeholders be promoted to participate in the governance process and, thereby, contributing to the sustainable development of EIPs (Chertow and Ehrenfeld, 2012).

In summary, the goal of this thesis was to contribute to solving these above-mentioned challenges by exploring the research topics of green supplier integration and sustainable development of EIPs.

The structure of this chapter is as follows. Section 11.2 summarizes the results of each study and provides detailed answers to all research questions. Section 11.3 explains the practical implications of two different research topics and makes relevant recommendations for company managers or actors in the park. Finally, Section 11.4 expounds the limitations of this thesis and emphasizes the future research directions to better realize China’s sustainable development strategy.

11.2 Summary of the answers to research questions

RQ1: How do we characterize the China’s current development and the historical process impacts?

The research background is explained in three parts. Specific information on the Chinese background and development under the research was reported in

Chapter 1. The introduction parts to two research topics follow dealing with green supplier integration and EIPs.

First, Chapter 1 describes China's development as entering a new stage with the challenge of how to truly implement the sustainable development strategy, while maintaining stable economic growth. This has become the focus of current attention. Therefore, the full implementation of green supply chain management and the construction of EIPs are now imminent. This doctoral thesis conducted an in-depth exploration into these two research topics.

Second, by consulting relevant literature and reports, we found that suppliers at the source of the supply chain supply all the required raw materials and resources (e.g., information and technology) to companies. Hence, green practice cooperation between companies and their suppliers will benefit companies wishing to realize the sustainable development model and, thereby, meet and comply with China's sustainable development needs. This thesis has green supplier integration as its research topic and sets out to clarify the characteristics of this topic and its special role in achieving the performance of companies' sustainable development.

Finally, the development of EIPs in China has become an important approach to effect sustainable practices of individual companies located in the same physical space. In the introduction to EIP part, I explained how to define an EIP and provided an overview of the characteristics and functions of such parks. Subsequently, this part has described the three development stages of China's EIPs and the historical development process since the concept of eco-industry was introduced into China. The case studies in this thesis are drawn from Jiangsu Province. The basic information on location, transportation and industrial advantages were briefly described as a background to exploring the development of EIPs in this province.

RQ2: In what ways do various factors interact in the supply chain and have a direct and indirect impact on green supplier integration?

To answer RQ2, I established a conceptual framework in Chapter 2 that includes coercive power, non-coercive power, normative commitment, instrumental commitment, supplier trust and dependence, and green supplier integration. The results of this research framework can be summarized as follows.

The direct effects on green supplier integration. The results revealed that:

- (i) Coercive power weakens normative commitment, whereas it has an insignificant correlation with instrumental commitment. This may be because the adoption of coercive power by firms can generate negative feedback on both the emotional and value-oriented aspects of suppliers, thereby hindering the formation of shared values and further undermining the internal commitment of companies to maintain the partnerships. The reason that there is no effect on instrumental commitment is that the implementation of coercive power involving a coercive attitude may cause their suppliers to rebel and refuse to perform the specific behaviors proposed by firms. The firms also measure the return that can be obtained from the implementation of coercive power and the cost of maintaining the relationship. Only when the return is greater than the cost can the instrumental commitment be realized.
- (ii) Non-coercive power improves both normative and instrumental commitments. Since non-coercive power is the core element for firms to establish and maintain green practices, it not only improves the attachment of cooperation and the similarity of values, but also promotes the acquisition of interests.
- (iii) Both normative and instrumental commitments enhance green supplier integration. This result indicated that the investment of a large amount of special capital, namely relationship commitment, in the environmental

cooperation between firms and their suppliers is conducive to enhancing the awareness of environmental and promoting the implementation of environmental behaviors and, thus, plays an important role in achieving green supplier integration.

As for *the indirect effects on green supplier integration*, this study focuses on the mediating effect of relationship commitment and the moderating effects of supplier trust and dependence. The specific conclusions were as follows:

- (i) Normative commitment mediates the influences between two types of power (i.e., coercive and non-coercive powers) and green supplier integration, while instrumental commitment only mediates the influence between non-coercive power and green supplier integration. The reason why instrumental commitment has no mediating effect on the relationship between coercive power and green supplier integration is that coercive power is designed to promote firms to benefit from specific behaviors, but such intention based on calculated benefits has no impact on the stable environmental cooperation. Based on this, coercive power may not promote green practices through instrumental commitment.
- (ii) Supplier trust and dependence negatively moderate the connection between instrumental commitment and green supplier integration, without significant effect on the connection between normative commitment and green supplier integration. The results are inconsistent with the hypotheses of supplier trust in that, no matter how the level of supplier trust, the role of normative commitment in enhancing green supplier integration is not affected. The negative impact on the link between instrumental commitment and green supplier integration is because supplier trust not only weakens the firm's ability to perceive risks, but also reduces the application of formal contracts, which may increase suppliers' opportunistic behavior and speculative activities. These actions reduce the enthusiasm of companies to establish a benefit-based environmental

partnership with their suppliers to implement green supplier integration. Additionally, research suggested that the higher level of supplier dependence may lead to abuse by suppliers to increase potential transaction costs, thereby negatively moderating the relationship between instrumental commitment and green supplier integration. However, the reason why supplier dependence has no significant moderating effect is that the interaction between firms and their suppliers is an interdependent relationship, that is, suppliers provide green raw materials, while firms provide information and channels, so as to promote the implementation of environmental behaviors.

Chapter 2 detailed the interactions between various factors that play different direct or indirect roles in promoting the implementation of green supplier integration. Such results help firms to seek suitable ways to achieve green supplier integration and lay the prerequisite for the sustainable development of the firm.

RQ3: How does green supplier integration affect firm performance to promote its sustainable development under the influence of China's serious environmental problems?

Chapter 3 moved the focus onto the impact of green supplier integration on firm performance. To address this research question, I used empirical research to establish a conceptual model. The following results were obtained to answer this question.

- (i) First, green supplier integration promotes the three types of social capital accumulation (i.e., relational, structural and cognitive capital accumulations). Green supplier integration indicates that firms and their suppliers achieve common environmental goals through mutual green cooperation. In order to achieve such a goal, the two parties will share environmental knowledge, information and resources, as well as establish a family-like relationship. To sum up, the cooperation advantages

demonstrated by green supplier integration increases social capital accumulation.

- (ii) Second, relational and structural capital accumulations enhance economic and environmental performances, while cognitive capital accumulation only enhances environmental performance. Relational capital accumulation strengthens the environmental collaboration between firms and their suppliers and builds a sense of trust, which helps to increase the motivation of both parties to carry out environmental activities and the willingness to jointly pursue economic benefits. Structural capital accumulation improves economic and environmental performances by facilitating the flow of resources and the sharing of information to improve access to economic and environmental resources. Cognitive capital accumulation is beneficial for firms to transfer their environmental concepts and knowledge to suppliers, so as to improve the common values and beliefs related to environmental performance. However, unlike environmental performance, economic performance is affected by many uncertainties (e.g., consumer preferences and goal orientation), making it difficult to unify the values of firms and their suppliers.
- (iii) Third, relational and structural capital accumulations mediate the links between green supplier integration and the two types of firm performance, while cognitive capital accumulation only mediates the link between green supplier integration and environmental performance. The research results shown the reason why cognitive capital accumulation has no mediating effect between green supplier integration and economic performance may be due to the frequent green practice activities between companies and their suppliers, which strengthens environmental awareness and encourages both parties to invest time and capital to implement these activities. Such behaviors undoubtedly improve the environmental performance of firms, but may not necessarily affect economic performance.

The results in this chapter suggested that, in the face of severe environmental problems, green supplier integration may simultaneously achieve economic and environmental performances through social capital accumulation, thereby helping firms to achieve the goal of sustainable development.

RQ4: From the perspective of ambidextrous governance, how does green supplier integration improve the environmental performance of firms?

To further explore the impact of green supplier integration on environmental performance, I built the conceptual model from the perspective of ambidextrous governance. The results in Chapter 4 are summarized here as follows.

- (i) Green supplier integration promotes environmental innovation (i.e., incremental and radical environmental innovation) and, subsequently, enhance environmental performance. Green supplier integration cannot only promote the establishment of communication channels between firms and their suppliers to achieve environmental goals, but also realize the sharing of environmental knowledge and related technologies. This is conducive to improving different types of environmental innovation. In addition, no matter what type of environmental innovation the firms and their suppliers carry out, the goal is to reduce the environmental hazards caused by operations and production activities and, therefore, help to improve the level of environmental performance.
- (ii) Both incremental and radical environmental innovations partially mediate the link between green supplier integration and environmental performance. The close environmental interaction and knowledge sharing between firms and their suppliers increase the enthusiasm and willingness of both parties to implement a friendly environment through the implementation of environmental innovations, thereby promoting the optimization of the environment.

- (iii) Balanced ambidexterity strengthens the link between green supplier integration and incremental environmental innovation and combined ambidexterity weakens the link between green supplier integration and radical environmental innovation. The research results revealed that adopting a governance scheme that balances relational norms and contract control can not only ensure an equal interaction status between firms and their suppliers in the process of environmental innovation, but also improve the flexibility and adaptability of green supplier integration to achieve incremental environmental innovation. Moreover, in the implementation of radical environmental innovation, environmental plans between firms and suppliers may face more uncertainty and risks. In such cases, it is difficult to solve these challenges, even with a higher level of combined ambidexterity. Instead, it increases maintenance and transaction costs. Accordingly, combined ambidexterity weakens the positive relationship between green supplier integration and radical environmental innovation.

Overall, this chapter concluded that green supplier integration achieves environmental performance through different types of environmental innovation, but the negative effect of green supplier integration cannot be ignored. Hence, according to the characteristics of different types of environmental innovation, it is necessary to choose appropriately and use relationship governance approach to promote the environmental benefits of green supplier integration.

RQ5: How to evaluate and improve the governance context and the sustainability level of eco-industrial parks in China?

I selected Chinese EIPs as the research cases to address RQ5 and conducted field interviews to evaluate the sustainable development of the EIP in terms of governance context and sustainability. Chapters 5, 6, 7, 8 and 9 respectively described the background situation of five selected park cases, such as

geography and historical development stages, and detailed the interviewees' results of governance context and sustainability. Chapter 10 compared and analyzed the five park cases, from the aspects of governance context and sustainability, and evaluated the sustainable development of each. The reasons for these results and the special performance in the context of China were subsequently explained.

The comparative analysis of the five EIPs showed that SIP performed best for both governance context and sustainability. This result also matched the fact that SIP ranked 1st in the comprehensive development level assessment of China's national development zones in 2018 (Ministry of Commerce of the People's Republic of China, 2018a). The results of the governance context showed that WND and YEDZ performed relatively weaker. Although the extent criterion of levels and scales dimension of YEDZ was negative, its other dimensions were mostly neutral assessment. The results for the three aspects of sustainability showed that the social and environmental aspects did not perform very well, while the economic aspect did.

Combined with the results above, this study found that the governance context did positively influence sustainability illustrating that the better the governance context, the better the sustainability performance. One outlier case had a special position as it was the very first case example in Nanjing and nearest to a big city. This meant it relied on the city infrastructure, rather than developing its own.

I also identified the general and major influences between the governance items and sustainability aspects. The results are as follows:

- (i) Social aspects: the four criteria and five dimensions of governance context influenced the social aspects. Therefore, all levels and actors need to focus on all aspects of governance management to achieve social sustainability.
- (ii) Environmental aspects: the environmental aspects were affected by three other criteria (i.e., extent, coherence and intensity) in addition to the

flexibility criterion. In terms of dimensions, the strategies and instruments dimension were particularly important. These results revealed that China currently attaches great importance to the ecological environment and also is instituting more comprehensive environmental protection system and measures. However, there were weak performance in their implementation, disclosure and regulation. This has created a disconnect from the formulation of laws and regulations. Thus, China should pay attention to and improve these governance aspects in order to improve the level of environmental performance.

- (iii) Economic aspects: the intensity and other criteria and dimensions influenced the economic aspects and helped the cases studied achieve better economic performance. What needs to be improved is the mutual cooperation and communication methods between different levels or actors. This would be conducive to implementing the subsidy policies and promoting openness of information about the punishment of companies that violate regulations.

RQ6: When implementing green supply chain management and eco-industrial parks, what strategies and measures can China use to improve the effectiveness of sustainable development practices?

Chapter 11 provided the details on how to answer this research question, where I elaborate the current strategic context and implementation of China and summarize the results of various studies included in this doctoral thesis. This forms the basis for the next section, where I put forward suggestions that are applicable to China's development and that are conducive to improving its sustainable development practices. In the last section, the future research directions are identified based on my own research and that of others.

11.3 Practical implications

This doctoral thesis has focused on an important development problem, namely: how does China enhance its sustainability practices through initiatives that target the supply chains and/or industrial parks? The results of the thesis allow ideas to come forth that can be used to help achieve sustainable development goals for green supplier integration and EIPs. This is especially important for China because these two aspects are the development direction that China currently applies to achieve the sustainable development goals. This thesis proposes various measures to address these two aspects as follows:

Green supplier integration

Focus on improving green supplier integration. Cooperation between firms and their suppliers to achieve green supplier integration has become an indispensable enabler that can obviously respond to the sustainable development model advocated in China. The results of Chapter 2 have led me to suggest some actions for firms to enhance the implementation of green supplier integration. First, firm managers might have both a tool to guide development and a way that can encourage environmental cooperation, that is, ‘stick + carrot’ approach, such as using coercive and non-coercive powers, in order to better improve green supplier integration. Specifically, when a firm conducts environmental cooperation with its suppliers, it could have clear development measures and implementation guidelines (e.g., penalties or compulsory measures) and also provide suppliers with technology, assistance and advice in a timely manner. This approach could increase the willingness of firms and their suppliers to cooperate and achieve green supplier integration faster. Second, firm managers should pay full attention to the important role of developing long-term and stable cooperative relationships to realize green supplier integration, whether this be based on emotional attachment or on their own benefits. Thus, implementing cooperative approaches, such as relationship commitment, play a key role in the green practice between firms and their

suppliers in assuming their respective environmental responsibilities and in reducing or avoiding environmental hazards. Third, there may be some boundary conditions that can affect green supplier integration that are also worthy of managers' attention. Chapter 2 has shown that, although relationship closeness can moderate the relationship between relationship commitment and green supplier integration, there is a problem of the degree of closeness. In other words, the closer the link between the firm and its suppliers is, the more likely it will cause abuse by suppliers, which, in turn, can bring on a negative effect. Therefore, firms need to maintain proper trust and dependence with their suppliers, which is conducive to the ultimate realization of green supplier integration.

Green supplier integration to improve firm performance. As firms realize the importance of green supplier integration, the emphasis of each firm's attention has been on how to achieve improved performance through it. I can make some practical suggestions based on the results of Chapters 3 and 4.

First, firm managers should be fully aware of the important role of green supplier integration in combating environmental degradation and accepting external pressure. This will help firms that are willing to invest time, energy and capital to establish environmental cooperation with their suppliers to achieve environmental goals as part of their sustainable development strategies.

Second, the green practices between firms and their suppliers can improve many aspects, such as social capital accumulation and environmental innovation. Social capital accumulation establishes a platform for firms to communicate with their suppliers, which contributes to the environmental cooperation and interdependence of both sides. For environmental innovation, firm managers might choose appropriate environmental innovation activities based on their own circumstances and pay attention to their development in real time, in order to ensure the smoothness of innovation practices. The findings indicated that all these aspects are conducive to enhancing the level of a firm's

performance. As a result, managers could strive to achieve green supplier integration to promote the improvement of economic and environmental performances.

Finally, firm managers ought to recognize that there are also some clear negative consequences of green supplier integration. So, it is important to adopt relationship governance that is designed to avoid these negative effects. The results in Chapter 4 indicated that different types of relationship governance have different effects on green supplier integration to achieve environmental benefits. The relationship governance mentioned in this chapter is different from the content expressed by the term ‘governance’ in the next part of the thesis. This chapter emphasized relationship-based governance to control or improve the cooperation between firms and their suppliers. Hence, firm managers may consider the characteristics of different types of environmental innovation, and use different relationship governance methods in different development stages or activities to promote the performance of green supplier integration.

Eco-industrial parks

In view of the EIPs, according to the second part of the thesis (i.e., Chapters 5 to 10), I propose relevant courses of action for actors in the park.

The way of communication is moving towards free or multi-level discussions. China is a country with a high-power distance. Therefore, the major policies at the national level, as well as the rules and regulations formulated by provinces and local governments, should be actively implemented and strictly observed. However, this should not represent a rigid communication system. In the EIPs, park managers cannot be dictatorial, but need to conduct multi-level communication with actors at different levels to clarify the needs and concerns of each level. High-level managers sometimes find it difficult to observe certain minor problems and pay attention to the implementation difficulties. All of these may affect the sustainable development processes for the parks. In

addition, discussing or reflecting problems in a freer manner can better identify and monitor problems. The results of the five park cases indicated that they did relatively little complaining. The park management departments could be more open to, facilitate and encourage feedback for improvement, as well as strengthen the feedback content, processing methods and subsequent implementation of disclosure transparency. This approach could increase the active participation of actors, especially employees and the surrounding community members and could attract the attention of the problem companies or departments related to other problems. At the same time, the disclosure of processing methods, such as fines, orders to suspend rectification, may also have a warning effect.

Clarify information disclosure and regulatory measures. The environmental results showed the relatively weak performance levels in monitoring and control, as well as disclosure of emission standards. Accordingly, in line with the national, provincial and local government relevant laws, regulations and policies, the parks could formulate corresponding regulatory measures and industry emission standards to match their actual situations, as well as to disclose publicly and in detail relevant items on its website. Even if a park does not have its own relevant measures and standards, the contents of the measures and standards it complies with should be disclosed in detail. Some aspects of sustainability were assessed as neutral as it was difficult to obtain or find relevant disclosure data to verify their performance. Therefore, the parks need to fully disclose relevant information, such as safety standards, environmental data and economic indicators. This approach will help to clarify the implementation status and also play a regulatory role.

Realizing biodiversity from the establishment of an ecological civilization. Biodiversity is a problem that requires significant consideration in all the park cases. China has proposed to establish an ecological civilization system. Although the governance of the ecological environment has been greatly strengthened and the environmental situation has been improved as well, the

EIP managers still need to work hard to truly realize the harmony between people and nature. Hence, the actors in the parks need to enhance their consciousness and their initiatives to promote a green development concept, as well as to more deeply understand the connotation, characteristics and values of biodiversity, so they can better promote efforts towards the realization of sustainable biodiversity.

11.4 Limitations and future research directions

Although this doctoral thesis has several contributions to both theory and practice, there are still limitations that need to be addressed in the future research.

Green supplier integration

I can summarize the following four points for green supplier integration.

First, since this part of the research focuses on manufacturing industry, empirical research can be conducted on different industries (e.g., service industry, logistics industry) in the future. It may be interesting to compare and analyze the factors that affect green supplier integration and how green supplier integration affects firm performance in different industries. Such research can make better recommendations for different industries in line with their industry characteristics based on survey results. In addition, the survey samples were derived from Chinese manufacturing firms. Therefore, the results are limited to an individual country and a special cultural background. In future, researchers can investigate manufacturing firms in other countries to further explore adaptability. We can analyze also the differences in cross-cultural findings in greater detail and find out more about the relevant reasons and, in so doing, propose more diversified and global suggestions.

Second, when exploring the impact of green supplier integration on firm performance, I only focused on the impacts on economic and environmental performances. In fact, in order to realize the sustainable development of firms,

the role of social performance should not be ignored, especially in the context of China's current development strategy. As a result, future research could better link green supplier integration to the triple bottom line (i.e., economic, environmental and social) performances, thereby promoting the sustainable development of firms more quickly.

Third, this part only discussed the results as they relate to green supplier integration. However, green internal integration and green customer integration are also important components of green supply chain integration. Future research could explore the antecedents of green internal integration and green customer integration and their impacts on firm performance, so as to provide a more comprehensive understanding of green supply chain management.

Finally, in the future, we should further study the green supplier integration's boundary conditions, antecedent factors and the impact on the sustainable development performance of firm from more theoretical perspectives. This would improve the research framework for green supplier integration and contribute to the literature on green supplier integration.

Eco-industrial parks

This part of the research only studied the EIPs in the Chinese context according to the SSEF of Kreiner and Franco-García (2019) and obtained relevant results. In the future, we could conduct research in other countries, particularly those that are different from China in terms of their regime system and cultural background and allow comparisons of the differences and similarities between countries. Such field investigation would help researchers understand the impact of national context differences on the link between governance context and sustainability. If based on actual experience, such as the parks environment, and the improved status of respondents to answer the questions, then this would better explain the reasons of the differences and similarities and allow us to put forward targeted opinions.

In addition, we could provide the findings and recommendations and offer these directly to the corresponding parks after the investigation. This would help verify the effectiveness of the recommendations and transform the research design into a longitudinal study to further discuss whether the governance context promotes the sustainability of the parks.

Finally, the cases in this research are from Jiangsu Province in China. In future, EIPs in other provinces of China should be investigated to explore whether differences in governance context (i.e., different provinces in the same country) might have different influences on the sustainability of the parks.

While the limitations and future research directions have been explained separately for the above two parts, it is a challenging perspective to study how these two can be combined to achieve sustainable development jointly. Would very supportive eco-industrial park governance provide extra good opportunities for green supplier integration? Could green supplier integration be a promising bases for the creation of advanced new eco-industrial parks? In the future, the two directions of promoting industrial sustainability that were studied in this thesis, could be combined to further explore the GSI process based on the characteristics of park governance.

Bibliography

Abdi, M. and Aulakh, P.S. (2017). Locus of uncertainty and the relationship between contractual and relational governance in cross-border interfirm relationships. *Journal of Management*, 43(3), 771-803.

Adler, P.S. and Kwon, S.W. (2002). Social capital: Prospects for a new concept. *Academy of Management Review*, 27(1), 17-40.

Afshari, H., Farel, R. and Peng, Q. (2018). Challenges of value creation in Eco-Industrial Parks (EIPs): A stakeholder perspective for optimizing energy exchanges. *Resources, Conservation and Recycling*, 139, 315-325.

Ağan, Y., Kuzey, C., Acar, M.F. and Açıkgöz, A. (2016). The relationships between corporate social responsibility, environmental supplier development, and firm performance. *Journal of Cleaner Production*, 112, 1872-1881.

Ahi, P. and Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production*, 52, 329-341.

Aiken, L.S. and West, S.G. (1991). *Multiple Regression: Testing and Interpreting Interactions*, Sage Publications, Newbury Park, CA.

Ali, T. and Khalid, S. (2017). Trust-performance relationship in international joint ventures: The moderating roles of structural mechanisms. *Journal of Business & Industrial Marketing*, 32(7), 962-973.

Alvarez, G., Pilbeam, C. and Wilding, R. (2010). Nestlé Nespresso AAA sustainable quality program: An investigation into the governance dynamics in a multi-stakeholder supply chain network. *Supply Chain Management: An International Journal*, 15(2), 165-182.

Amores-Salvadó, J., Martín-de Castro, G. and Navas-López, J.E. (2014). Green corporate image: Moderating the connection between environmental product innovation and firm performance. *Journal of Cleaner Production*, 83, 356-365.

Andersen, P.H. and Gadde, L.E. (2019). Organizational interfaces and innovation: The challenge of integrating supplier knowledge in LEGO systems. *Journal of Purchasing and Supply Management*, 25(1), 18-29.

Anh, N.T.M., Hui, L., Khoa, V.D. and Mehmood, S. (2019). Relational capital and supply chain collaboration for radical and incremental innovation. *Asia Pacific Journal of Marketing and Logistics*, 31(4), 1076-1094.

Armstrong, J.S. and Overton, T.S. (1977). Estimating non-response bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.

Ashnai, B., Henneberg, S.C., Naudé, P. and Francescucci, A. (2016). Inter-personal and inter-organizational trust in business relationships: An attitude-behavior-outcome model. *Industrial Marketing Management*, 52, 128-139.

Aurier, P. and N'Goala, G. (2010). The differing and mediating roles of trust and relationship commitment in service relationship maintenance and development. *Journal of the Academy of Marketing Science*, 38(3), 303-325.

Baca, H-S. and David, B. (2018). Investigating effects of organisational culture and learning on environmental collaboration and performance of Korean exporting firms. *International Journal of Logistics Research and Applications*, 21(6), 614-630.

Baron, R.M. and Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical consideration. *Journal of Personality and Social Psychology*, 51(6), 1173.

Bazyar, A., Mohammadi, S., Teimoury, E., Fesharaki, M. and Moini, A. (2013). Linking power, risk, and governance: A survey research in new product development relationships. *Journal of Business & Industrial Marketing*, 28(5), 371-382.

Berthon, P., Pitt, L.F., Ewing, M.T. and Bakkeland, G. (2003). Norms and power in marketing relationships: Alternative theories and empirical evidence. *Journal of Business Research*, 56(9), 699-709.

Berger, R., Herstein, R., Silbiger, A. and Barnes, B.R. (2018). Is guanxi universal in China? Some evidence of a paradoxical shift. *Journal of Business Research*, 86, 344-355.

Blome, C., Schoenherr, T. and Kaesser, M. (2013). Ambidextrous governance in supply chains: The impact on innovation and cost performance. *Journal of Supply Chain Management*, 49(4), 59-80.

Bode, C., Wagner, S.M., Petersen, K.J. and Ellram, L.M. (2011). Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, 54(4), 833-856.

Boons, F., Chertow, M., Park, J., Spekkink, W. and Shi, H. (2017). Industrial symbiosis dynamics and the problem of equivalence: Proposal for a comparative framework. *Journal of Industrial Ecology*, 21(4), 938-952.

Bressers, H. (2004). Implementing sustainable development: How to know what works where when and how. In: Lafferty W.M. (Eds.), *Governance for sustainable development: The challenge of adapting form to function*. Edward Elgar, Cheltenham Northampton, 284-318.

Bressers, H. (2009). From public administration to policy networks. Contextual interaction analysis. In: Stéphane N. and Varone F. (Eds.), *Rediscovering public law and public administration in comparative policy analysis. A tribute to Peter Knoepfel*. Presses polytechniques, Lausanne, 123-142.

Bressers, H., de Boer, C., Lordkipanidze, M., Özerol, G., Vinke-De Kruijf, J., Furusho, C., La Jeunesse, I., Larrue, C., Ramos, M.H., Kampa, E., Stein, U., Tröltzsch, J., Vidaurre, R. and Browne, A. (2013a) Water governance assessment tool. With an elaboration for drought resilience. Report to the DROP project, CSTM University of Twente, Enschede.

Bressers, H., de Boer, C., Lordkipanidze, M., Özerol, G., Vinke-de Kruijf, J., Farusho, C., La Jeunesse, I., Larrue, C., Ramos, M-H., Kampa, E., Stein, U., Tröltzsch, J., Vidaurre, R. and Brown, A. (2013b). Water governance assessment tool. Retrieved

December 20, 2019, from <http://doc.utwente.nl/86879/1/Governance-Assessment-Tool-DROP-final-for-online.pdf>

Bressers, J.T.A., Bressers, N., Kuks, S.M.M. and Larrue, C. (2016). The Governance Assessment Tool and Its Use. In: Bressers H., Bressers N. and Larrue C. (Eds.), *Governance for Drought Resilience: Land and Water Drought Management in Europe*. Springer International Publishing, 45-65.

Brown, J.R., Lusch, R.F. and Nicholson, C.Y. (1995). Power and relationship commitment: Their impact on marketing channel member performance. *Journal of Retailing*, 71(4), 363-392.

Bstieler, L. and Hemmert, M. (2015). The effectiveness of relational and contractual governance in new product development collaborations: Evidence from Korea. *Technovation*, 45, 29-39.

Burt, R.S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Burkert, M., Ivens, B.S. and Shan, J. (2012). Governance mechanisms in domestic and international buyer-supplier relationships: An empirical study. *Industrial Marketing Management*, 41(3), 544-556.

Busse, C., Schleper, M.C., Niu, M. and Wagner, S.M. (2016). Supplier development for sustainability: Contextual barriers in global supply chains. *International Journal of Physical Distribution & Logistics Management*, 46(5), 442-468.

Busse, C., Schleper, M.C., Weilenmann, J. and Wagner, S.M. (2017). Extending the supply chain visibility boundary: Utilizing stakeholders for identifying supply chain sustainability risks. *International Journal of Physical Distribution & Logistics Management*, 47(1), 18-40.

Cai, S. and Yang, Z. (2014). The role of the guanxi institution in skill acquisition between firms: A study of Chinese firms. *Journal of Supply Chain Management*, 50(4), 3-23.

Cainelli, G., De Marchi, V. and Grandinetti, R. (2015). Does the development of environmental innovation require different resources? Evidence from Spanish manufacturing firms. *Journal of Cleaner Production*, 94, 211-220.

Canzaniello, A., Hartmann, E. and Fifka, M.S. (2017). Intra-industry strategic alliances for managing sustainability-related supplier risks: Motivation and outcome. *International Journal of Physical Distribution & Logistics Management*, 47(5), 387-409.

Cao, Q., Gedajlovic, E. and Zhang, H. (2009). Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science*, 20(4), 781-796.

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, 15-42.

Carrión-Flores, C.E. and Innes, R. (2010). Environmental innovation and environmental performance. *Journal of Environmental Economics and Management*, 59(1), 27-42.

Carson, S.J., Madhok, A. and Wu, T. (2006). Uncertainty, opportunism, and governance: The effects of volatility and ambiguity on formal and relational contracting. *Academy of Management Journal*, 49(5), 1058-1077.

Carey, S., Lawson, B. and Krause, D.R. (2011). Social capital configuration, legal bonds and performance in buyer-supplier relationships. *Journal of Operations Management*, 29(4), 277-288.

Casiano Flores, C., Özerol, G., Bressers, H., Kuks, S., Edelenbos, J. and Gleason, A. (2019). The state as a stimulator of wastewater treatment policy: A comparative assessment of three subnational cases in central Mexico. *Journal of Environmental Policy & Planning*, 21(2), 134-152.

Cecere, G., Corrocher, N., Gossart, C. and Ozman, M. (2014). Technological pervasiveness and variety of innovators in green ICT: A patent-based analysis. *Research Policy*, 43(10), 1827-1839.

Chae, S., Choi, T.Y. and Hur, D. (2017). Buyer power and supplier relationship commitment: A cognitive evaluation theory perspective. *Journal of Supply Chain Management*, 53(2), 39-60.

Chang, K.H. and Huang, H.F. (2011). Using influence strategies to advance supplier delivery flexibility: The moderating roles of trust and shared vision. *Industrial Marketing Management*, 41(5), 849-860.

Chen, H.Q. (21 July, 2017). Kunshan Economic and Technological Development Zone National Ecological Industry Demonstration Park. Retrieved January 6, 2020, from <https://max.book118.com/html/2017/0721/123292434.shtm> (in Chinese)

Chen, X., Huang, Q. and Davison, R.M. (2017). Economic and social satisfaction of buyers on consumer-to-consumer platforms: The role of relational capital. *International Journal of Electronic Commerce*, 21(2), 219-248.

Cheng, T.C.E., Yip, F.K. and Yeung, A.C.L. (2012). Supply risk management via guanxi in the Chinese business context: The buyers perspective. *International Journal of Production Economics*, 139(1), 3-13.

Cheng, C.C. and Chen, J.S. (2013). Breakthrough innovation: The roles of dynamic innovation capabilities and open innovation activities. *Journal of Business & Industrial Marketing*, 28(5), 444-454.

Cheng, C.C. (2020). Sustainability orientation, green supplier involvement, and green innovation performance: Evidence from diversifying green entrants. *Journal of Business Ethics*, 161(2), 393-414.

Chertow, M. and Ehrenfeld, J. (2012). Organizing self-organizing systems: Toward a theory of industrial symbiosis. *Journal of Industrial Ecology*, 16(1), 13-27.

Chi, M., Zhao, J., George, J.F., Li, Y. and Zhai, S. (2017). The influence of inter-firm IT governance strategies on relational performance: The moderation effect of

information technology ambidexterity. *International Journal of Information Management*, 37(2), 43-53.

Chiarvesio, M., Marchi, V.D. and Maria, E.D. (2015). Environmental innovations and internationalization: Theory and practices. *Business Strategy and the Environment*, 24(8), 790-801.

Chicksand, D. (2015). Partnerships: The role that power plays in shaping collaborative buyer-supplier exchanges. *Industrial Marketing Management*, 48, 121-139.

China Daily. (19 April, 2006). Kunshan Economic and Technological Development Zone. Retrieved January 6, 2020, from http://www.chinadaily.com.cn/bizchina/2006-04/19/content_571680.htm

China Daily. (29 January, 2019). Kunshan Economic and Technological Development Zone. Retrieved January 6, 2020, from <http://investinchina.chinadaily.com.cn/a/201901/29/WS5c78ebcc498e27e33803958d.html>

China Development Zones. (2018). China development zone review announcement. Retrieved March 13, 2020, from <http://www.cadz.org.cn/index.php/develop/index.html> (in Chinese)

China Daily. (12 December, 2018). Nanjing Economic and Technological Development Zone. Retrieved December 28, 2019, from <http://investinchina.chinadaily.com.cn/s/201812/12/WS5c7ceafc498e27e338039804/nanjing-economic-and-technological-development-zone.html>

Chinafolio. (2019). Jiangsu Province. Retrieved March 15, 2020, from <http://www.chinafolio.com/provinces/jiangsu-province/>

China Jiangsu Net. (17 July, 2014). Nanjing Development Zone-Modern Lingang New City Rising Along the Yangtze River Economic Belt. Retrieved December 28, 2019, from <http://jsnews2.jschina.com.cn/system/2014/07/17/021413402.shtml> (in Chinese)

China Ports Association. (16 June, 2008). Yangzhou Port. Retrieved January 21, 2020, from <http://www.port.org.cn/info/200806/109614.htm> (in Chinese)

Chinese Academy of Translation. (28 December, 2018). Key word of China: Sustainable development strategy. Retrieved March 26, 2020, from https://www.sohu.com/a/285191908_488902

Chinese Research Academy of Environmental Sciences. (July, 2006). Construction Plan of Yangzhou Economic Development Zone National Ecological Industry Demonstration Park (review draft). Retrieved January 21, 2020, from <https://wenku.baidu.com/view/bd9b59d2326c1eb91a37f111f18583d048640f28.html> (in Chinese)

China Tourist Maps. (2010). Travel Maps of Jiangsu. Retrieved March 15, 2020, from <http://www.chinatouristmaps.com/travel/jiangsu.html>

Chiou, T.Y., Chan, H.K., Lettice, F. and Chung, S.H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E: Logistics & Transportation Review*, 47(6), 822-836.

Chong, A.Y.L., Chan, F.S., Goh, M. and Tiwari, M.K. (2013). Do interorganisational relationships and knowledge-management practices enhance collaborative commerce adoption? *International Journal of Production Research*, 51(7), 2006-2018.

Cigdem, A. and Anand, N. (2017). Assessment of supply chain integration and performance relationships: A meta-analytic investigation of the literature. *International Journal of Production Economics*, 185, 252-265.

Claro, D.P., Oliveira Claro, P.B. and Hagelaar, G. (2006). Coordinating collaborative joint efforts with suppliers: The effects of trust, transaction specific investment, and information network in the Dutch flower industry. *Supply Chain Management: An International Journal*, 11(3), 216-224.

Coleman, J.S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94, 95-120.

Coleman, J.S. (1990). *Foundations of social theory*. Cambridge, MA: Belknap Press of Harvard University Press.

Commission on Sustainable Development. (2012). About the Rio+20 Conference. Retrieved March 26, 2020, from <https://sustainabledevelopment.un.org/rio20/about>

Cousins, P.D., Handfield, R.B., Lawson, B. and Peterson, K.J. (2006). Creating supply chain relational capital: The impact of formal and informal socialization processes. *Journal of Operations Management*, 24(6), 851-863.

Cox, A. (2001). Understanding buyer and supplier power: A framework for procurement and supply competence. *Journal of Supply Chain Management*, 37(2), 8-15.

Cronin, J.J., Smith, J.S., Gleim, M.R., Ramirez, E. and Martinez, J.D. (2011). Green marketing strategies: an examination of stakeholders and the opportunities they present. *Journal of the Academy of Marketing Science*, 39(1), 158-174.

CSY. (2019). China Statistical Yearbook. China Statistical Publishing House, Beijing.

Currall, S.C. and Inkpen, A.C. (2002). A multilevel approach to trust in joint ventures. *Journal of International Business Studies*, 33(3), 479-495.

Dai, J., Cantor, D.E. and Montabon, F.L. (2015). How environmental management competitive pressure affects a focal firm's environmental innovation activities: A green supply chain perspective. *Journal of Business Logistics*, 36(3), 242-259.

Dangelico, R.M. and Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics*, 95(3), 471-486.

De Boer, C. and Bressers, H. (2011). Complex and dynamic implementation processes: Analyzing the renaturalization of the Dutch Regge river. University of Twente and Water Governance Centre, Enschede.

De Boer, C. (2012). Contextual Water Management. A study of governance and implementation processes in local stream restoration projects. University of Twente, Enschede.

De Giovanni, Pietro. (2012). Do internal and external environmental management contribute to the triple bottom line? *International Journal of Operations & Production Management*, 32(3), 265-290.

De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research Policy*, 41(3), 614-623.

Den Elzen, M., Fekete, H., Höhne, N., Admiraal, A., Forsell, N., Hof, A.F. ... and van Soest, H. (2016). Greenhouse gas emissions from current and enhanced policies of China until 2030: Can emissions peak before 2030? *Energy Policy*, 89, 224-236.

Depner, H. and Bathelt, H. (2005). Exporting the German model: The establishment of a new automobile industry cluster in Shanghai. *Economic Geography*, 81(1), 53-81

Diabat, A. and Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, 55(6), 659-667.

Doney, P.M. and Cannon, J.P. (1997). An examination of the nature of trust in buyer-seller relationships. *Journal of Marketing*, 61(2), 35-51.

Dou, Y., Zhu, Q. and Sarkis, J. (2018). Green multi-tier supply chain management: An enabler investigation. *Journal of Purchasing and Supply Management*, 24(2), 95-107.

Du, L., Zhang, Z. and Feng, T. (2018). Linking green customer and supplier integration with green innovation performance: The role of internal integration. *Business Strategy and the Environment*, 27(8), 1583-1595.

Duhaylongsod, J.B. and De Giovanni, P. (2019). The impact of innovation strategies on the relationship between supplier integration and operational performance. *International Journal of Physical Distribution & Logistics Management*, 49(2), 156-177.

Dyer, J.H. and Singh, H. (1998). The relational view: Cooperative strategy and sources of inter-organizational competitive advantage. *Academy of Management Review*, 23(4), 660-679.

Dyer, J.H. and Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, 21(3), 345-367.

ElMassah, S. (2018). Industrial symbiosis within eco-industrial parks: Sustainable development for Borg El-Arab in Egypt. *Business Strategy and the Environment*, 27(7), 884-892.

Etgar, M. (1978). Differences in the use of manufacturer power in conventional and contractual channels. *Journal of Retailing*, 54(4), 49-62.

Fang, S.R., Chang, Y.S. and Peng, Y.C. (2011). Dark side of relationships: A tensions-based view. *Industrial Marketing Management*, 40(5), 774-784.

Fawcett, S., McCarter, M., Fawcett, A., Webb, G. and Magnan, G. (2015). Why supply chain collaboration fails: The socio-structural view of resistance to relational strategies. *Supply Chain Management: An International Journal*, 20(6), 648-663.

Feng, T., Wang, D. and Prajogo, D. (2014). Incorporating human resource management initiatives into customer services: Empirical evidence from Chinese manufacturing firms. *Industrial Marketing Management*, 43(1), 126-135.

Feng, B. and Magen, E. (2016). Relationship closeness predicts unsolicited advice giving in supportive interactions. *Journal of Social and Personal Relationships*, 33(6), 751-767.

Feng, T. and Wang, D. (2016). The influence of environmental management systems on financial performance: A moderated-mediation analysis. *Journal of Business Ethics*, 135(2), 265-278.

Feng, T., Cai, D., Wang, D. and Zhang, X. (2016a). Environmental management systems and financial performance: The joint effect of switching cost and competitive intensity. *Journal of Cleaner Production*, 113, 781-791.

Feng, T., Cai, D., Zhang, Z. and Liu, B. (2016b). Customer involvement and new product performance: The jointly moderating effects of technological and market newness. *Industrial Management & Data Systems*, 116(8), 1700-1718.

Feng, T., Huang, Y. and Avgerinos, E. (2018a). When marketing and manufacturing departments integrate: The influences of market newness and competitive intensity. *Industrial Marketing Management*, 75, 218-231.

Feng, M., Yu, W., Wang, X., Wong, C.Y., Xu, M. and Xiao, Z. (2018b). Green supply chain management and financial performance: The mediating roles of operational and environmental performance. *Business Strategy and the Environment*, 27, 811-824.

Feng, T., Wang, D., Lawton, A. and Luo, B.N. (2019). Customer orientation and firm performance: The joint moderating effects of ethical leadership and competitive intensity. *Journal of Business Research*, 100, 111-121.

Feng, T., Jiang, Y. and Xu, D. (2020). The dual-process between green supplier collaboration and firm performance: A behavioral perspective. *Journal of Cleaner Production*, 260, 121073.

Fernando, Y., Jabbour, C.J.C. and Wah, W.X. (2019). Pursuing green growth in technology firms through the connections between environmental innovation and sustainable business performance: Does service capability matter? *Resources, Conservation and Recycling*, 141, 8-20.

Flynn, B.B., Zhao, X., Huo, B. and Yeung, J.H.Y. (2008). We've got the power! How customer power affects supply chain relationships. *Business Horizons*, 51(3), 169-174.

Flynn, B.B., Huo, B. and Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach, *Journal of Operations Management*, 28(1), 58-71.

Foerstl, K., Reuter, C., Hartmann, E. and Blome, C. (2010). Managing supplier sustainability risks in a dynamically changing environmental-sustainable supplier management in the chemical industry. *Journal of Purchasing and Supply Management*, 16(2), 118-130.

Formentini, M. and Taticchi, P. (2016). Corporate sustainability approaches and governance mechanisms in sustainable supply chain management. *Journal of Cleaner Production*, 112, 1920-1933.

Fornell, C. and Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.

Fraj, E., Martínez, E. and Matute, J. (2013). Green marketing in B2B organizations: An empirical analysis from the natural-resource-based view of the firm. *Journal of Business & Industrial Marketing*, 28(5), 396-410.

Frazier, G.L. and Summers, O.J. (1984). Interfirm influence strategies and their application within distribution channels. *Journal of Marketing*, 48(3), 43-55.

Frazier, G.L. and Rody, R.C. (1991). The use of influence strategies in interfirm relationships in industrial product channels. *Journal of Marketing*, 55(1), 52-69.

Gelderman, C.J., Semeijn, J. and Mertschuweit, P.P. (2016). The impact of social capital and technological uncertainty on strategic performance: The supplier perspective. *Journal of Purchasing and Supply Management*, 22(3), 225-234.

Geng, Y., Fu, J., Sarkis, J. and Xue, B. (2012). Towards a national circular economy indicator system in China: An evaluation and critical analysis. *Journal of Cleaner Production*, 23(1), 216-224.

Geng, R., Mansouri, S.A., Aktas, E. and Yen, D.A. (2017). The role of Guanxi in green supply chain management in Asia's emerging economies: A conceptual framework. *Industrial Marketing Management*, 63, 1-17.

Genovese, A., Acquaye, A.A., Figueroa, A. and Koh, S.C.L. (2017). Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. *Omega*, 66, 344-357.

Ghadimi, P., Azadnia, A.H., Heavey, C., Dolgui, A. and Can, B. (2016). A review on the buyer-supplier dyad relationships in sustainable procurement context: Past, present and future. *International Journal of Production Research*, 54(5), 1443-1462.

Gibbs, D. and Deutz, P. (2007). Reflections on implementing industrial ecology through eco-industrial park development. *Journal of Cleaner Production*. 15(17), 1683-1695.

Granovetter, M.S. (1992). Problems of explanation in economic sociology. In N. Nohria, & R. Eccles (Eds.), *Networks and organizations: Structure, form and action*, Boston: Harvard Business School Press.

Green Jr, K.W., Zelbst, P.J., Meacham, J. and Bhadauria, V.S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, 17(3), 290-305.

Green Manufacturing Association of China. (2018). Nanjing Economic and Technological Development Zone. Retrieved December 28, 2019, from <http://www.gmpsp.org.cn/portal/article/index/id/3172/cid/4.html> (in Chinese)

Grimm, J., Hofstetter, J. and Sarkis, J. (2014). Critical factors for sub-supplier management: A sustainable food supply chains perspective. *International Journal of Production Economics*, 152, 159-173.

Gu, Q. (2008). *Industrial Clusters in China (seventh version)*: China Machine Press, Beijing, China.

Hair, J.F., Anderson, R.E., Babin, B.J. and Black, W.C. (2010). *Multivariate Data Analysis: A Global Perspective*, Pearson, Upper Saddle River, NJ.

Hajmohammad, S., Vachon, S., Klassen, R.D. and Gavronski, I. (2013). Reprint of Lean management and supply management: Their role in green practices and performance. *Journal of Cleaner Production*, 56, 86-93.

Hammervoll, T., Jensen, L.M. and Beske, P. (2012). Dynamic capabilities and sustainable supply chain management. *International Journal of Physical Distribution & Logistics Management*, 42(4), 372-387.

Han, Z. and Huo, B. (2020). The impact of green supply chain integration on sustainable performance. *Industrial Management & Data Systems*. 120(4), 657-674.

Handley, S.M. and Benton Jr, W.C. (2012a). The influence of exchange hazards and power on opportunism in outsourcing relationships. *Journal of Operations Management*, 30(1), 55-68.

Handley, S.M. and Benton Jr, W.C. (2012b). Mediated power and outsourcing relationships. *Journal of Operations Management*, 30(3), 253-267.

Hanmer-Lloyd, S.A. (1996). Relationship appraisal: A route to improved reseller channel performance. *Industrial Marketing Management*, 25(3), 173-185.

Hart, S.L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), 986-1014.

Harness, D., Ranaweera, C., Karjaluo, H. and Jayawardhena, C. (2018). The role of negative and positive forms of power in supporting CSR alignment and commitment between large firms and SMEs. *Industrial Marketing Management*, 75, 17-30.

Hausman, A. and Johnston, W.J. (2010). The impact of coercive and non-coercive forms of influence on trust, commitment, and compliance in supply chains. *Industrial Marketing Management*, 39(3), 519-526.

Heide, J.B. (1994). Interorganizational governance in marketing channels. *Journal of Marketing*, 58(1), 71-85.

He, Z.L. and Wong, P.K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15(4), 481-494.

He, Q., Ghobadian, A. and Galleary, D. (2013). Knowledge acquisition in supply chain partnerships: The role of power. *International Journal of Production Economics*, 141(2), 605-618.

Hillman, A.J., Withers, M.C. and Collins, B.J. (2009). Resource dependence theory: A review. *Journal of Management*, 35(6), 1404-1427.

Hoejmose, S., Brammer, S. and Millington, A. (2012). Green supply chain management: The role of trust and top management in B2B and B2C markets. *Industrial Marketing Management*, 41(4), 609-620.

Hong, H. and Gasparatos, A. (2020). Eco-industrial parks in China: Key institutional aspects, sustainability impacts, and implementation challenges. *Journal of Cleaner Production*, 274(20), 122853.

Hopkinson, G.C. and Blois, K. (2014). Power-base research in marketing channels: A narrative review. *International Journal of Management Reviews*, 16(2), 131-149.

Hsu, C.W., Kuo, T.C., Chen, S.H. and Hu, A.H. (2013). Using dematel to develop a carbon management model of supplier selection in green supply chain management. *Journal of Cleaner Production*, 56(10), 164-172.

Huang, M.C., Cheng, H.L. and Tseng, C.Y. (2014). Reexamining the direct and interactive effects of governance mechanisms upon buyer-supplier cooperative performance. *Industrial Marketing Management*, 43(4), 704-716.

Huang, X.X., Hu, Z.P., Liu, C.S., Yu, D.J. and Yu, L.F. (2016). The relationships between regulatory and customer pressure, green organizational responses, and green innovation performance. *Journal of Cleaner Production*, 112, 3423-3433.

Huang, J.W. and Li, Y.H. (2017). Green innovation and performance: The view of organizational capability and social reciprocity. *Journal of Business Ethics*, 145(2), 1-16.

Huang, H., He, Y. and Li, D. (2018). Pricing and inventory decisions in the food supply chain with production disruption and controllable deterioration. *Journal of Cleaner Production*, 180, 280-296.

Huang, A.P. (12 April, 2019). Take the greenest road to build the most beautiful city-The 25th anniversary of the green development of Suzhou Industrial Park. *Suzhou Daily*. Retrieved December 12, 2019, from http://news.sipac.gov.cn/sipnews/yqzt/25th/mtjj/201904/t20190412_1015183.htm (in Chinses)

Huang, B., Yong, G., Zhao, J., Domenech, T., Liu, Z., Chiu, S. F. ... and Yao, Y. (2019). Review of the development of China's Eco-industrial Park standard system. *Resources, Conservation and Recycling*, 140, 137-144.

Huo, B., Zhao, X. and Lai, F. (2014). Supply chain quality integration: Antecedents and consequences. *IEEE Transactions on Engineering Management*, 61(1), 38-51.

Huo, B., Liu, C., Kang, M. and Zhao, X. (2015). The impact of dependence and relationship commitment on logistics outsourcing: Empirical evidence from greater China. *International Journal of Physical Distribution & Logistics Management*, 45(9/10), 887-912

Huo, B., Ye, Y., Zhao, X. and Shou, Y. (2016a). The impact of human capital on supply chain integration and competitive performance. *International Journal of Production Economics*, 178, 132-143.

Huo, B., Fu, D., Zhao, X. and Zhu, J. (2016b). Curbing opportunism in logistics outsourcing relationships: The role of relational norms and contract. *International Journal of Production Economics*, Vol. 182, pp. 293-303.

Huo, B., Flynn, B.B. and Zhao, X. (2017). Supply chain power configurations and their relationship with performance. *Journal of Supply Chain Management*, 53(2), 88-111.

Huo, B., Tian, M., Tian, Y. and Zhang, Q. (2019a). The dilemma of inter-organizational relationships: Dependence, use of power and their impacts on opportunism. *International Journal of Operations & Production Management*, 39(1), 2-23.

Huo, B., Gu, M. and Wang, Z. (2019b). Green or lean? A supply chain approach to sustainable performance. *Journal of Cleaner Production*, 216, 152-166.

Hunt, S.D. and Nevin, J.R. (1974). Power in a channel of distribution: Sources and consequences. *Journal of Marketing Research*, 11(2), 186-193.

Inkpen, A.C. and Tsang, E.W. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30(1), 146-165.

Investment Promotion Agency of Ministry of Commerce. (3 August, 2008). Yangzhou Economic Development Zone was Upgraded to State-level ETDZ. Retrieved January 21, 2020, from http://fdi.gov.cn/1800000121_37_39717_0_7.html

Investment Promotion Agency of MOFCOM. (27 February, 2017). Yangzhou Economic Development Zone. Retrieved January 21, 2020, from http://project.mofcom.gov.cn/1200000020_6_140_0_7.html (in Chinese)

Ireland, R.D. and Webb, J.W. (2007). A multi-theoretic perspective on trust and power in strategic supply chains. *Journal of Operations Management*, 25(2), 482-497.

Jain, M., Khalil, S., Johnston, W.J. and Cheng, M.S. (2014). The performance implications of power-trust relationship: The moderating role of commitment in the supplier-retailer relationship. *Industrial Marketing Management*, 43(2), 312-321.

Jain, M. (2018). Energy transition in the Indian building sector, University of Twente, Enschede.

Jap, S.D. and Anderson, E. (2003). Safeguarding inter-organizational performance and continuity under ex post opportunism. *Management Science*, 49(12), 1684-1701.

Jean, R., Sinkovics, R. and Hiebaum, T. (2014). The effects of supplier involvement and knowledge protection on product innovation in customer-supplier relationships: A study of global automotive suppliers in China. *Journal of Product Innovation Management*, 31(1), 98-113.

Jehn, K.A. and Mannix, E.A. (2001). The dynamic nature of conflict: A longitudinal study of intragroup conflict and group performance. *Academy of Management Journal*, 44(2), 238-251.

Jiangsu Chamber of International Commerce. (17 April, 2016). Transportation. Retrieved March 15, 2020, from <http://en.coicjs.org/News/Detail2-113.aspx>

Jiangsu People. (9 December, 2011). Half of the state-level eco-industrial parks are in Jiangsu. Retrieved March 15, 2020, from <http://js.people.com.cn/html/2011/12/09/54582.html> (in Chinese)

Jiang, Z., Henneberg, S.C. and Peter, Naudé. (2012). Supplier relationship management in the construction industry: The effects of trust and dependence. *Journal of Business & Industrial Marketing*, 27(1), 3-15.

Jiang, W., Chai, H., Shao, J. and Feng, T. (2018). Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective. *Journal of Cleaner Production*, 198, 1311-1323.

Jill Harness. (21 June, 2019). Effects of Globalization on Human Resource Management. Retrieved March 26, 2020, from <https://bizfluent.com/info-8568053-effects-globalization-human-resource-management.html>

Johnson, J.L., Sakano, T., Cote, J.A. and Onzo, N. (1993). The exercise of interfirm power and its repercussions in U.S.-Japanese channel relationships. *Journal of Marketing*, 57(2), 1-10.

John, G. (1984). An empirical investigation of some antecedents of opportunism in a marketing channel. *Journal of Marketing Research*, 21(3), 278-289.

John, G. and Reve, T. (2010). Transaction cost analysis in marketing: Looking back, moving forward. *Journal of Retailing*, 86(3), 248-256.

Kannan, D., Jabbour, A.B.L. and Jabbour, C.J.C. (2014). Selecting green suppliers based on GSCM practices: Using fuzzy TOPSIS applied to a Brazilian electronics company. *European Journal of Operational Research*, 233(2), 432-447.

Kaynak, R., Sert, T., Sert, G. and Akyuz, B. (2015). Supply chain unethical behaviors and continuity of relationship: Using the PLS approach for testing moderation effects of inter-organizational justice. *International Journal of Production Economics*, 162, 83-91.

Ke, W., Liu, H., Weil, K.K., Gu, J. and Chen, H. (2009). How do mediated and non-mediated power affect electronic supply chain management system adoption? The mediating effects of trust and institutional pressures. *Decision Support System*, 46(4), 839-851.

Kembro, J. and Selviaridis, K. (2015). Exploring information sharing in the extended supply chain: An interdependence perspective. *Supply Chain Management: An International Journal*, 20(4), 455-470.

KETD. (May 18, 2016). Kunshan Economic and Technological Development Zone. Retrieved January 6, 2020, from <http://ks.jsxhjj.com/index.php/Home-Index-contact> (in Chinese)

Kim, J. and Rhee, J. (2012). An empirical study on the impact of critical success factors on the balanced scorecard performance in Korean green supply chain management enterprises. *International Journal of Production Research*, 50(9), 2465-2483.

Koka, B.R. and Prescott, J.E. (2002). Strategic alliances as social capital: A multidimensional view. *Strategic Management Journal*, 23(9), 795-817.

Kong, T., Feng, T., Huang, Y. and Cai, J. (2020). How to convert green supply chain integration efforts into green innovation: A perspective of knowledge-based view. *Sustainable Development*. DOI: 10.1002/sd.2062

Kotabe, M., Martin, X. and Domoto, H. (2003). Gaining from vertical partnerships: knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. *Strategic Management Journal*, 24(4), 293-316.

Krause, D.R., Handfield, R.B. and Tyler, B.B. (2007). The relationships between supplier development, commitment, social capital accumulation, and performance improvement. *Journal of Operations Management*, 25(2), 528-545.

Kreiner, I. and Franco-García, M.L. (2019). A Strategic Evaluation Framework to Assess the Sustainability Level of Industrial Parks in the Post-global Economy. In *Sustainable Development Goals and Sustainable Supply Chains in the Post-global Economy*. Springer, Cham, 205-224.

Kruschwitz, N. (2012). How Dell turned bamboo and mushrooms into environmental-friendly packaging. *MIT Sloan Management Review*, 54(1), 1.

Kühne B., Gellynck X. and Weaver R. (2013). The influence of relationship quality on the innovation capacity in traditional food chains. *Supply Chain Management International Journal*, 18(1), 52-65.

Kumar, N., Scheer, L.K. and Steenkamp, J.B.E.M. (1995). The effects of supplier fairness on vulnerable resellers. *Journal of Marketing Research*, 32(1), 54-65.

Kumar, V., Bak, O., Guo, R., Shaw, S., Colicchia, C., Garza-Reyes, J. and Kumari, A. (2018). An empirical analysis of supply and manufacturing risk and business performance: A Chinese manufacturing supply chain perspective. *Supply Chain Management: An International Journal*, 23(6), 461-479.

Kunshan Audiovisual. (30 December, 2018). 2018 National Development Zone Rankings have been Released! Kunshan Development Zone Ranks Fifth in the Country. Retrieved January 6, 2020, from <http://dy.163.com/v2/article/detail/E49RNSKS0514EH5S.html> (in Chinese)

Kunshan Municipal People's Government. (12 March, 2020). Economic and Technological Development Zone. Retrieved June 14, 2020, from <http://www.ks.gov.cn/zrgk?id=1723&status=1> (in Chinese)

Kunshan Release. (6 April, 2016). Kunshan River Channel Protection. Retrieved January 6, 2020, from https://www.sohu.com/a/68018891_351262 (in Chinese)

Laaksonen, T., Pajunen, K. and Kulmala, H.I. (2008). Co-evolution of trust and dependence in customer-supplier relationships. *Industrial Marketing Management*, 37(8), 910-920.

Lager, T. and Frishammar, J. (2010). Equipment supplier/user collaboration in the process industries: In search of enhanced operating performance. *Journal of Manufacturing Technology Management*, 21(6), 698-720.

Lai, K.H., Bao, Y. and Li, X. (2008). Channel relationship and business uncertainty: Evidence from the Hong Kong market. *Industrial Marketing Management*, 37(6), 713-724.

Lai, K., Wu, S.J. and Wong, C.W.Y. (2013). Did reverse logistics practices hit the triple bottom line of Chinese manufacturers? *International Journal of Production Economics*, 146(1), 106-117.

Lai, B.J. (2013). Research on environmental performance index of eco-industrial park development in China. Tsinghua University, Beijing, China.

Lai, K.H., Wong, C.W. and Lam, J.S.L. (2015). Sharing environmental management information with supply chain partners and the performance contingencies on environmental munificence. *International Journal of Production Economics*, 164, 445-453.

Lambert, A.J.D. and Boons, F.A. (2002). Eco-industrial parks: Stimulating sustainable development in mixed industrial parks. *Technovation*, 22(8), 471-484.

Lawson, B., Tyler, B.B. and Cousins, P.D. (2008). Antecedents and consequences of social capital on buyer performance improvement. *Journal of Operations Management*, 26(3), 446-460.

Lawson, B., Petersen, K.J., Cousins, P.D. and Handfield, R.B. (2009). Knowledge sharing in interorganizational product development teams: The effect of formal and informal socialization mechanisms. *Journal of Product Innovation Management*, 26(2), 156-172.

Lee, R. and Jones, O. (2008). Networks, communication and learning during business start-up: The creation of cognitive social capital. *International Small Business Journal*, 26(5), 559-594.

Lee, S.Y. and Klassen, R.D. (2008). Drivers and enablers that foster environmental management capabilities in small-and medium-sized suppliers in supply chains. *Production and Operations Management*, 17(6), 573-586.

Lee, H. (2010). Don't tweak your supply chain-Rethink it end to end, *Harvard Business Review*, 88(10), 63-69.

Lee, K.H. and Kim, J.W. (2011). Integrating suppliers into green product innovation development: An empirical case study in the semiconductor industry. *Business Strategy and the Environment*, 20(8), 527-538.

Lee, J., Palekar, U.S. and Qualls, W. (2011). Supply chain efficiency and security: Coordination for collaborative investment in technology. *European Journal of Operational Research*, 210(3), 568-578.

- Lee, K.H. (2015a). Drivers and barriers to energy efficiency management for sustainable development. *Sustainable Development*, 23(1), 16-25.
- Lee, S.Y. (2015b). The effects of green supply chain management on the supplier's performance through social capital accumulation. *Supply Chain Management: An International Journal*, 20(1), 42-55.
- Lee, S.Y. (2016). Responsible supply chain management in the Asian context: The effects on relationship commitment and supplier performance. *Asia Pacific Business Review*, 22(2), 325-342.
- Leonidou, L.C., Christodoulides, P., Kyrgizi, L. and Palihawadana, D. (2017). Internal drivers and performance consequences of small firm green business strategy: The moderating role of external forces. *Journal of Business Ethics*, 140(3), 585-606.
- Liao, Z. (2016). Temporal cognition, environmental innovation, and the competitive advantage of enterprises. *Journal of Cleaner Production*, 135, 1045-1053.
- Liao, Z. (2018). Corporate culture, environmental innovation and financial performance. *Business Strategy and the Environment*, 27(8), 1368-1375.
- Li, W., Humphreys, P.K., Yeung, A.C.L. and Cheng, T.C.E. (2007). The impact of specific supplier development efforts on buyer competitive advantage: An empirical model. *International Journal of Production Economics*, 106(1), 230-247.
- Li, J.J., Poppo, L. and Zhou, K.Z. (2010a). Relational mechanisms, formal contracts, and local knowledge acquisition by international subsidiaries. *Strategic Management Journal*, 31(4), 349-370.
- Li, Y., Xie, E., Teo, H.H. and Peng, M.W. (2010b). Formal control and social control in domestic and international buyer-supplier relationships. *Journal of Operations Management*, 28(4), 333-344.
- Li, W.Y., Chow, P.S., Choi, T.M. and Chan, H.L. (2016a). Supplier integration, green sustainability programs, and financial performance of fashion enterprises under global financial crisis. *Journal of Cleaner Production*, 135, 57-70.

- Li, S., Jayaraman, V., Paulraj, A. and Shang, K.C. (2016b). Proactive environmental strategies and performance: Role of green supply chain processes and green product design in the Chinese high-tech industry. *International Journal of Production Research*, 54(7), 2136-2151.
- Li, D., Zheng, M., Cao, C., Chen, X., Ren, S. and Huang, M. (2017). The impact of legitimacy pressure and corporate profitability on green innovation: Evidence from China top 100. *Journal of Cleaner Production*, 141, 41-49.
- Li, Y.H. and Huang, J.W. (2017). The moderating role of relational bonding in green supply chain practices and performance. *Journal of Purchasing and Supply Management*, 23(4), 290-299.
- Li, Y., Ye, F., Sheu, C. and Yang, Q. (2018). Linking green market orientation and performance: Antecedents and processes. *Journal of Cleaner Production*, 192, 924-931.
- Liu, Y., Luo, Y. and Liu, T. (2009). Governing buyer-supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management*, 27(4), 294-309.
- Liu, S.X. (2016). Innovation design: Made in China 2025. *Design Management Review*, 27(1), 52-58.
- Liu, Y., Zhu, Q. and Seuring, S. (2017). Linking capabilities to green operations strategies: The moderating role of corporate environmental proactivity. *International Journal of Production Economics*, 187, 182-195.
- Liu, Y., Blome, C., Sanderson, J. and Paulraj, A. (2018). Supply chain integration capabilities, green design strategy and performance: A comparative study in the auto industry. *Supply Chain Management: An International Journal*, 23(5), 431-443.
- Lo, S.M., Shanshan, Z., Zhiqiang, W. and Xiande, Z. (2018). The impact of relationship quality and supplier development on green supply chain integration: A mediation and moderation analysis. *Journal of Cleaner Production*, 202, 525-535.

Lu, P., Guo, S., Qian, L., He, P. and Xu, X. (2015). The effectiveness of contractual and relational governances in construction projects in China. *International Journal of Project Management*, 33(1), 212-222.

Luo, Y. (2007). *Guanxi and business*. Hackensack, NJ: World Scientific Publishing Company.

Luo, Y., Huang, Y. and Wang, S.L. (2011). Guanxi and organizational performance: A meta-analysis. *Management and Organization Review*, 8, 139-172.

Lumineau, F. and Malhotra, D. (2011). Shadow of the contract: How contract structure shapes interfirm dispute resolution. *Strategic Management Journal*, 32(5), 532-555.

Luomaranta, T. and Martinsuo, M. (2019). Supply chain innovations for additive manufacturing. *International Journal of Physical Distribution & Logistics Management*, 50(1), 54-79.

Lusch, R.F. and Brown, J.R. (1982). A modified model of power in the marketing channel. *Journal of Marketing Research*, 19(3), 312-323.

Maloni, M. and Benton, W.C. (2000). Power influences in the supply chain. *Journal of Business Logistics*, 21(1), 49-73.

Management Committee of Wuxi National High-tech District. (2016). The outline of “Thirteenth Five-Year Plan” for National Economic and Social Development of High-tech Zones in Wuxi (2016-2020), China. Retrieved December 20, 2019, from <https://max.book118.com/html/2019/0104/8013111101001143.shtm> (in Chinese)

Mann, H.B. and Whitney, D.R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *The Annals of Mathematical Statistics*, 18(1), 50-60.

Massard, G., Jacquat, O. and Zurcher, D. (2014). *International Survey on Eco-Innovation Parks. Learning from Experiences on the Spatial Dimensions of Eco-Innovation*. Federal Office for the Environment and the ERA-NET Eco-INNOVERA. Bern. *Environmental Studies*, No.1402.

Matthews, R.L. and Marzec, P.E. (2012). Social capital, a theory for operations management: A systematic review of the evidence. *International Journal of Production Research*, 50(24), 7081-7099.

McEvily, B., Perrone, V. and Zaheer, A. (2003). Trust as an organizing principle. *Organization Science*, 14(1), 91-103.

McGrath, R. and Sparks, W.L. (2005). The importance of building social capital. *Quality Progress*, 38 (22), 45-49.

MEP. (Ministry of Environmental Protection, 2014). National Eco-industrial Demonstration Park List, China. Retrieved March 25, 2019, from <http://kjs.mep.gov.cn/stgysfyq/m/200807/t20080718-125900.htm> (in Chinese)

Meqdadi, O., Johnsen, T.E. and Johnsen, R.E. (2017). The role of power and trust in spreading sustainability initiatives across supply networks: A case study in the bio-chemical industry. *Industrial Marketing Management*, 62, 61-76.

Meqdadi, O., Johnsen, T.E. and Johnsen, R.E. (2018). Power and diffusion of sustainability in supply networks: Findings from four in-depth case studies. *Journal of Business Ethics*, 159(4), 1089-1110.

Microsoft Technology. (7 September, 2018). Cloud and mobile application incubation platform in Nanjing Economic and Technological Development Zone. Retrieved June 13, 2020, from https://m.sohu.com/a/252434792_181341 (in Chinese)

Ministry of Commerce of the People's Republic of China. (31 December, 2018a). 2018 National Economic and Technological Development Zone Comprehensive Development Level Assessment Results. Retrieved January 6, 2020, from http://www.gov.cn/xinwen/2018-12/31/content_5353745.htm (in Chinese)

Ministry of Commerce of the People's Republic of China. (29 October, 2018b). Institutional innovation in Kunshan Economic and Technological Development Zone promotes regional economic development. Retrieved January 6, 2020, from http://ezone.mofcom.gov.cn/article/zt_cxfz/column02/201810/20181002800721.shtml (in Chinese)

Ministry of Ecology and Environment of the People's Republic of China. (18 April, 2014). List of National Ecological Industry Demonstration Parks. Retrieved December 20, 2019, from http://kjs.mee.gov.cn/stgysfyq/glwj/sfyqmd/201302/t20130222_248379.shtml (in Chinese)

Ministry of Industry and Information Technology of the People's Republic of China. (7 May, 2012). Ministry of Industry and Information Technology issued "Twelfth Five-Year Development Plan for High-end Equipment Manufacturing Industry". Retrieved December 28, 2019, from <http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057267/n3057273/c3522282/content.html> (in Chinese)

Mishra, M. and Banerjee, M. (2018). Non-coercive influence: Scale development and validation based on resource and relational paradigms. *Journal of Purchasing and Supply Management*, 25(5), 100498.

Mittal, I. and Gupta, R.K. (2015). Natural resources depletion and economic growth in present era. *SOCH-Mastnath Journal of Science & Technology (BMU, Rohtak)*, 10(3), 24-28.

Moorman, C., Deshpande, R. and Zaltman, G. (1993). Factors affecting trust in market research relationships. *Journal of Marketing*, 57(1), 81-101.

Molm, L.D. (1997). Risk and power use: Constraints on the use of coercion in exchange. *American Sociological Review*, 62(1), 113-133.

Morgan, R.M. and Hunt, S.D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20-38.

Moran, P. (2005). Structural vs. relational embeddedness: Social capital and managerial performance. *Strategic Management Journal*, 26(12), 1129-1151.

Nahapiet, J. and Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Nanjing Daily. (14 March, 2012). Nanjing Economic Development Zone Transforms into a Complex Industrial City. Retrieved December 28, 2019, from http://njrb.njdaily.cn/njrb/html/2019-09/26/content_548702.htm?div=8

Narasimhan, R., Nair, A., Griffith, D.A., Arlbjorn, J.S. and Bendoly, E. (2009). Lock-in situations in supply chains: A social exchange theoretic study of sourcing arrangements in buyer-supplier relationships. *Journal of Operations Management*, 27(5), 374-389.

NBS. (2019). *China Statistical Yearbook*: China Statistical Publishing House, Beijing, China.

NBS. (2020). *China Statistical Yearbook*: China Statistical Publishing House, Beijing, China.

NET. (27 September, 2017). An overview of Nanjing Economic and Technological Development Zone. Retrieved December 28, 2019, from http://jjkfq.nanjing.gov.cn/gzdt/201709/t20170927_502046.html (in Chinese)

NET. (12 December, 2018). Brief Introduction to the State-level Nanjing Economic and Technological Development Zone. Retrieved December 28, 2019, from http://jjkfq.nanjing.gov.cn/njjjskfqglwyh/201901/t20190109_1368668.html (in Chinese)

Ni, W. and Sun, H. (2019). The effect of sustainable supply chain management on business performance: Implications for integrating the entire supply chain in the Chinese manufacturing sector. *Journal of Cleaner Production*, 232, 1176-1186.

Nie, R., Zhong, W., Zhou, M., Jiang, W. and Wang, X. (2011). A bittersweet phenomenon: The internal structure, functional mechanism, and effect of guanxi on firm performance. *Industrial Marketing Management*, 40(4), 540-549.

Nielson, C.C. (1998). An empirical examination of the role of ‘closeness’ in industrial buyer-seller relationships. *European Journal of Marketing*, 32, 441-463.

Nyaga, G.N., Whipple, J.M. and Lynch, D.F. (2010). Examining supply chain relationships: Do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management*, 28(2), 101-114.

Nygaard, A. and Biong, H. (2010). The influence of retail management's use of social power on corporate ethical values, employee commitment and performance. *Journal of Business Ethics*, 97(1), 341-363.

Özerol, G. and Bressers, H. (2015). Scalar alignment and sustainable water governance: The case of irrigated agriculture in Turkey. *Environmental Science & Policy*, 45, 1-10.

Pang, Q., Yang, T., Li, M. and Shen, Y. (2017). A fuzzy-grey multicriteria decision making approach for green supplier selection in low-carbon supply chain. *Mathematical Problems in Engineering*, 8(1), 1-9.

Parmigiani, A., Klassen, R.D. and Russo, M.V. (2011). Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. *Journal of Operations Management*, 29(3), 212-223.

Paulraj, A., Lado, A.A. and Chen, I.J. (2008). Inter-organizational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer-supplier relationships. *Journal of Operations Management*, 26(1), 45-64.

Peng, B., Tu, Y. and Wei, G. (2018). Governance of electronic waste recycling based on social capital embeddedness theory. *Journal of Cleaner Production*, 187, 29-36.

People's Daily. (9 October, 2012). Glorious History, Shining Footprints-Event in Kunshan Economic and Technological Development Zone. Retrieved January 6, 2020, from http://www.360doc.com/content/12/1009/05/7499155_240351824.shtml (in Chinese)

People's Daily Online. (27 May, 2013). Country Profile: Jiangsu Province. Retrieved March 15, 2020, from <http://en.people.cn/data/province/jiangsu.html>

Pfeffer, J. and Salancik, G. (1978). *The external control of organizations: A resource dependence perspective*, Harper and Row: New York.

Philipp, H., Paul, S. and Holger, S. (2014). Internal integration as a pre-condition for external integration in global sourcing: A social capital perspective. *International Journal of Production Economics*, 153(3), 54-65.

Plainvim International Co., Ltd. (2016). Layout & Planning. Retrieved January 06, 2020, from <http://en.mg.plainvim.com.cn/sv.aspx?TypeId=128&FId=t8:128:8>

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903.

Podsakoff, P.M., MacKenzie, S.B. and Podsakoff, N.P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63, 539-569.

Poppo, L. and Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8), 707-725.

Prahinski, C. and Benton, W.C. (2004). Supplier evaluations: Communication strategies to improve supplier performance. *Journal of Operations Management*, 22(1), 39-62.

Preacher, K.J. and Hayes, A.F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods*, 36(4), 717-731.

Public Business Information Service of the Ministry of Commerce. (October 25, 2012). Introduction to Nanjing Economic and technological Development Zone. Retrieved December 28, 2019, from <http://ezone.mofcom.gov.cn/article/ao/201210/20121008401751.shtml> (in Chinese)

Qi, Y., Huo, B., Wang, Z. and Yeung, H.Y.J. (2017). The impact of operations and supply chain strategies on integration and performance. *International Journal of Production Economics*, 185, 162-174.

- Radas, S. and Bozic, L. (2009). The antecedents of SME innovativeness in an emerging transition economy. *Technovation*, 29, 438-450.
- Ramaseshan, B., Yip, L.S.C. and Pae, J.H. (2006). Power, satisfaction, and relationship commitment in Chinese store-tenant relationship and their impact on performance. *Journal of Retailing*, 82(1), 63-70.
- Rao, P. (2002). Greening the supply chain: A new initiative in South East Asia. *International Journal of Operations and Production Management*, 22(6), 632-655.
- Reimann, F. and Ketchen, D.J.J.R. (2017). Power in supply chain management. *Journal of Supply Chain Management*, 53(2), 3-9.
- Reuter, C., Foerstl, K.A.I., Hartmann, E.V.I. and Blome, C. (2010). Sustainable global supplier management: The role of dynamic capabilities in achieving competitive advantage. *Journal of Supply Chain Management*, 46(2), 45-63.
- Rothaermel, F.T. and Alexandre, M.T. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science*, 20, 759-780.
- Sakr, D., Baas, L., El-Haggar, S. and Huisingh, D. (2011). Critical success and limiting factors for eco-industrial parks: Global trends and Egyptian context. *Journal of Cleaner Production*, 19(11), 1158-1169.
- Sancha, C., Gimenez, C., Sierra, V. and Kazeminia, A. (2015). Does implementing social supplier development practices pay off? *Supply Chain Management: An International Journal*, 20(4), 389-403.
- Shi, H., Moriguichi, Y. and Yang, J. (2003). Industrial ecology in China, part I: Research. *Journal of Industrial Ecology*, 6(3-4), 7-11.
- Shi, H., Chertow, M. and Song, Y. (2010). Developing country experience with eco-industrial parks: A case study of the Tianjin Economic-Technological Development Area in China. *Journal of Cleaner Production*, 18(3), 191-199.
- Shi, H., Tian, J. and Chen, L. (2012a). China's quest for eco-industrial parks, part I. *Journal of Industrial Ecology*, 16(1), 8-10.

Shi, H., Tian, J. and Chen. L. (2012b). China's quest for eco-industrial parks, part II. *Journal of Industrial Ecology*, 16(3), 290-292.

Shou, Y., Li, Y., Park, Y.W. and Kang, M. (2017). The impact of product complexity and variety on supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 47(4), 297-317.

Shu, C., Zhou, K.Z., Xiao, Y. and Gao, S. (2016). How green management influences product innovation in China: The role of institutional benefits. *Journal of Business Ethics*, 133(3), 471-485.

SIP. (4 July, 2011). Scientific Masterplan. Retrieved December 12, 2019, from http://www.sipac.gov.cn/english/InvestmentGuide/ScientificMasterPlan/201107/t20110704_102990.htm

SIP. (30 October, 2019a). Geographical Transportation. Retrieved December 12, 2019, from http://www.sipac.gov.cn/zjyq/dljt/201810/t20181030_880329.htm (in Chinese)

SIP. (10 April, 2019b). Strategic Location. Retrieved December 12, 2019, from http://www.sipac.gov.cn/english/InvestmentGuide/LocalAndTransportation/201904/t20190410_1014377.htm

SIP. (9 April, 2019c). Sino-Singapore Cooperation. Retrieved December 12, 2019, from http://www.sipac.gov.cn/english/InvestmentGuide/SinoSingaporeCooperation/201904/t20190409_1013816.htm

SIP. (8 March, 2019d). Park Introduction. Retrieved December 12, 2019, from http://www.sipac.gov.cn/zjyq/yqgk/201903/t20190308_1003941.htm (in Chinese)

SIP. (3 March, 2019e). Development Stage. Retrieved December 12, 2019, from http://www.sipac.gov.cn/zjyq/fzjd/201903/t20190303_996712.htm (in Chinese)

SIP. (4 March, 2019f). Education Culture. Retrieved December 12, 2019, from http://www.sipac.gov.cn/zjyq/jywh/201903/t20190304_997568.htm (in Chinese)

SIP. (17 October, 2019g). 2018 Suzhou Industrial Park Environmental Quality Bulletin. Retrieved February 17, 2020, from http://www.sipac.gov.cn/dept/gthbj/hb/hbxxgk/hjzl/201910/t20191017_1063850.htm (in Chinses)

Simpson, D., Power, D. and Samson, D. (2007). Greening the automotive supply chain: A relationship perspective. *International Journal of Operations and Production Management*, 27(1), 28-48.

Son, B.G., Kocabasoglu-Hillmer, C. and Roden, S. (2016). A dyadic perspective on retailer-supplier relationships through the lens of social capital. *International Journal of Production Economics*, 178, 120-131.

Song, X.Y. and Shen, J. (2015). The ecological performance of eco-industrial parks in shandong based on principal component analysis and set pair analysis. *Resources Science*, 37(3), 546-554.

Srivastava, V. and Singh, T. (2010). Value creation through relationship closeness. *Journal of Strategic Marketing*, 18(1), 3-17.

Staas, L. (2017). Resilient governance for resilient cities-Assessing the governance context for green infrastructure implementation in Hoboken. Thesis University of Twente, Enschede.

Su, B., Heshmati, A., Geng, Y. and Yu. X. (2013). A review of the circular economy in China: Moving from rhetoric to implementation. *Journal of Cleaner Production*, 42, 215-227.

Subramaniam, P.L., Iranmanesh, M., Kumar, K.M. and Foroughi, B. (2019). The impact of multinational corporations' socially responsible supplier development practices on their corporate reputation and financial performance. *International Journal of Physical Distribution & Logistics Management*, 50(1), 3-25.

Suzhou Economy. (1 January, 2019). How Strong is the Kunshan Economic and Technological Development Zone? Retrieved January 6, 2020, from <http://mini.eastday.com/bdmip/190101124014762.html# 2019-01-01> (in Chinese)

Sweetman, K. (10 April, 2012). In Asia, Power Gets in the Way. Retrieved June 11, 2020, from <https://hbr.org/2012/04/in-asia-power-gets-in-the-way>

Tang, M., Walsh, G., Lerner, D., Fitza, M.A. and Li, Q. (2018). Green innovation, managerial concern and firm performance: An empirical study. *Business Strategy and the Environment*, 27(1), 39-51.

Taoketao, E., Feng, T., Song, Y. and Nie, Y. (2018). Does sustainability marketing strategy achieve payback profits? A signaling theory perspective. *Corporate Social Responsibility and Environmental Management*, 25(6), 1039-1049.

Tashman, P. and Rivera, J. (2016). Ecological uncertainty, adaptation, and mitigation in the U.S. ski resort industry: Managing resource dependence and institutional pressures. *Strategic Management Journal*, 37(7), 1507-1525.

Tate, W.L., Ellram, L.M. and Dooley, K.J. (2014). The impact of transaction costs and institutional pressure on supplier environmental practices. *International Journal of Physical Distribution & Logistics Management*, 44(5), 353-372.

The China Perspective. (26 March, 2016). Jiangsu Province: Economic News and Statistics for Jiangsu's Economy. Retrieved March 15, 2020, from <https://web.archive.org/web/20130511201549/http://www.thechinaperspective.com/topics/province/jiangsu-province/>

Theyel, G. and Hofmann, K. (2012). Stakeholder relations and sustainability practices of us small and medium-sized manufacturers. *Management Research Review*, 35(12), 1110-1133.

Tian, J., Liu, W., Lai, B., Li, X. and Chen, L. (2014). Study of the performance of eco-industrial park development in China. *Journal of Cleaner Production*, 64, 486-494.

Touboulis, A. and Walker, H. (2015). Love me, love me not: A nuanced view on collaboration in sustainable supply chain. *Journal of Purchasing and Supply Management*, 21(3), 178-191.

Tsai, W. and Ghoshal, S. (1998). Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41(4), 464-476.

Vachon, S. and Klassen, R.D. (2008). Environmental management and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics*, 111(2), 299-315.

Valenzuela-Venegas, G., Salgado, J.C. and Díaz-Alvarado, F.A. (2016). Sustainability indicators for the assessment of eco-industrial parks: Classification and criteria for selection. *Journal of Cleaner Production*, 133, 99-116.

Vanalle, R.M., Ganga, G.M.D., Godinho Filho, M. and Lucato, W.C. (2017). Green supply chain management: An investigation of pressures, practices, and performance within the Brazilian automotive supply chain. *Journal of Cleaner Production*, 151, 250-259.

Victor C.F. and Frederick F.H. (13 April, 2016). Jiangsu Province, Retrieved March 15, 2020, from <https://www.britannica.com/place/Jiangsu>

Vikolainen, V., Flikweert, J., Bressers, H. and Lulofs, K. (2017). Governance context for coastal innovations in England: The case of Sandscaping in North Norfolk. *Ocean and Coastal Management*, 145, 82-93.

Xue Y. (2018). Sustainable urban mining. University of Twente, Enschede.

Villena, V.H., Revilla, E. and Choi, T.Y. (2011). The dark side of buyer-supplier relationships: A social capital perspective. *Journal of Operations Management*, 29(6), 561-576.

Walker, K., Ni, N. and Huo, W. (2014). Is the red dragon green? An examination of the antecedents and consequences of environmental proactivity in China. *Journal of Business Ethics*, 125(1), 27-43.

Wang, L., Yeung, J.H.Y. and Zhang, M. (2011). The impact of trust and contract on innovation performance: The moderating role of environmental uncertainty. *International Journal of Production Economics*, 134(1), 114-122.

Wang, Z., Huo, B., Tian, Y. and Hua, Z. (2015a). Effects of external uncertainties and power on opportunism in supply chains: Evidence from China. *International Journal of Production Research*, 53(20), 6294-6307.

Wang, L., Shen, J. and Chung, C.K.L. (2015b). City profile: Suzhou-a Chinese city under transformation. *Cities*, 44, 60-72.

Wang, Y., Wang, N., Jiang, L., Yang, Z. and Cui, V. (2016a). Managing relationships with power advantage buyers: The role of supplier initiated bonding tactics in long-term buyer-supplier collaborations. *Journal of Business Research*, 69(12), 5587-8896.

Wang, M., Zhang, Q., Wang, Y. and Sheng, S. (2016b). Governing local supplier opportunism in China: Moderating role of institutional forces. *Journal of Operations Management*, 46(1), 84-94.

Wang, G., Feng, T., Zhao, X. and Song, Y. (2018). Influence of supplier trust and relationship commitment on green supplier integration. *Sustainable Development*, 26(6), 879-889.

Wang, Y. and Liu, F. (2019). Proactive or responsive market orientation for stronger service innovation capability: The moderating roles of contractual and relational governance. *Journal of Business & Industrial Marketing*, 35(5), 863-874.

Wang, Z., McNally, R. and Lenihan, H. (2019a). The role of social capital and culture on social decision-making constraints: A multilevel investigation. *European Management Journal*, 37(2), 222-232.

Wang, Y., Jia, T., Chen, J. and Sun, H. (2019b). Recombine supplier-side search via innovation ambidexterity. *International Journal of Physical Distribution & Logistics Management*, 49(2), 178-199.

Wever, M., Wognum, P.M., Trienekens, J.H. and Omta, S.W.F. (2012). Supply chain-wide consequences of transaction risks and their contractual solutions: Towards an extended transaction cost economics framework. *Journal of Supply Chain Management*, 48(1), 73-91.

Wichmann, B.K., Carter, C.R., Kaufmann, L. and Wilson, J.R. (2016). Making environmental SCM initiatives work-Moving beyond the dyad to gain affective commitment. *Journal of Supply Chain Management*, 52(1), 21-40.

Wijethilake, C., Munir, R. and Appuhami, R. (2018). Environmental innovation strategy and organizational performance: Enabling and controlling uses of management control systems. *Journal of Business Ethics*, 151(4), 1139-1160.

Wilczynski, J. (1971). From extensive to intensive growth under socialist economic planning. *Economic Record*, 47(117), 60-76.

Winn, M., Pinkse, J. and Illge, L. (2012). Case studies on trade-offs in corporate sustainability. *Corporate Social Responsibility and Environmental Management*, 19(2), 63-68.

WND. (2016). About. Retrieved December 20, 2019, from <http://www.bizwnd.com/wndabout.html>

WND. (2019a). Overview. Retrieved December 20, 2019, from <http://www.bizwnd.com/wndoverview.html>

WND. (15 March, 2019b). High-tech Zone (Xinwu District) Statistical Bulletin 2018. Retrieved December 20, 2019, from <http://www.wnd.gov.cn/doc/2019/05/15/2507338.shtml> (in Chinese)

WND. a. Industrial Parks. December 20, 2019, from <http://www.bizwnd.com/wndindustrialparks.html>

WND. b. Wuxi-Singapore Industrial Park. Retrieved December 20, 2019, from http://www.bizwnd.com/2019-07/30/c_54543.htm

WND. c. Healthcare. Retrieved December 20, 2019, from <http://www.bizwnd.com/wndhealthcare.html>

Woo, C., Kim, M.G., Chung, Y.H. and Rho, J.J. (2016). Suppliers' communication capability and external green integration for green and financial performance in Korean construction industry. *Journal of Cleaner Production*, 112(1), 483-493.

Wong, M. (2010). Guanxi management in lean production system-An empirical study of Taiwan-Japanese firms. *American Journal of Economics & Sociology*, 69(3), 1079-1106.

Wong, C.W., Lai, K.H., Shang, K.C., Lu, C.S. and Leung, T.K.P. (2012). Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. *International Journal of Production Economics*, 140(1), 283-294.

Wong, C.Y., Wong, C.W. and Boon-itt, S. (2020). Effects of green supply chain integration and green innovation on environmental and cost performance. *International Journal of Production Research*, DOI: 10.1080/00207543.2020.1756510.

Wry, T., Cobb, J. and Aldrich, H. (2013). More than a metaphor: Assessing the historical legacy of resource dependence and its contemporary promise as a theory of environmental complexity. *The Academy of Management Annals*, 7(1), 441-488.

Wu, G.C., Ding, J.H. and Chen, P.S. (2012). The effects of GSCM drivers and institutional pressures on GSCM practices in Taiwan's textile and apparel industry. *International Journal of Production Economics*, 135, 618-636.

Wu, G.C. (2013). The influence of green supply chain integration and environmental uncertainty on green innovation in Taiwan's IT industry. *Supply Chain Management: An International Journal*, 18(5), 539-552.

Xinhua. (3 November, 2017). Xi Jinping delivered a report at the 19th National Congress of the Communist Party of China (CPC) on October 18, 2017. Retrieved March 25, 2020, from http://www.xinhuanet.com/english/special/2017-11/03/c_136725942.htm

Xixia District People's Government of Nanjing. (31 December, 2019). District Overview. Retrieved February 27, 2020. from http://www.njqxq.gov.cn/ssqx/qxgk/201312/t20131221_1142626.html (in Chinese)

Xu, Y., Liu, J., Wu, J. and Luo, C. (2016). Improving supply chain performance through industry standards use and community socialization. *International Journal of Physical Distribution & Logistics Management*, 46(8), 763-782.

Yang, J., Wang, J.J., Wong, C.W.Y. and Lai, K.H. (2008). Relational stability and alliance performance in supply chain. *Omega*, 36(4), 600-608.

Yang, C.S., Lu, C.S., Haider, J.J. and Peter, B.M. (2013). The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. *Transportation Research Part E: Logistics & Transportation Review*, 55(55), 55-73.

Yang, Q., Zhao, X., Yeung, H.Y.J. and Liu, Y. (2016). Improving logistics outsourcing performance through transactional and relational mechanisms under transaction uncertainties: Evidence from China. *International Journal of Production Economics*, 175, 12-23.

Yang, Q., Geng, R. and Feng, T. (2020). Does the configuration of macro-and micro-institutional environments affect the effectiveness of green supply chain integration? *Business Strategy and the Environment*, 29(4), 1695-1713.

Yangzhou People's Government. (23 April, 2018). Yangzhou Economic Development Zone. Retrieved January 30, 2020, from <http://www.yangzhou.gov.cn/yangzhou/yqzl/201804/a30ae13c19984a43b2fdd16fdeba5ed3.shtml> (in Chinese)

Yawar, S.A. and Seuring, S. (2017). Management of social issues in supply chains: A literature review exploring social issues, actions and performance outcomes. *Journal of Business Ethics*, 141(3), 621-643.

YEDZ. (October, 2019a). Location Traffic. Retrieved January 21, 2020, from http://kfq.yangzhou.gov.cn/kfq/qwjt1/kfqjj_lmtt.shtml (in Chinese)

YEDZ. (October, 2019b). National Yangzhou Economic Development Zone. Retrieved January 21, 2020, from http://kfq.yangzhou.gov.cn/kfq/kfqjj/kfqjj_lmtt.shtml (in Chinese)

YEDZ. (October, 2019c). Overall Plan. Retrieved January 21, 2020, from http://kfq.yangzhou.gov.cn/kfq/ztgh/kfqjj_lmtt.shtml (in Chinese)

YEDZ. (October, 2019d). Development Environment. Retrieved January 21, 2020, from http://kfq.yangzhou.gov.cn/kfq/fzhj/kfqjj_lmtt.shtml (in Chinese)

Yen, D.A., Yu, Q. and Barnes, B.R. (2007). Focusing on relationship dimensions to improve the quality of Chinese-Western business-to-business exchanges. *Total Quality Management & Business Excellence*, 18(8), 889-899.

Yeung, J.H.Y., Selen, W., Zhang, M. and Huo, B. (2009). The effects of trust and coercive power on supplier integration. *International Journal of Production Economics*, 120(1), 66-78.

Yim, B. and Leem, B. (2013). The effect of the supply chain social capital. *Industrial Management & Data Systems*, 113(3), 324-349.

Yu, C.M.J., Liao, T.J. and Lin, Z.D. (2006). Formal governance mechanisms, relational governance mechanisms, and transaction-specific investments in supplier-manufacturer relationships. *Industrial Marketing Management*, 35(2), 128-139.

Yu, W., Jacobs, M.A., Salisbury, W.D. and Enns, H. (2013). The effects of supply chain integration on customer satisfaction and financial performance: An organizational learning perspective. *International Journal of Production Economics*, 146(1), 346-358.

Yu, Y., Zhang, M. and Huo, B. (2017). The impact of supply chain quality integration on green supply chain management and environmental performance. *Total Quality Management & Business Excellence*, 30(9-10), 1110-1125.

Yu, Y., Zhang, M. and Huo, B. (2019). The impact of supply chain quality integration on green supply chain management and environmental performance. *Total Quality Management and Business Excellence*, 30(10), 1110-1125.

Yu, Y. and Huo, B. (2019). The impact of environmental orientation on supplier green management and financial performance: The moderating role of relational capital. *Journal of Cleaner Production*, 211, 628-639.

Yuan, Z., Zhang, L. and Bi, J. (2010). Which is more cost-effective? A comparison of two wastewater treatment models in China-Singapore Suzhou Industrial Park, China. *Journal of Cleaner Production*, 18(13), 1270-1275

Zablah, A.R., Johnston, W.J. and Bellenger, D.N. (2005). Transforming partner relationships through technological innovation. *Journal of Business & Industrial Marketing*, 20(7), 355-363.

Zaefarian, G., Najafi-Tavani, Z., Henneberg, S.C. and Naudé, P. (2016). Do supplier perceptions of buyer fairness lead to supplier sales growth? *Industrial Marketing Management*, 53, 160-171.

Zailani, S., Jeyaraman, K., Vengadasan, G. and Premkumar, R. (2012). Sustainable supply chain management (SSCM) in Malaysia: A survey. *International Journal of Production Economics*, 140(1), 330-340.

Zhang, L., Yuan, Z., Bi, J., Zhang, B. and Liu, B. (2010). Eco-industrial parks: National pilot practices in China. *Journal of Cleaner Production*, 18(5), 504-509.

Zhang, Q., Pan, J., Jiang, Y. and Feng, T. (2020a). The impact of green supplier integration on firm performance: The mediating role of social capital accumulation. *Journal of Purchasing and Supply Management*, 26(2), 100579.

Zhang, Q., Pan, J., Xu, D. and Feng, T. (2020b). Balancing coercive and non-coercive powers to enhance green supplier integration: Do relationship commitment and closeness matter? *Supply Chain Management: An International Journal*. 25(6), 637-653.

Zhang, Q., Pan, J. and Feng, T. (2020). Green supplier integration and environmental performance: Do environmental innovation and ambidextrous governance matter? *International Journal of Physical Distribution & Logistics Management*. DOI: 10.1108/ijpdlm-01-2020-0027.

Zhao, X., Huo, B., Flynn, B.B. and Yeung, J. (2008). The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain. *Journal of Operations Management*, 26(3), 368-388.

Zhao, X., Huo, B., Selen, W. and Yeung, J. (2011). The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management*, 29(1-2), 17-32.

Zhao, Y., Feng, T. and Shi, H. (2018). External involvement and green product innovation: The moderating role of environmental uncertainty. *Business Strategy and the Environment*, 27(8), 1167-1180.

Zhan, Y., Tan, K.H., Ji, G., Chung, L. and Chiu, A.S. (2018). Green and lean sustainable development path in China: Guanxi, practices and performance. *Resources, Conservation and Recycling*, 128, 240-249.

Zheng, W.T. (12 July, 2018). Make good use of dialectics to promote high-quality development, Retrieved March 29, 2020, from http://paper.ce.cn/jjrb/html/2018-07/12/content_367447.htm (in Chinese)

Zhong, Q., Yao, Y., Qiao, Q., Bai, W. and Fang, L. (2014). Development progress and regional characteristics of eco-industrial parks in China. *Journal of Environmental Engineering Technology*, 4(5), 429-435.

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*, 41(5), 861-881.

Zhu, Q. and Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, 22(3), 265-289.

Zhu, Q., Sarkis, J. and Lai, K. (2007a). Initiatives and outcomes of green supply chain management implementation by Chinese manufacturers. *Journal of Environmental Management*, 85(1), 179-189.

Zhu, Q., Sarkis, J. and Lai, K.H. (2007b). Green supply chain management: Pressures, practices and performance within the Chinese automobile industry. *Journal of Cleaner Production*, 15(11-12), 1041-1052.

Zhu, Q., Lowe, E.A., Wei, Y.A. and Barnes, D. (2007c). Industrial symbiosis in China-A case study of the Guitang Group. *Journal of Industrial Ecology*, 11(1), 31-42.

Zhu, Q.H., Joseph, S. and Kee, H.L. (2012a). Examining the effects of green supply chain management practices and their mediations on performance improvements. *International Journal of Production Research*, 50(5), 1377-1394.

Zhu, Y., Wittmann, X. and Peng, M.W. (2012b). Institution-based barriers to innovation in SEMs in China. *Asia Pacific Journal of Management*, 29(4), 1131-1142.

Zhu, Q., Sarkis, L. and Lai, K.H. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management*, 19(2), 106-117.

Zhu, Q.H. and Lai, K-H. (2019). Enhancing supply chain operations with extended corporate social responsibility practices by multinational enterprises: Social capital perspective from Chinese suppliers. *International Journal of Production Economics*, 213, 1-12.

Zhuang, G., Xi, Y. and Tsang, A.S.L. (2010). Power, conflict, and cooperation: The impact of guanxi in Chinese marketing channels. *Industrial Marketing Management*, 39(1), 137-149.

Ziegler, A. and Nogareda, J.S. (2009). Environmental management systems and technological environmental innovations: Exploring the causal relationship. *Research Policy*, 38(5), 885-893.

Appendices

Appendix 2.A: SEM analysis results

Note: ⁺ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

Appendix 3.A: List of measurement items

Green supplier integration ($\alpha=0.961$, AVE=0.805)

GSI1: Achieving environmental goals collectively

GSI2: Developing a mutual understanding of responsibilities regarding environmental performance

GSI3: Working together to reduce environmental impact of our activities

GSI4: Conducting joint planning to anticipate and resolve environmental-related problems

GSI5: Making joint decisions about ways to reduce the environmental impact of our products/services

GSI6: Accumulating and sharing environmental knowledge

Relational capital accumulation ($\alpha=0.911$, AVE=0.734)

RCA1: Our major supplier and our firm trust each other

RCA2: Our firm has a family-like relationship with our major customer

RCA3: Our major supplier and our firm respect each other

RCA4: Our major supplier considers us as a long-term partner

Structural capital accumulation ($\alpha=0.914$, AVE=0.743)

SCA1: Our major supplier and our firm share relevant and timely information

SCA2: Our major supplier and our firm interact in a frequent and intensive manner

SCA3: Our major supplier and our firm solve problems jointly

SCA4: Our major supplier and our firm share and transfer knowledge and know how each other

Cognitive capital accumulation ($\alpha=0.937$, AVE=0.787)

CCA1: Our major supplier and our firm share similar corporate culture/values and management style

CCA2: Our major supplier and our firm share similar philosophies/approaches to business dealings

CCA3: Our major supplier and our firm share compatible goals and objectives

CCA4: Our major supplier and our firm share the same vision of business in the relationship

Economic performance ($\alpha=0.933$, AVE=0.739)

ECP1: Increase in return on investment

ECP2: Increase in market share

ECP3: Growth in profit

ECP4: Increase in return on sales

ECP5: Growth in sales

Environmental performance ($\alpha=0.947$, AVE=0.785)

ENP1: Reduction of wastes and emissions (such as air-pollutant emission, waste water, and solid wastes)

ENP2: Reduction of the environmental impacts of our products/service

ENP3: Decrease of consumption for hazardous/harmful/toxic materials

ENP4: Decrease of frequency for environmental accidents

ENP5: Reduction of energy and materials consumption

Appendix 4.A: List of scale items

Green supplier integration (Vachon and Klassen, 2008; Wu, 2013)

GSI1: Achieving environmental goals collectively

GSI2: Developing a mutual understanding of responsibilities regarding environmental performance

GSI3: Working together to reduce environmental impact of our activities

GSI4: Conducting joint planning to anticipate and resolve environmental-related problems

GSI5: Making joint decisions about ways to reduce the environmental impact of our products/services

GSI6: Accumulating and sharing environmental knowledge

Incremental environmental innovation (Dai et al., 2015)

IEI1: We often create new patterns of product that are more environmentally friendly

IEI2: We often improve existing products to make them more environmentally friendly

IEI3: We often exploit existing technologies to make products more environmentally friendly

IEI4: We often exploit existing technologies to make processes more environmentally friendly

IEI5: We often improve existing processes to make them more environmentally friendly

Radical environmental innovation (Dai et al., 2015)

REI1: We often create radically new environmentally friendly products

REI2: We often introduce radically new concept innovations to make products more environmentally friendly

REI3: We often introduce radical innovations to make processes more environmentally friendly

REI4: We often develop and introduce radically new environmentally friendly technologies into the industry

REI5: We are often the creator of radically new environmentally friendly techniques and technologies

Environmental performance (Zhu et al., 2013)

ENP1: Reduction of wastes and emissions (such as air emission, waste water, and solid wastes

ENP2: Reduction of environmental impacts of our products/service

ENP3: Decrease of consumption for hazardous/harmful/toxic materials

ENP4: Decrease of frequency for environmental accidents

ENP5: Reduction of energy and materials consumption

Relational norms (Blome et al., 2013)

RN1: This supplier is involved early in our environmental issues solving process

RN2: The relationship with this supplier is characterized by close, personal interaction at multiple levels

RN3: It is common to establish joint teams with this supplier to analyze and discuss environmental issues

RN4: We regularly hold joint workshops with this supplier

RN5: This supplier is located close by or staff is continually present at our premises

Contract control (Li et al., 2010b; Liu et al., 2009)

CC1: Our relationship with this supplier is governed primarily by written contracts

CC2: We have formal agreements that detail the obligations and rights of our firm and this supplier

CC3: The contract precisely defines the role/responsibilities of our firm and this supplier

Appendix B.1: The planning and construction of five EIPs

Main descriptive questions	Suzhou Industrial Park	Wuxi National Hi-Tech District
Were the social conditions evaluated? (Human resources supply, housing,)	The establishment of SIP demonstrates a strategy, linking local famous universities at home and abroad, technical schools to the needs of the park. Communication with local community or housing areas are included. It forms its own separate operating systems for education, health care, sports amongst others. At the same time, its emergency and security measures are relatively complete and systematic.	WND has formed as a mature education system. The park provides many schools that can meet the education needs of both foreign investors and employees' children. The talent pool is pyramid-shaped and contains human resources with various skills at different levels. The emergency measures are systematic. However, other aspects, such as housing and infrastructures, need to be improved.
Were the economic-industrial conditions evaluated?	In accordance with the principle of 'planning before construction' and 'underground before ground', SIP has maintained a high level and standard of urban planning and construction. Take the green as the vein, and take the water as the soul of the park. The well-designed rainwater collection and drainage system makes the park a city free from waterlogging. In addition, the park strictly monitors the discharge of various pollutants and attaches great importance to biodiversity.	In order to be able to establish and operate the park, XWD meets basic legal requirements in most environmental aspects, such as pollutant discharge, protection measures and waste management.
Were the environmental conditions evaluated? (Water supply, waste management, etc.)	Supply chain is evaluated in the plan and the cost-benefits of all stakeholders are considered.	XWD considers the geographical location when choosing a location, which helps save a lot of logistics costs. The cost-benefits are considered.

Main descriptive questions	Nanjing Economic and Technological Development Zone	Kunshan Economic and Technological Development Zone
Were the social conditions evaluated? (Human resources supply, housing,)	NET has established a development strategy of scientific and technological innovation, introduced a large number of leading talents and innovation teams at home and abroad, and cooperated with the neighboring Xianlin University. Communication with local community is also included, which basically meets the needs in infrastructure. There are systematic emergency measures and employee training systems.	KETD has formed a comprehensive park with a modern atmosphere, and its construction reflects the development strategy. At present, the park has established links with a number of universities and technical schools as needed. Moreover, through communication with the local community, the park has established relatively complete infrastructure, housing systems, security and emergency measures.
Were the economic-industrial conditions evaluated?	NET adheres to the development concept of 'innovation-driven, endogenous growth, and green development'. Therefore, in some environmental aspects, the park implements further measures than required by legal requirements, such as water resources integration and rain and sewage diversion projects to promote the efficient use of water resources. However, the results obtained are at an average level.	KETD has abundant water resources and two sewage treatment plants established in the park. The water management system complies with legal requirements and the water supply is in compliance with national drinking water standards. In terms of waste management, there are specialized systems, processes and equipment to handle physical objects.
Were the environmental conditions evaluated? (Water supply, waste management, etc.)	The site selection of NET mainly considers the development of local industry, adheres to the principle of 'developing high-tech and realizing industrialization', and vigorously develops the high-tech industry with independent intellectual property rights. Lacks consideration of social costs.	The site selection of KETD considers the geographical location and environmental factors, and establishes a perfect supporting service institution, so as to build a good investment environment. Social costs are not considered sufficiently.

Main descriptive questions	Yangzhou Economic Development Zone
Were the social conditions evaluated? (Human resources supply, housing,)	The establishment of YEDZ relies on the advantages of the university, such as Yangzhou University, Xi'an Jiaotong University science and technology park and Jianghai University, which are rich in human resources and have strong technical support. Employee training, security and emergency measures also performed well. However, in terms of infrastructure construction and housing, the park has not fully met the requirements of local community.
Were the economic-industrial conditions evaluated?	YEDZ meets legal requirements in most environmental aspects, such as pollutant discharge, water resource management and protection, and waste management. Simultaneously, the park requires all companies to carry out wastewater station upgrade projects. In addition, the park strives to realize a circular economy industrial chain to promote the coordinated development of economic and ecological benefits.
Were the environmental conditions evaluated? (Water supply, waste management, etc.)	The site selection of YEDZ considers the unique location, that is, there are many suppliers of equipment manufacturing industry. The ecological environment is well, but there is a lack of consideration of social costs.

Supplementary

List of Figures

Figure 1.1: Analytical framework for the evaluation of sustainable parks.....	7
Figure 1.2: Structures of the doctoral thesis.....	8
Figure 2.1: Conceptual model.....	20
Figure 2.2: Simple slopes for the interaction effect of instrumental commitment and supplier trust on green supplier integration.....	42
Figure 2.3: Simple slopes for the interaction effect of instrumental commitment and supplier dependence on green supplier integration.....	43
Figure 3.1: Conceptual model.....	56
Figure 4.1: Conceptual model.....	92
Figure 4.2: Simple slopes for the interaction effect of green supplier integration and balanced ambidexterity on incremental environmental innovation.....	116
Figure 4.3: Simple slopes for the interaction effect of green supplier integration and combined ambidexterity on radical environmental innovation.....	116
Figure B.1: The Map of China.....	129
Figure B.2: The Map of Jiangsu Provence.....	132
Figure 5.1: Geographical map of SIP.....	148
Figure 5.2: Functional partition of SIP.....	149
Figure 5.3: Development stage of SIP.....	149
Figure 5.4: The specific visualization of SIP sustainability.....	162
Figure 5.5: Basic situation of space layout.....	163
Figure 6.1: Geographical map of WND.....	168
Figure 6.2: Functional partition of WND.....	169
Figure 6.3: Development stage of WND.....	170
Figure 6.4: The specific visualization of WND sustainability.....	183
Figure 7.1: Geographical map of NET.....	190
Figure 7.2: Major sections of NET.....	191
Figure 7.3: Development stage of NET.....	192

Figure 7.4: The specific visualization of NET sustainability.....	205
Figure 8.1: Geographical map of KETD.....	212
Figure 8.2: Functional partition of KETD.....	213
Figure 8.3: Development stage of KETD.....	214
Figure 8.4: The specific visualization of KETD sustainability.....	228
Figure 9.1: Geographical map of YEDZ.....	236
Figure 9.2: Functional partition of YEDZ.....	237
Figure 9.3: Development stage of YEDZ.....	238
Figure 9.4: The specific visualization of YEDZ sustainability.....	252
Figure 10.1: Comparison of social aspects.....	267
Figure 10.2: Comparison of environmental aspects.....	269
Figure 10.3: Comparison of economic aspects.....	271
Figure 10.4: The general overall picture of five EIP cases.....	273

List of Tables

Table 2.1: Main classification of power.....	23
Table 2.2: Sample characteristics.....	32
Table 2.3: Results of validity and reliability analysis.....	35
Table 2.4: Mean, standard deviations, and correlations.....	38
Table 2.5: Results of regression analysis.....	40
Table 2.6: Bootstrapped mediation results.....	44
Table 3.1: Profile of the sample.....	68
Table 3.2; Results of confirmatory factor analysis.....	73
Table 3.3: Mean, standard deviations, and correlations.....	74
Table 3.4: Results of regression analysis.....	78
Table 3.5: Bootstrapped mediation results.....	80
Table 4.1: A summary of research hypotheses.....	101
Table 4.2: Sample characteristics.....	103
Table 4.3 The diversity of Chinese manufacturing firms.....	104
Table 4.4: Results of confirmatory factor analysis.....	109
Table 4.5: Mean, standard deviations, and correlations.....	110
Table 4.6: Results of regression analysis.....	113
Table B.1: List of Chinese provinces by Nominal GDP 2010-2018.....	131
Table B.2: Basic description of the park.....	133
Table B.3: The governance assessment tool matrix with its main evaluative question.....	136
Table B.4: The sustainable strategic evaluation framework.....	141
Table 5.1: The governance context of SIP.....	157
Table 6.1: The governance context of WND.....	177
Table 7.1: The governance context of NET.....	199
Table 8.1: The governance context of KETD.....	222
Table 9.1: The governance context of YEDZ.....	246
Table 10.1: Comparison of levels and scales.....	259
Table 10.2: Comparison of actors and networks.....	261

Table 10.3: Comparison of problems perspective and goal ambitions.....	262
Table 10.4: Comparison of strategies and instruments.....	264
Table 10.5: Comparison of responsibilities and resources.....	265
Table 10.6: Compare the governance context and sustainability of each EIP.	273
Table 10.7: The influence of governance context on social aspects.....	277
Table 10.8: The influence of governance context on environmental aspects..	279
Table 10.9: The influence of governance context on economic aspects.....	282

Summary

Sustainable development has become the long-term strategic goal for China. Although China's economy has achieved rapid growth until now, if it is to continue to ensure stable economic growth, while also improving the ecological environment and people's quality of life, it will need a new approach. What development model could realize this harmonious symbiosis between the economic, environment and social dimensions? To achieve this, China will need to attach importance to the transformation and upgrading of industries to promote sustainable development. While this clearly needs measures that go beyond that which individual companies can do alone, it will require special attention to be paid regarding the green supply chain management of manufacturing and the construction or development of eco-industrial parks.

To improve green supply chain management means that the suppliers who are the source of the supply chain that sustain the companies need to incorporate green practices to fundamentally address the environmental problems of companies. This thesis focuses on the importance of the role of green supplier integration. At the same time, the transformation of the traditional industrial park into the eco-industrial park is also considered a strategic way to promote industrial agglomerations to achieve sustainable development targets.

The overarching goal of this doctoral thesis is to shed light on enhancing the sustainability of Chinese production through green supplier integration and eco-industrial parks. Multiple methods were applied in this research, including several conceptual models to explore the antecedents of green supplier integration and its impact on company performance, as well as case studies to compare and summarize the sustainable development of China's eco-industrial parks.

The following provides and overviews of the content of the chapters. Chapter 1 provides the background, research goal and questions, and research approach of

the doctoral thesis. The research background illustrates the current development situation and challenges of China, and why the strategic goal of sustainable development has become the focus of attention. The implementation of green supplier integration and the construction of eco-industrial parks play an important role in China achieving sustainable development. The research goal and questions combine the use of qualitative and quantitative research to explore how green supplier integration and eco-industrial parks can achieve sustainable development by improving green practices. The research focuses on empirical research and case studies. The empirical research approach in the part studying green supplier integration adopts different model frameworks for each research questions and conducts questionnaire surveying with relevant companies to obtain their important feedback. In the part researching the eco-industrial parks part, a case study approach is used to study aspects of the governance context and sustainability performance, as well as used interviews and questionnaires worked up with relevant stakeholders of eco-industrial parks in Jiangsu Province to assess the level of sustainable development reached in each park.

Chapter 2 emphasizes the direct or indirect role played by the antecedent factors influencing green supplier integration, namely power (i.e., coercive and non-coercive powers), relationship commitment (i.e., normative and instrumental commitments), and relationship closeness (i.e., supplier trust and dependence). Through the conceptual model and the analysis of the data, the conclusions are as follows:

- First, coercive power weakens normative commitment, whereas non-coercive power improves both normative and instrumental commitments. Subsequently, both normative and instrumental commitments enhance green supplier integration.
- Second, normative commitment mediates the influences between two types of power and green supplier integration, while instrumental commitment

only mediates the influence between non-coercive power and green supplier integration.

- Finally, supplier trust and dependence only negatively moderate the connection between instrumental commitment and green supplier integration.

These findings suggest that in order to achieve green supplier integration, firms need to properly implement power and establish relationship closeness with suppliers, and encourage the realization of relationship commitment.

Chapter 3 illustrates the impact of green supplier integration on firm performance (i.e., economic and environmental performances) in the face of serious environmental problems in China. The main conclusions are:

- Green supplier integration promotes social capital accumulation (i.e., relational, structural and cognitive capital accumulations).
- Relational and structural capital accumulations enhance economic and environmental performances, while cognitive capital accumulation only enhances environmental performance.
- Relational and structural capital accumulations mediate the links between green supplier integration and the two types of firm performance, whilst cognitive capital accumulation only mediates the link between green supplier integration and environmental performance.

These conclusions clarify that green supplier integration can enable the achievement of the economic and environmental performances through social capital accumulation, which, in itself, is conducive to the sustainable development of firms.

Chapter 4 explores how green supplier integration improves a firm's environmental performance from the perspective of ambidextrous governance. The research results showed that green supplier integration does promote environmental innovation (i.e., incremental and radical environmental

innovation) and, subsequently, improves environmental performance. Both incremental and radical environmental innovation partially mediate the link between green supplier integration and environmental performance. Finally, balanced ambidexterity strengthens the link between green supplier integration and incremental environmental innovation, whereas combined ambidexterity weakens the link between green supplier integration and radical environmental innovation. These findings reveal that environmental innovation is the bond between green supplier integration and environmental performance. At the same time, in order to better realize the environmental innovation of green supplier integration, firms also need to use appropriate relationship governance carefully.

Chapters 5, 6, 7, 8 and 9 focus on case studies of five eco-industrial parks in Jiangsu Province. These chapters start by introducing the basic geographical and environmental information for each park, as well as their historical context. Then, under the framework of the Sustainable Strategic Evaluation Framework (SSEF), the governance context and sustainability (i.e., social, environmental and economic) aspects of the five park cases were investigated and described in detail. The results enable explanations of the influence of governance context on sustainability and, thus, to evaluate the level of sustainable development achieved in each of those parks.

Chapter 10 covers two aspects. First, it compares the results of the five eco-industrial park cases in relation to their governance context and sustainability performance. This highlights the main similarities and differences between them. This shows that Suzhou Industrial Park (SIP) performed best in both its governance context and sustainability. Second, this chapter summarizes the state of sustainable development state seen across the eco-industrial parks overall and, by a detailed comparison, identifies the relationships between governance quality and sustainable development performance. The results suggest that, except for the ‘outlier’ Nanjing Economic and Technological Development Zone (NET), the overall

performance of the governance context is related to the sustainability performance of the park. It was concluded that governance quality may contribute to the achievement of sustainable development of the eco-industrial parks studied here. The detailed comparison was mainly carried out by summarizing the results of all the park cases to analyze which sustainability aspect had been influenced by the specific governance items. The general and major influences between the two were drawn, as well as the special performance in the Chinese context.

Chapter 11 answers all the research questions and summarizes the conclusions of the PhD dissertation. It elaborates on the practical implications of green supplier integration and eco-industrial parks, as well as offers some suggestions for companies and actors in the related parks. This chapter concludes by explaining the limitations of this research and provides future research directions.

Samenvatting

Duurzame ontwikkeling is het strategische doel van China voor de lange termijn geworden. Hoewel de Chinese economie recent een snelle groei heeft doorgemaakt, is het de moeite waard om te onderzoeken hoe het land een stabiele economische groei kan blijven garanderen, rekening houdend met zowel de verbetering van het ecologische milieu als de kwaliteit van het leven van de Chinese bevolking. Wat voor soort ontwikkelingsmodel kan de harmonieuze symbiose tussen de economische, ecologische en sociale dimensies realiseren? In dit verband is het noodzakelijk dat China belang hecht aan de transformatie en opwaardering van industrieën om hun duurzame ontwikkeling te bevorderen. Omdat dit maatregelen vereist die verder gaan dan wat individuele bedrijven kunnen doen, vereist dit speciale aandacht voor het groene beheer van de productie- of toeleveringsketen en de aanleg of verdere ontwikkeling van eco-industriële parken. Wat het groene beheer van de toeleveringsketen betreft, aangezien leveranciers de bron van de toeleveringsketen zijn, moeten bedrijven hun leveranciers aanzetten tot groene praktijken om de milieuproblemen van bedrijven fundamenteel aan te pakken. Daarom richt deze dissertatie zich op de belangrijke rol van de integratie van groene leveranciers. Tegelijkertijd wordt de transformatie van traditionele industrieparken in eco-industrieel parken ook beschouwd als een strategische manier om industriële agglomeraties te bevorderen om de doelstellingen voor duurzame ontwikkeling te bereiken.

Het overkoepelende doel van dit proefschrift is om de uitdagingen in het ontwikkelingsproces aan te pakken door de twee hierboven vermelde onderzoeksthema's te verkennen, om zo licht te werpen op manieren waarop China de productiepraktijken kan verbeteren om duurzame ontwikkeling te bereiken door middel van de integratie van groene leveranciers en eco-industriële parken. Om dit doel te bereiken zijn in deze dissertatie meerdere methoden toegepast, waaronder het opstellen van verschillende conceptuele modellen om de integratie van groene leveranciers te verklaren en

de impact daarvan op de bedrijfsprestaties te onderzoeken, evenals het analyseren en vergelijken van de duurzame ontwikkeling van China's eco-industriële parken door middel van casestudies. Een overzicht van de inhoud van de hoofdstukken van deze thesis wordt hieronder gegeven.

Hoofdstuk 1 geeft de achtergrond, het onderzoeksdoel en de vragen, en de onderzoeksaanpak van het proefschrift. De tekst over de achtergrond van het onderzoek illustreert de huidige ontwikkelingssituatie en uitdagingen van China. Daarom is het strategische doel van duurzame ontwikkeling in het middelpunt van de belangstelling komen te staan. Om duurzame ontwikkeling te bereiken, spelen de implementatie van groene leveranciersintegratie en de bouw van eco-industriële parken een belangrijke rol. De onderzoeksdoelstelling en -vragen zijn vooral het combineren van kwalitatief en kwantitatief onderzoek om te onderzoeken hoe groene leveranciersintegratie en eco-industriële parken duurzame ontwikkeling kunnen bereiken door het verbeteren van groene praktijken. De onderzoeksaanpak richt zich vooral op empirisch onderzoek en casestudies. Voor het deel over de integratie van groene leveranciers wordt een empirische onderzoeksaanpak gebruikt waarbij verschillende modelkaders op worden gesteld en vragenlijsten voor relevante bedrijven worden gebruikt om antwoorden op de onderzoeksvragen te krijgen. In het onderdeel eco-industriële parken is een casestudy-aanpak gekozen om aspecten van de governance-context en van de duurzaamheidsprestaties te bestuderen. Voor dit doel zijn vragenlijsten aan relevante belanghebbenden van eco-industriële parken in de provincie Jiangsu gebruikt om het niveau van duurzame ontwikkeling van die industrieparken te beoordelen.

Hoofdstuk 2 benadrukt de directe of indirecte rol die de antecedenten van groene leveranciersintegratie spelen, namelijk macht (d.w.z. dwingende en niet-dwingende bevoegdheden), relatieverbintenis (d.w.z. normatieve en instrumentele verbintenissen), en relatiebetrokkenheid (d.w.z. vertrouwen in en afhankelijkheid van leveranciers). Uit het conceptuele model en de analyse van de gegevens kunnen de volgende conclusies worden getrokken. Ten eerste

verzwakt het gebruik van dwingende macht de normatieve verbintenis, terwijl de niet-dwangmacht zowel de normatieve als de instrumentele verbintenis verbetert. Vervolgens verbeteren zowel normatieve als instrumentele verplichtingen de groene integratie van leveranciers. Ten tweede bemiddelt de normatieve verbintenis de invloed tussen de twee soorten macht en de integratie van groene leveranciers, terwijl de instrumentele verbintenis alleen de invloed tussen niet-dwingende macht en de integratie van groene leveranciers bemiddelt. Ten slotte wordt het verband tussen instrumentele inzet en groene leveranciersintegratie slechts negatief modereert door het vertrouwen en de afhankelijkheid van de leverancier. Deze bevindingen suggereren dat om tot een groene leveranciersintegratie te komen, bedrijven op de juiste manier macht moeten implementeren en relatiebetrokkenheid met leveranciers moeten aangaan, en het realiseren van een relatieveverbintenis moeten stimuleren.

Hoofdstuk 3 illustreert het effect van groene leveranciersintegratie op de bedrijfsprestaties (d.w.z. de economische en milieuprestaties) in het licht van de ernstige milieuproblemen in China. De belangrijkste conclusies zijn:

- Groene leveranciersintegratie bevordert de accumulatie van sociaal kapitaal (d.w.z. relationele, structurele en cognitieve kapitaalaccumulatie).
- Relationele en structurele kapitaalaccumulaties verbeteren de economische en milieuprestaties, terwijl cognitieve kapitaalaccumulatie alleen de milieuprestaties verbetert.

Deze conclusies verduidelijken dat de integratie van groene leveranciers de verwezenlijking van de economische en milieuprestaties mogelijk kan maken door middel van de accumulatie van sociaal kapitaal, wat op zich al bevorderlijk is voor de duurzame ontwikkeling van bedrijven.

In hoofdstuk 4 wordt onderzocht hoe de integratie van groene leveranciers de milieuprestaties van het bedrijf kan verbeteren vanuit het perspectief van een ambidexteriteit in governance. De onderzoeksresultaten toonden aan dat groene leveranciersintegratie milieu-innovatie bevordert (d.w.z. incrementele en

radicale milieu-innovaties), en vervolgens de milieuprestaties verbetert. Bovendien bemiddelen zowel incrementele als radicale milieu-innovaties gedeeltelijk het verband tussen groene leveranciersintegratie en milieuprestaties. Ten slotte versterkt een evenwichtige ambidexteriteit de link tussen groene leveranciersintegratie en incrementele milieu-innovatie, en verzwakt een gecombineerde ambidexteriteit de link tussen groene leveranciersintegratie en radicale milieu-innovatie. Uit dit onderzoek blijkt dat milieu-innovatie de band is tussen de integratie van groene leveranciers en milieuprestaties. Tegelijkertijd moeten bedrijven, om de milieu-innovatie van de integratie van groene leveranciers beter te kunnen realiseren, ook zorgvuldig gebruik maken van passend relatiebeheer.

Hoofdstuk 5, 6, 7, 8 en 9 richten zich op casestudies van vijf eco-industriële parken in de provincie Jiangsu. Deze hoofdstukken beginnen met de introductie van geografische en ecologische basisinformatie van elk park, evenals het historische proces. Vervolgens zijn in het kader van het Sustainable Strategic Evaluation Framework (SSEF) de vijf casestudy's van de parken onderzocht en in detail beschreven vanuit de aspecten van de governance context en van duurzaamheid (d.w.z. sociaal, milieu en economisch). Op basis van bovenstaande resultaten werd de invloed van de governancecontext op de duurzaamheidsprestaties geanalyseerd, zodat de duurzame ontwikkeling van deze parken kan worden beoordeeld.

Hoofdstuk 10 behandelt twee aspecten, enerzijds de vergelijking van de resultaten van de vijf eco-industriële parken wat betreft hun governance context en duurzaamheidsprestaties. De vergelijking heeft tot doel de belangrijkste overeenkomsten en verschillen tussen de vijf parken aan het licht te brengen, waaruit bijvoorbeeld blijkt dat Suzhou Industrial Park (SIP) het best presteert in zowel de governance-context als de duurzaamheid. Aan de andere kant geeft dit hoofdstuk een samenvatting van de relatie tussen governance en duurzame ontwikkeling van eco-industriële parken op grond van een algemene en een meer gedetailleerde vergelijking. Dat wil zeggen, het identificeren van relaties

tussen de kwaliteit van de governance context en de prestaties op het gebied van duurzame ontwikkeling. De resultaten van de algemene vergelijking van de parkgevallen suggereerden dat, met uitzondering van de ‘uitschieter’ Nanjing Economische en Technologische Ontwikkelingszone (NET), de kwaliteit van de governance context nauw is gerelateerd aan de duurzaamheidsprestaties van het park. Met andere woorden, er werd geconcludeerd dat de kwaliteit van de governance kan bijdragen aan de verwezenlijking van een duurzame ontwikkeling van de bestudeerde eco-industriële parken. De gedetailleerde vergelijking wordt voornamelijk uitgevoerd door de resultaten van alle park cases te analyseren om te bezien welke dimensie van de duurzaamheidsaspecten is beïnvloed door specifieke governance-items.

Hoofdstuk 11 geeft antwoord op alle onderzoeksvragen en vat de conclusies van het proefschrift samen. Op basis hiervan werden een aantal praktische implicaties voor respectievelijk de integratie van groene leveranciers en eco-industriële parken uitgewerkt, en werden enkele suggesties gedaan voor bedrijven en andere actoren. Aan het eind van dit hoofdstuk worden de beperkingen van het onderzoek toegelicht en worden toekomstige onderzoeksrichtingen aangegeven.

About the author

Qiansong Zhang was born on January 21st, 1991 in Xi'an City, P.R. of China. It is the capital of Shaanxi Province and is located in western China. Simultaneously, it is also an important scientific research, education and industrial base, and also has a rich history and culture. After completing her elementary and secondary education, she was admitted as a student by the Xi'an Jiaotong University Affiliated Middle School after the high school entrance examination in 2006.

In September 2009, she started her study at the Department of Economics and Management, Xi'an Jiaotong University City College. Before obtaining her Bachelor degree in July 2013, she was accepted to continue her study for a Master degree from the Department of Economics and Management of Guizhou Normal University. From 2013 to 2016, she won the first-class scholarship many times. Under the supervision of Professor Lv Ping (Dean of the department), she obtained her Master degree in July 2016.

In September 2016, she became a PhD candidate at the Department of Management, Northwestern Polytechnical University, Xi'an, Shaanxi, under the supervision of Professor Jieyi Pan. Moreover, Professor Feng Taiwen, School of Economics and Management, Harbin Institute of Technology (Weihai), also served as her co-supervisor to guide her research in China.

Starting from October 2018, as a joint PhD student, she visited the Department of Governance and Technology for Sustainability (CSTM), University of Twente, the Netherlands to perform the research focusing on the governance context and sustainability of industrial parks, under the supervision of Professor Michiel Heldeweg and Professor Hans Bressers, and co-supervision by Dr. Laura Franco-García. This research has been sponsored by the China Scholarship Council. The main results obtained from the research that was developed since May 2018 have been collected in this book.