An investigation of the adoption of green supply chain management practices in manufacturing sector in Asian emerging economies: Guanxi, antecedents and performance

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Abstract

In recent decades, rapid industrial modernization and economic growth have resulted in substantial environmental problems such as air, waste and water pollution in Asian emerging economies (AEE). Green supply chain management (GSCM) has attracted increasing attention from scholars and practitioners as a strategy to reduce negative environmental impacts while achieving economic, operational, social and environmental benefits. As the results of empirical studies on the impact of GSCM practices on firm performance are not conclusive, there is a clear academic need for research to identify whether GSCM practices lead to desirable firm performance, and if so, what the subsequent outcomes are. Therefore, this study first aimed to identify the effect of the adoption of GSCM practices on firm performance. In doing so, a meta-analysis was conducted of 130 effects from 25,680 effect sizes from 50 empirical articles that surveyed 11,127 manufacturing companies. The meta-analysis results indicated that the adoption of GSCM practices led to better performance in four aspects: economic, environmental, operational, and social. Then, this study developed a conceptual framework based on a systematic literature review of 42 papers published between 2005 and 2016. In this framework, the author specifically examined the moderating effect of Guanxi on the relationships between drivers/barriers and the adoption of GSCM practices. In doing so, this study opens a new avenue of research by proposing the roles of Guanxi on the adoption of GSCM practices while accounting for various drivers and barriers.

Academic knowledge regarding the adoption of GSCM practices is scarce. Some anecdotal evidence suggested that the adoption of GSCM in this region is partly influenced by Guanxi, a cultural norm which plays a significant role in relationship governance within supply chain activities in the AEE. However, studies on the effects of Guanxi in GSCM are in their infancy, and they simply note Guanxi's importance without detailing how it might influence, positively or otherwise, the adoption of GSCM practices. In addition, the initial academic evidence on

supply chain barriers and stakeholders' drivers inspired this study to take them into account regarding the antecedents for the adoption of GSCM practices within the scope of manufacturing supply chains in the AEE. By drawing on the stakeholder theory and social exchange theory, this study also aimed to investigate the effect of antecedents including stakeholders' drivers and supply chain barriers on the adoption of GSCM practices as well as the moderating role of Guanxi on the given effects. For doing so, this study used data from 418 manufacturing companies from four major industrial parks in China. There are two reasons for conducting this survey in the manufacturing sector in China. Firstly, China is currently the world's largest and fastest-growing emerging economy and a global production base, exporting a wide variety of merchandise and accounting for 40% of the worldwide manufacturing outputs of different products. Secondly, environmental management has been observed to be a critical factor affecting the prosperity of Chinese manufacturing enterprises. SPSS 20.0 and AMOS 20.0 software were used to analyse the data by using two suitable and effective statistical techniques, namely, covariance-based structural equation modelling (CB-SEM) and hierarchical moderated regression. The findings showed that Guanxi is a significant moderator in reducing the negative impact of high perceived costs and complexity of regulations on the adoption of GSCM practices. Furthermore, the results also indicated that Guanxi reduces the positive relationship between suppliers' advice and communities' pressures on the adoption of GSCM practices. In addition, this study extended the body of knowledge on the adoption of green supply chain practices by manufacturing companies in the AEE through the lens of stakeholder theory and social exchange theory.

This study contributes to current literature at different levels. First, the meta-analysis conducted in this study has important implications for the research community on sustainability and GSCM in emerging economies. The meta-analysis results indicate that GSCM practices led to better performance in four aspects: economic, environmental, operational, and social.

Specifically, the GSCM practice–performance relationship was the strongest for economic performance, followed by operational and environmental performance. Second, in light of the rapidly increasing body of literature on adopting GSCM practices but the scarce literature on Guanxi, this study proposed and empirically tested the effects of Guanxi in enhancing positive drivers and reducing the negative effects of barriers to the adoption of GSCM practices. In this way, this study provided empirical evidence that building Guanxi is essential to ensuring better chances of implementing GSCM practices.

In terms of further research, first, based on the meta-analysis conducted in this study, the limited empirical evidences on the relationship between GSCM and social performance indicated that more studies are needed in this domain. Second, given the complexity of this theoretical framework, this study only considered Guanxi as a dyadic between a focal company and its suppliers. Future studies may consider evaluating a focal firm's comparative Guanxi by measuring the degree of centrality using its network position index. This concept is drawn from the social network theory in which the degree of centrality denotes the level of being at the core of a network by comparing the distance of the position of an individual's linkage to others in the network at the firm level. Finally, given the similarities among emerging economies, further studies can apply these results in less-explored regions in the AEE such as Korea, Malaysia, and Thailand and emerging economies outside Asia, such as Brazil and Turkey.

Keywords: Green supply chain management; Green supplier integration; Green customer cooperation; Guanxi; Drivers; Barriers; Firm performance; Asian emerging economies; Chinese manufacturing sector; Systematic literature review; Meta-analysis; Stakeholder theory; Social exchange theory

Dedication

To my parents,

Geng Jian and Wang Lingmin

I dedicate this thesis.

Acknowledgment

First and foremost, I would like to express my gratitude to my supervisor **Professor Afshin Mansouri** for guiding me through all these years. In my PhD study, Professor Mansouri is the salt of the earth and light of the world. Professor Mansouri is a person that you will instantly love and never forget once you meet him. He is the best supervisor and one of the smartest people as I know. He helped me revise with the thesis topic and guided me over almost a year of development.

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My four years' time at Brunel was enjoyable in a large part due to the many friends and groups and that became a part of my life. I am grateful for time spent with colleagues and friends.

Declaration

I hereby declare that the materials contained in this thesis have not been previously submitted for a degree in this or any other university. I further declare that this thesis is solely based on my own research.

I also declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct.

Geng Ruoqi

Publications associated with this thesis

Journal Papers

- Geng, R., Mansouri, SA. and Aktas, E. (2017) 'The relationship between green supply chain management and performance: A meta-analysis of empirical evidences in Asian emerging economies'. *International Journal of Production Economics*. 183 (Part A), 245-258. doi: 10.1016/j.ijpe.2016.10.008 Download publication
- Geng, R., Mansouri, SA. Aktas, E. and Yen, DA. (2017) The role of Guanxi in green supply chain management in Asia's emerging economies: A conceptual framework. *Industrial Marketing Management.* doi:*10.1016/j.indmarman.2017.01.002*
- Geng, R., Mansouri, SA. Aktas, E. and Yen, DA. An empirical study of green supplier integration in the Chinese manufacturing sector: a double-edged sword effect of Guanxi, *Journal of Operations Management* (in preparation)

Conferences proceeding:

- Geng, R., Mansouri, SA. Aktas, E. and Yen, DA. (forthcoming) "An empirical study of green supplier integration in the Chinese manufacturing sector: a double-edged sword effect of Guanxi", Proceedings of the POMS 28th Annual Conference, Sealtle, Washington, USA.
- Geng, R., Mansouri, S. A. and Aktas, E. (2016) "Greening manufacturing in China: The role of antecedents and Guanxi", Proceedings of the POMS 27th Annual Conference, Orlando, Florida, USA.
- Geng, R., Mansouri, S. A., and Aktas, E. (2015)" Greening Manufacturing Supply Chains in Asia's Emerging Economies: A Meta-Analysis of Empirical Evidence." Proceedings of the POMS 26th Annual Conference, Washington DC, USA.

- Geng, R., Mansouri, S. A., and Aktas, E. (2014) "Greening manufacturing supply chains in Asian's emerging economies: a conceptual framework." Proceedings of the Annual Cambridge International Manufacturing Symposium, Cambridge, UK.

- Geng, R., Mansouri, S. A., and Aktas, E. (2014) "Greening manufacturing supply chain in Asia's emerging economies: A conceptual framework." Proceedings of the LRN Annual conference, Huddersfield, UK.

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Chapter 1: Introduction

1.1 Background of the study

Environmental problems have emerged as significant issues that affect businesses worldwide. The manufacturers of most products consumed in developed countries relocated their manufacturing bases and production facilities to Asian emerging economies (AEE) (Lai and Wong, 2012; Tang and Zhou, 2012). This was primarily because of the low material and labour costs in AEE region (Lai et al., 2013), especially in China, Taiwan, India, Malaysia, Indonesia, Thailand, and South Korea. However, these countries need to improve their supply chains in all aspects (Faber and Frenken, 2009; Lai and Wong, 2012; Woo et al., 2014). One of the main concerns of Western investors is the lack of stable legal and regulatory systems that could be used to monitor and facilitate business operations in the AEE. Instead, firms often rely on Guanxi (translated as 'relationships' or 'connections' in English: Luo, 1997; Seligman, 1999) norms to regulate business dealings (Tseng, Kwan, and Cheung, 1995) by referring to the cultural characteristics of interpersonal relationship ties that exist within a society. Recent

green supply chain management (GSCM) literature has focused largely on drivers of and barriers to the adoption of GSCM practices but ignored the impact of the culturally specific concept of Guanxi in the AEE.

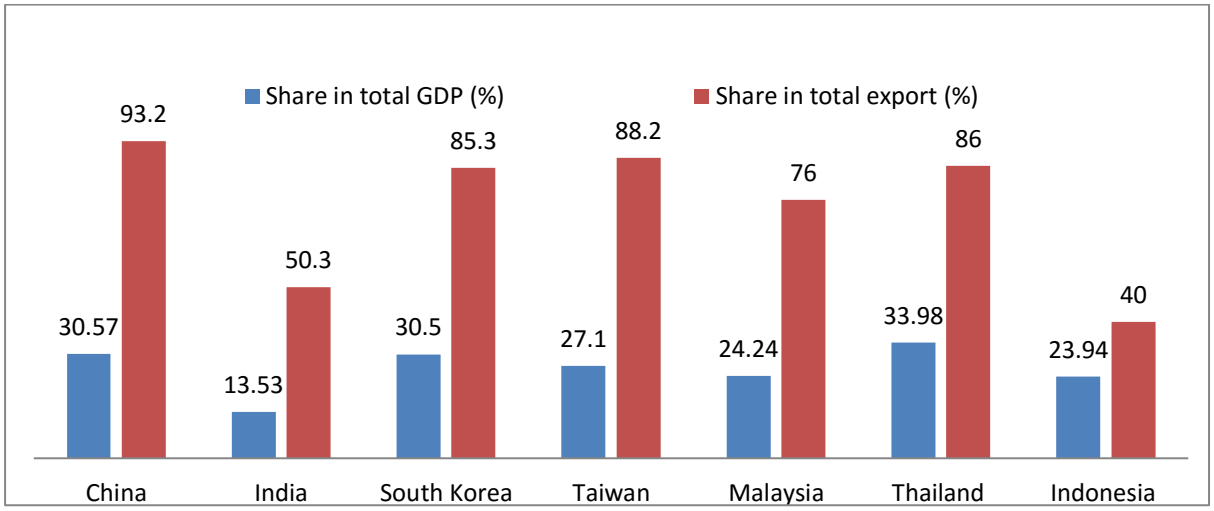

Figure 1-1. Contribution of manufacturing sector to total GDP and exports in the AEE (2012), Source: Bloomberg (2014).

As shown in Fig. 1-1, manufacturers in the AEE serve as the global production base, and they are expected to continue increasingly contributing to their countries' economic growth. As the manufacturing sector in the AEE is projected to continue its rapid growth beyond the next decade, managerial practices should balance economic growth and environmental issues (Zhu et al., 2008b; Lee, 2008). Subsequently, manufacturers in the AEE, including foreign direct investments and local manufacturers in upper tiers of the supply chain, are beginning to realize the urgency of implementing green strategies and environmental practices with their customers and suppliers to reduce the environmental impacts of their products and services (Zhu and Sarkis, 2004; Zhu and Geng 2013).

To reduce negative environmental effects while improving company performance, many manufacturing businesses in AEE have adopted green supply chain management (GSCM) practices (Lai and Wong, 2012; Zhou et al., 2014). Over the past decade, GSCM has emerged as a significant environmental strategy within the domain of sustainability; it involves activities

that range from green purchasing to product recycling with suppliers and customers (Walker and Jones, 2012). In particular, GSCM refers to comprehensive consideration of the environment within supply chain management (SCM), and it includes product design, selection and sourcing of raw materials, manufacturing process, delivery of final product to customers, and recycling and disposal after the useful life of a product (Zhu and Sarkis, 2004).

In the past few years, researchers and practitioners have shown growing interest in exploring the balance between environmental damage and economic growth by adopting GSCM practices in the AEE. Many researchers have studied GSCM and its relationship with supply chain performance. However, results of empirical studies on the impact of GSCM practices on firm performance are not conclusive. For instance, Zhu and Sarkis (2004) and Zhu et al. (2005) consistently argued that GSCM practices have not contributed to better economic performance in Chinese manufacturing firms. Admittedly, the concept of GSCM practices was in its early stages during those two studies. An early stage of adoption usually requires investment, which will increase companies' operational costs and have an adverse impact on firms' economic benefits. In contrast, recent studies have examined the positive relationship between GSCM practices and economic performance (e.g. Kuei et al., 2013; Lai et al., 2012). For instance, as competition in the manufacturing industry increases among supply chains and decreases among individual firms, Peng and Lin (2008) stated that the adoption of GSCM practices is becoming an important and valuable strategy to reduce costs while satisfying different stakeholders' requirements.

Previous literature indicated that companies in the AEE have started adopting GSCM practices owing to an increase in motivational drivers from related stakeholders, including customers (Zhu et al., 2005a; Lai and Wong, 2012), legislative authorities (Birkin et al., 2009; Liu et al., 2012), and suppliers (Lee, 2008; Yen and Yen, 2012). Stakeholders increasingly demand that companies in China address and manage environmental issues. Moreover, GSCM practices

require intra-organisational collaborations with all interested parties in a highly competitive environment (Walker and Jones, 2012). That is why there is a transition from traditional SCM toward GSCM, with more focus on the environmental impact of supply chain activities. Despite this transition, some barriers hinder the implementation of GSCM practices (Porter and Van der Linde, 1995; González-Torre et al., 2010). During the adoption of GSCM in industries used to traditional SCM, some hurdles such as high adoption costs and lack of relevant knowledge can be anticipated owing to the expected transition. Industries should equip themselves to remove these barriers.

Researchers have also reported that relational governance plays a significant role in achieving a competitive advantage, including the maintenance of healthy relationships between a company and its partners in the supply chain (Wang and Wei, 2007; Cheng, 2011). While relational governance in the West is administered largely by legislation and regulations such as contracts, in China, it is driven by morality and social norms (Arias, 1998) and governed by Guanxi (Yen, Yu, and Barnes, 2007). In AEE, Guanxi has been identified as the most useful approach for managers in maintaining business relationships (Zhou et al., 2006). The reason for this is that the AEE culture is deeply influenced by Confucianism, which highlights the role of appropriate behaviours between the ruler and the subject, father and son, spouse and spouse, elder and younger brothers, and senior and junior friends (Zhao et al., 2008). Therefore, Guanxi is leading the development of social harmony, order, and stability. Guanxi also refers to the cultural characteristic of interpersonal relationship ties that affect firms' business decisions and behaviours (Lee and Humphreys, 2007; Zhao et al., 2011; Zhou et al., 2014).

1.2 Research problem

The topic of GSCM in manufacturing sectors in emerging economies has received increasing attention from industry, academia, regulatory institutions, and customers (Golicic and Smith, 2013; Lai et al., 2013). For instance, Zhu and Sarkis (2004) and Zhu et al. (2005) consistently

argued that GSCM practices have not contributed to better economic performance in Chinese manufacturing firms. Admittedly, the concept of GSCM practices was in its early stages during these two studies. The early stage of adoption usually requires investment, which will increase companies' operational costs and have a negative impact on their economic benefits. In contrast, recent studies have examined the positive relationship between GSCM practices and economic performance (Kuei et al., 2013; Lai et al., 2012). Moreover, there is a clear academic need for research to determine whether GSCM practices lead to desirable firm performance and if so, what the subsequent outcomes are regardless of the relationship between GSCM practices and firm performance (Mitra and Datta, 2014; Lo, 2014). These mixed results on the relationship between GSCM practices and firm performance and the need to gain further insight into the link between generalized GSCM practices and performance is one of the motivations of this study. Such empirical generalization is necessary because GSCM practices have been implemented differently for different firm sizes, industry types, and export orientations. Therefore, one of aim of this study is to provide empirical generalizations regarding the relationship between GSCM practices and firm performance.

Manufacturers understand the importance of responding to pressure from stakeholders to help improve their competitive posture (Sarkis, 2010). However, manufacturers also need to develop specific capabilities to manage supply chain barriers such as complex regulations and the perceived high costs of adopting GSCM practices (Gimenez and Tachizawa, 2012; Krause et al., 2007; Sancha et al., 2014). To examine the relationship between drivers/barriers and the adoption of GSCM practices, the stakeholder theory is considered appropriate for this study as it aims to identify and group the input and output environments of each company (chiefly, suppliers and consumers), its competitive environment (companies that produce similar products or offer similar services), and its regulatory environment (Delmas and Toffel, 2004; DiMaggio and Powell, 1983). Moreover, as typical intra-organizational collaborations,

stakeholder theory, with its broad acceptance, would be more suitable for discussing GSCM issues than intra-organisational management activities. Despite the fact that stakeholder theory is appropriate for discussing the influence of the adoption of GSCM practices, only two papers have explored the specified theoretical stances using this theory (Liu et al., 2012; Guoyou et al., 2013). Therefore, it would be interesting to identify how stakeholder theory shapes the adoption of GSCM practices. Despite initial academic evidence that stakeholders place pressure on the focal firm to implement environmental management practices, the impact of these pressures on the adoption of GSCM practices remains largely unexplored (Zhu et al., 2011 and Hofer et al., 2012). Therefore, this study takes into account the initial academic evidence on supply chain barriers and stakeholders' drivers for the adoption of GSCM practices within the scope of AEE's manufacturing supply chains.

Existing literature often attributed Chinese firms' adoption of GSCM practices to drivers and barriers; however, the impact of relational governance is largely ignored in the discussion of GSCM adoption. Relational governance in the AEE differs from that in many developed Western markets (Rubera and Kirca, 2012; Wang et al., 2016). While relational governance in the West is administered largely by legislation and regulations such as contracts, in China, it is driven by morality and social norms (Tomás Gómez Arias, 1998) and governed by Guanxi (Yen, Yu, and Barnes, 2007). There is a fully developed body of literature about Guanxi, which refers to interpersonal networking in inter-firm business relationships in the Chinese manufacturing sector (Luo et al., 2014). However, there is limited literature that discusses the role of Guanxi in the GSCM context. In fact, studies about the effects of Guanxi in the context of GSCM adoption are at an initial stage, and they merely highlight the importance of Guanxi rather than discussing its role in the adoption of GSCM. To date, only two studies have explored the role of Guanxi in GSCM, with contradictory results (Cheng et al., 2012; Luo et al., 2014). Luo et al. (2014) found that a high level of Guanxi between the focal company and its suppliers

reduces the focal company's willingness to implement GSCM practices. On the contrary, Cheng et al. (2012) indicated that better Guanxi between the focal company and its suppliers results in a positive effect on the adoption of GSCM practices. The reason may be that better Guanxi would increase a buyer's transaction-specific investments while reducing its opportunistic behaviours, thereby accelerating the adoption of GSCM practices (Cheng et al., 2012). Based on critical discussions of previous literature, this study intends to investigate how manufacturing companies can deploy Guanxi with suppliers in a manner that is conducive to materializing drivers and barriers for the adoption of GSCM practices.

1.3 Research questions

To address the research problem discussed above, this study seeks to answer the following questions:

1. Do GSCM practices lead to desirable firm performance in the AEE, and if so, what are the subsequent outcomes?
2. Does any stakeholder driver and supply chain barrier influence the adoption of GSCM practices in manufacturing companies in the AEE?
3. Does Guanxi play any role in the adoption of GSCM by manufacturing companies in the AEE?

Chapter 2 discusses the meta-analysis used to answer the first research question. In Chapter 3, many hypotheses and a conceptual framework are developed to answer the second and third research questions. The empirical examination of the framework is designed in Chapter 4, tested in Chapter 5, and discussed in Chapter 6. Finally, Chapter 7 discusses the conclusions for the various research questions.

1.4 Aim and objectives of the research

The aim of this research is to examine the following:

a. the relationship between the adoption of GSCM practices and firm performance,
b. the impact of stakeholders' drivers and supply chain barriers to the adoption of GSCM practices, and
c. the moderating role of Guanxi on the effects of stakeholders' drivers and supply chain barriers on the adoption of GSCM practices in the AEE.

To achieve the aim of this study, the objectives are set out as below:

1. To conduct a meta-analysis based on the result of the systematic review to guide empirical generalizations regarding the relationship between GSCM practices and firm performance in the AEE.
2. To conduct a systematic review of the relevant literature to identify the indicator of GSCM practices in the AEE, drivers/barriers and Guanxi.
3. To develop a theoretical framework that sheds light on the effects of drivers/barriers on the adoption of GSCM practices and the moderating role of Guanxi on these effects in the AEE.
4. To empirically assess the relationships hypothesised in the theoretical framework for manufacturing companies in the AEE.
5. To offer managerial and theoretical implications for practitioners and researchers.

1.5 Research methodology

To answer the first research question, this study conducted a meta-analysis on the empirical relationship between GSCM practices and their impact on economic, environmental, social, and operational performance. To conduct the analysis, the software 'comprehensive meta-analysis' version 3 was used. The meta-analysis focused on 50 empirical articles published between 1996 and 2015 that surveyed 11,127 manufacturing companies. Subsequently, this

meta-analysis analysed 130 effects from 25,680 effect sizes from reviewed papers in the extant literature on GSCM in the manufacturing sector in the AEE.

To achieve the aim and objectives of the second and third research questions, first, this study adopted a systematic approach to review literature on GSCM in AEE (Tranfield et al., 2003; Denyer and Tranfield, 2009). The author searched five well-known databases that index the majority of academic literature in operations management in two rounds: December 2014 to March 2015 and September to October 2016. These databases include ABI/INFORM, Scopus, Emerald, Business Source Premier, and Science Direct. For a paper to qualify for our literature review, it should focus on (1) the AEE, (2) supply-chain-based activities with management focus, (3) manufacturing sector, and (4) be published in a CABS-listed journal. By using all combinations of search terms in the operations and SCM fields, this search found 359 results from peer-reviewed journals. A total of 270 papers remained after crosschecking and removing duplicate results. We then read the titles, abstracts, and keywords and applied the four inclusion-exclusion criteria to these papers; this further reduced the number of papers to 79. Finally, we read the full text of these 79 papers and examined whether their results and insights were actually relevant to our research question. After this final screening, 42 papers were included in this study.

After the systematic literature review, the theoretical framework with the hypotheses is empirically tested by a questionnaire. This study constructed the questionnaire in two parts to reduce the common method bias by targeting two informants in each firm (Guide and Ketokivi, 2015; Ketokivi and Schroeder, 2004). In this regard, Part I focused on the organizational characteristics, formal institutional forces, and adoption of GSCM practices. Part II of the questionnaire specifically focused on Guanxi and targeted purchasing managers who directly interact with suppliers. With regard to data collection, because very few firms provide their email addresses on their websites, the 'Sanjintong' (http://sanjintong.net/) database was used

to obtain the contact details of supply chain managers and CEOs/presidents of all manufacturing companies in the selected industrial parks. In doing so, this study identified 2143 companies from 11 industrial parks. This study collected data in two rounds: the first round was from November 10, 2015, to December 31, 2015, and the second round was from January 15, 2016, to February 15, 2016. In total, we received 936 responses for Parts I and II, and after combining respondents from the same company, 420 completed samples were used for the data analysis.

Finally, this study conducted a rigorous process to validate the constructs of survey items by performing a series of analyses which were modelled on previous empirical studies (e.g. Zhao et al., 2011; Bai et al., 2016). SPSS 20.0 and AMOS 20.0 software were used to perform a series of analyses by using two suitable and effective statistical techniques, namely, covariance-based structural equation modelling (CB-SEM) and hierarchical moderated regression.

1.7 Contributions of the research

This study contributes to extend the current knowledge on the adoption of GSCM practices. First, the meta-analysis on the relationship of GSCM practices-performance contributes to the research community on sustainability and, in particular, GSCM in emerging economies. This meta-analysis established strong empirical evidence that GSCM practices can affect firm performance regardless of the company size, industry, ISO certification, and export orientation. In fact, this research finding suggested that when manufacturers take the environment into account in their SCM, they not only achieve better performance on sales, profit, and market share but also save energy and reduce waste, pollution, and emissions. Nevertheless, the efficiency of a firm's operations, such as scrap rate, delivery time, inventory levels, and capacity utilization, can be improved. The positive relationships between the adoption of

GSCM practices and environmental, operational, and economic performance have the potential to promote the adoption of GSCM as a strategy to improve the firm performance.

Second, owing to the rapidly increasing attention on the adoption of GSCM practices and limited literature on Guanxi, we proposed and empirically tested the moderating role of Guanxi on the effect of the relationship between stakeholders' drivers/chain barriers and the adoption of GSCM practices. Our study primarily extended the body of knowledge on the adoption of green supply chain practices by manufacturing companies in China through the lens of the stakeholder theory and social exchange theory. We proposed and empirically tested the role of Guanxi in moderating the impact of stakeholders' drivers and chain barriers on the adoption of GSI practices. Our findings posit that Guanxi plays an important role in the adoption of GSCM practices. In particular, our study expands the rather limited literature at the intersection between Guanxi and GSCM. In this way, our study provided empirical evidence that building Guanxi is essential to ensuring better chances of implementing GSI practices.

1.8 Structure of the thesis

This thesis has eight chapters along with references and appendices. The structure of this thesis is as follows:

Chapter 1: Introduction

The first chapter presents the background and motivation of the study, gap in literature addressed by the study, and research questions, aims, and objectives. It finishes by presenting the scope of the study, research methodology and methods, and research contribution and novelty.

Chapter 2: Meta-analysis of GSCM adoption-performance relationships

This section presents a meta-analysis of the empirical relationship between GSCM practices and their impact on economic, environmental, social, and operational performance.

Chapter 3: Literature review and framework development

This chapter systematically reviews the relevant literature on the basic concepts, theories, and methods regarding the current research and highlights of the adoption of GSCM practices. Moreover, this chapter also presents the theoretical framework and associated hypotheses to be examined empirically in this study. In addition, two theoretical foundations of the developed model in this study are discussed, including stakeholder theory and social exchange theory. Finally, the research framework is established with several related hypotheses.

Chapter 4: Methodology

This chapter presents the research methodology adopted in this study. First, it explains the adoption of positivism and the quantitative approach. Then, the sampling method and data collection techniques are discussed. Moreover, the development of the survey questionnaire, including item development, measurement scales, the pilot study, and its results, are introduced. Finally, statistical approaches for validating the research framework, analysing the empirical data, and ethical issues are discussed.

Chapter 5: Data analysis and results

This chapter outlines the data analysis and its results for this study. First, a preliminary examination of the data using outliers, normality, homoscedasticity, and multicollinearity examinations is presented, followed by a description of the demographic profiles of the participants. Then, descriptive statistics of the survey constructs are outlined. Next, the measurement reliability and validity are assessed. Subsequently, confirmatory factor analysis (CFA) was performed. Finally, a structural model was employed to test the direct hypothesized relationships, and hierarchical moderated regression was used to test the moderating hypothesized relationships.

Chapter 6: Discussion

This chapter provides a detailed discussion of the hypotheses. Moreover, it examines the research framework with relevant literature.

Chapter 7: Conclusion

This chapter provides a summary and final remark about the study. It also provides theoretical and managerial contributions with implications. Moreover, it highlights the limitations of this study and provides opportunities and directions for future research.

Figure 1-2 shows the structure and flow of the thesis associated with each chapter.

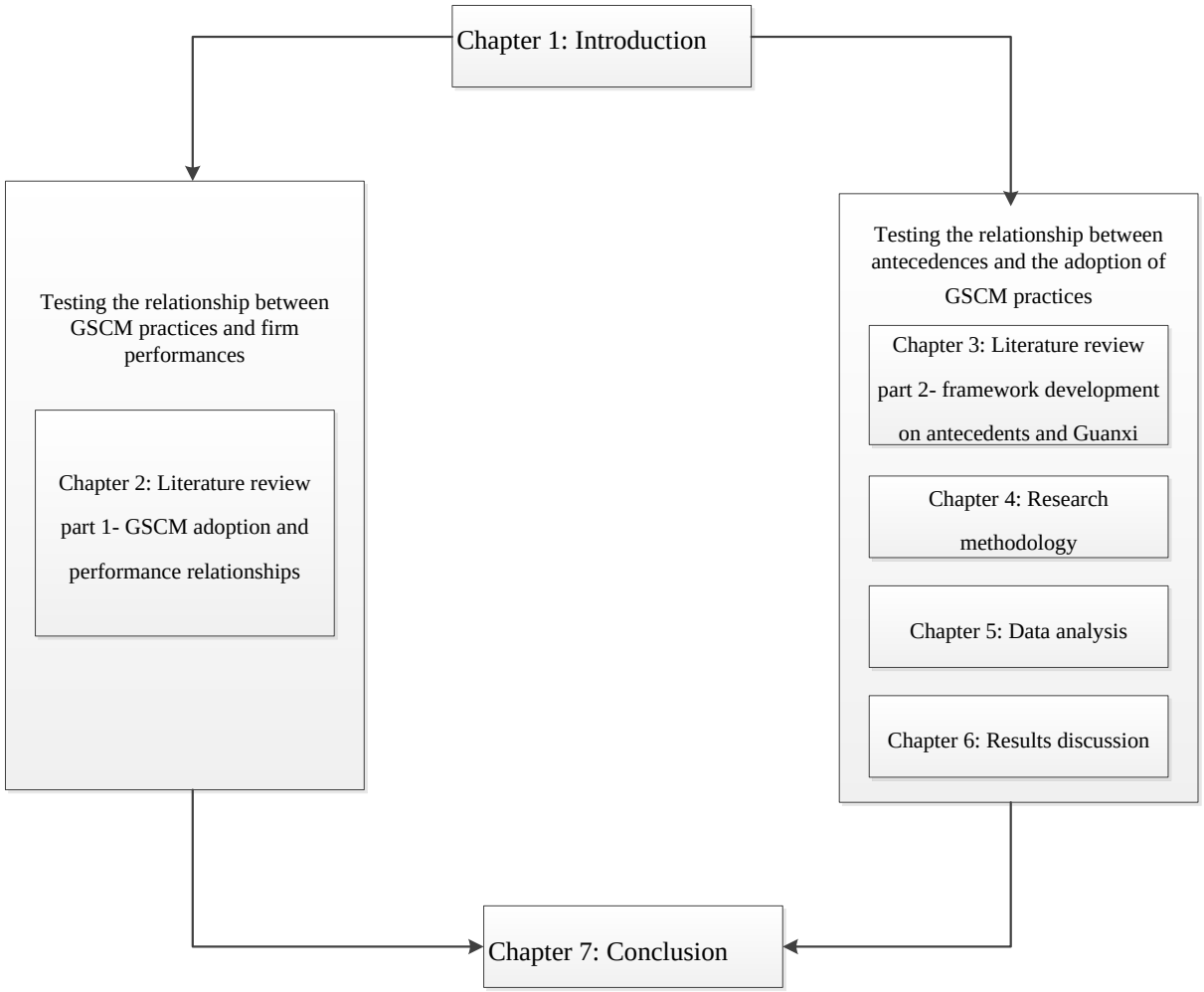

Figure 1-2. Structure and flow of the thesis

Chapter 2: Literature review part 1- GSCM adoption and performance relationships

2.1 Overview

This chapter presents a meta-analysis of the empirical relationship between the adoption of GSCM practices and its impact on firm performance in manufacturing sectors in AEE. First, a background is presented for empirical evidences on the relationship between the adoption of GSCM practices and firm performance in four categories: economic, environmental, social, and operational performance.

2.2 Background

The GSCM practices-performance relationship in manufacturing sectors in AEE has received increasing attention from industry, academia, regulatory institutions, and customers (Golicic and Smith, 2013; Lai et al., 2013). In particular, there is a clear academic need to identify whether GSCM practices lead to desirable firm performance and if so, what the subsequent outcomes are (Mitra and Datta, 2014; Lo, 2014; Subramanian, 2014). Moreover, the results of empirical studies on the impact of GSCM practices on firm performance are not conclusive. For instance, Zhu and Sarkis (2004) and Zhu et al. (2005) consistently argued that GSCM practices have not contributed to better economic performance in Chinese manufacturing firms. Admittedly, the concept of GSCM practices was in its early stages during these two studies. An early stage of adoption usually requires investment, which will increase companies' operational costs and have a negative impact on firms' economic benefit. In contrast, recent studies have examined the positive relationship between GSCM practices and economic performance (e.g. Kuei et al., 2013; Lai et al., 2012). These mixed results and the need to gain further insights into the link between generalized GSCM practices and performance have motivated our study. Such empirical generalization is necessary because GSCM practices have been implemented differently in different regions and industries. Therefore, our study aims to

provide empirical generalizations regarding the relationship between GSCM practices and firm performance.

According to Hunter and Schmidt (1990, 2004), a meta-analysis is a quantitative accumulation that aims to analyse effect sizes across literatures. Empirical researches on environmental practices and firm performance have been characterized by a large number of small-scale field studies with controversial findings regarding their impact on performance. Rosenbusch et al. (2011) indicated that such empirical studies lack generalizability because of the differences in sampling criteria. Meta-analysis can be used to generalize the empirical results of previous researches (Raudenbush et al., 1991).

2.3 Literature search for meta-analysis

To collect empirical studies for the meta-analysis, this study conducted a systematic literature review of empirical papers that consider the effects of GSCM practices in the manufacturing industry in the AEE (Tranfield et al., 2003). This study used combinations of keywords to avoid artificial limitations in five well-known databases: ABI/INFORM, Scopus, Emerald, Business Source Premier, and Science Direct. For instance, keywords were related to country/region (China, Taiwan, India, Malaysia, Indonesia, Thailand, and South Korea), GSCM practices (e.g. green purchasing and eco-design) and performance outcomes (e.g. performance, outcome, and benefit). This search initially resulted in approximately 200 studies (with duplication of approximately 100 papers in five databases), which we further scrutinized for inclusion in the meta-analysis. To be included in our meta-analysis, articles had to meet three criteria: (1) focus on AEE (China, India, South Korea, Indonesia, Vietnam, Philippines, Taiwan, Malaysia, and Thailand), (2) data collected from manufacturing sector, and (3) report on the relationship between GSCM practices and performance with empirical effect sizes. By applying these criteria, we identified 50 qualifying empirical studies that represent a total sample of 11,127 companies. These articles are summarized in Table 2-1.

Table 2-1. Empirical papers for meta-analysis

	Paper	*Methodology*	Analysis method	Sample size[1]	Theoretical approach	Region
1	Lee and Miller (1996)	Survey	Pearson correlation analysis	151	Contingency theory	South Korea
2	Zhu and Sarkis (2004)	Survey	Regression analysis	186	Not specified (NS)	China
3	Rao and Holt (2005)	Mail survey	Covariance-based structural equation modelling (CB-SEM)	52	NS	15 South East Asian countries
4	Ann, Zailani, and Wahid (2006)	Mail survey	Factor analysis	159	NS	Malaysia
5	Zhu, Sarkis, and Lai (2007)	Survey with convenience sampling	Pearson correlation analysis	89	NS	China
6	Peng and Lin (2008)	Mail survey	CB-SEM	101	Institutional theory	Taiwan
7	Yang et al. (2010)	Mail survey	Multivariate linear regression model	107	NS	China and Taiwan
8	Chiou et al. (2011)	E-mail survey	CB-SEM	124	NS	Taiwan
9	Kim, Youn, and Roh (2011)	Mail survey	CB-SEM	125	NS	South Korea
10	Wong et al. (2011)	Mail survey	CB-SEM	151	Contingency theory	Thailand
11	Chan et al. (2012)	Mail survey	Path analysis	194	Resource-based view	Taiwan
12	Huang, Wu, and Rahman (2012)	Mail survey	CB-SEM	349	NS	Taiwan
13	Kim and Rhee (2012)	E-mail survey	CB-SEM	249	NS	South Korea
14	Lai and Wong (2012)	Mail survey	CB-SEM	134	NS	China
15	Lee, Kim, and Choi (2012)	Survey with consulting firm	CB-SEM	233	NS	South Korea
16	Wong et al. (2012)	Mail survey	CB-SEM	122	NS	Taiwan
17	Zailani et al. (2012)	E-mail survey	CB-SEM	132	Institutional theory	Malaysia
18	Kuei et al. (2013)	Mail survey	CB-SEM	113	NS	China
19	Lai et al. (2013)	Mail survey	Seemingly unrelated regression	128	Production frontier theory	China
20	Laosirihongthong, Adebanjo, and Tan (2013)	Mail survey	Multivariate linear regression model	190	Institutional theory	Thailand
21	Lee et al. (2013)	Mail survey	CB-SEM	128	Institutional theory and resource-based view	South Korea
22	Lin et al. (2013)	Mail survey	Regression analysis	208	NS	Vietnam
23	Nagarajan et al. (2013)	Survey	CB-SEM	75	Resource-based view	India
24	Ye et al. (2013)	Mail survey	CB-SEM	209	Intuitional theory	China
25	Youn et al. (2013)	Mail survey	CB-SEM	141	NS	South Korea
26	Lee et al. (2013B)	Mail survey	CB-SEM	119	NS	Malaysia
27	Abdullah and Yaakub (2014)	E-mail survey	Partial Least Squares Structural Equation Modelling (PLS-SEM)	201	NS	Malaysia
28	Cheng, Yang, and Sheu (2014)	Mail survey	CB-SEM	121	Resource-based view	Taiwan
29	Huang and Yang (2014)	Mail survey	Regression analysis	1200	Institutional theory	Taiwan
30	Hung, Chen, and Chung (2014)	Mail survey	PLS-SEM	160	Social capital theory	Taiwan
31	Huo et al. (2014)	Mail survey	CB-SEM	617	Stage theory	China
32	Sancha et al. (2014)	Mail survey	CB-SEM	170	Transaction cost economies theory	China

Table 2-1. Empirical papers for meta-analysis

	Paper	*Methodology*	Analysis method	Sample size[1]	Theoretical approach	Region
33	Woo et al. (2014)	Survey	Multivariate linear regression model	1656	Stakeholder theory	South Korea
34	Wu et al. (2014)	Survey	Regression analysis	172	NS	Taiwan
35	Wong et al. (2014)	Mail survey	CB-SEM	122	NS	Taiwan
36	Yu et al. (2014)	Mail survey	CB-SEM	126	NS	China
37	Lai et al. (2014a)	Mail and e-mail survey	CB-SEM	134	Contingency theory	China
38	Lai et al. (2014b)	Mail survey	CB-SEM	210	Resource dependence theory	China
39	Chan et al. (2015)	Survey	CB-SEM	250	Contingency theory	China
40	Choi and Hwang (2015)	Web-based survey	Hierarchical regression	230	Resource-based view	South Korea
41	Dubey, Gunasekaran, and Alic (2015)	Electronic survey	Hierarchical regression	361	Institutional theory	India
42	Feng et al. (2015)	Two waves of survey	Hierarchical moderated regression	214	Contingency theory	China
43	Gopal and Thakkar (2015)	Mail survey	CB-SEM	98	NS	India
44	Lai, Wong, and Lam (2015)	Mail survey	CB-SEM	210	Resources dependence theory	China
45	Lee (2015)	Mail survey	CB-SEM	207	Social capital theory	South Korea
46	Lee et al. (2015)	Mail survey	PLS-SEM	119	NS	Malaysia
47	Li et al. (2015)	Survey	CB-SEM	256	Stakeholder theory and resource-based view	China
48	Chen, Wu, and Wu (2015)	Mail survey	Regression analysis	205	Resource-based view	Taiwan
49	Huang et al. (2015)	Mail survey	Hierarchical regression	284	Contingency theory	Taiwan
50	Zailani (2015)	Mail survey	PLS-SEM	153	Institutional theory	Malaysia

[1]: Number of companies in the paper
CB-SEM = Covariance-based structural equation modelling; PLS-SEM = Partial least squares structural equation modelling; NS = Not specified

2.4 Data coding for meta-analysis

To ensure the commensurability and heterogeneity of the studies in the meta-analysis, coding data along the dimension of variables posed an additional unique challenge. For instance, there is the issue regarding construct boundaries. In this regard, the systematic literature review revealed that the term 'performance' has been used broadly with a variety of indicators. The author resolved this issue by carefully comparing the definitions and survey items used in each study.

2.4.1 Dependent variables

Following the insight from the systematic review of the literature on performance measurement, the author focused on studies that measure performance along four dimensions: economic, environmental, operational, and social. the autohr coded studies that measured economic performance using objective or perceived growth in sales, profit, and market share (Chan et al., 2012; Lee et al., 2013; Kuei et al., 2013; Abdullah and Yaakub, 2014). Measures of environmental performance included indicators such as saving energy and reducing waste, pollution, and emissions (Rao, 2002; Zhu et al., 2005; Chiou et al., 2011; Lee et al., 2012). Operational performance included various indicators related to the efficiency of the firm's operations such as scrap rate, delivery time, inventory levels, and capacity utilization (Wong et al., 2009; Lai et al., 2012; Dou et al., 2013). Moreover, this study considered social performance as a concept to quantify the outcomes of the GSCM practices on improving the product and company image, protecting employee health and safety, and ensuring customer loyalty and satisfaction (Zailani et al., 2012; Ashby et al., 2012). Accordingly, this coded the firm performance along four dimensions: economic, environmental, operational, and social performance as defined below:

i.

Economic performance, referring to profitability in general, is a significant reason for companies to implement GSCM practices. Therefore, we coded studies that measured economic performance using objective or perceived growth in sales, profit, and market share (Chan et al., 2012; Lee et al., 2013; Kuei et al., 2013; Abdullah and Yaakub, 2014) within GSCM practice - economic performance relationship.

ii.

The environmental performance is usually concerned with saving energy and reducing waste, pollution, and emissions. Moreover, linking the supply chain performance with manufacturing sectors, the environmental performance included reducing air emissions, water wastes, and solid wastes, as well as decreasing consumption of hazardous materials (Zhu, et al., 2005). Measures of environmental performance included indicators of saving energy and reducing waste, pollution, and emissions (Rao, 2002; Zhu et al., 2005; Chiou et al., 2011; Lee et al., 2012).

iii.

Operational performance is related to the efficiency of the firm's operations such as decreased scrap rates and delivery times, decreased inventory levels, and improved capacity utilization (Zhu, et al., 2012). In the meta-analysis, operational performance included various indicators related to the efficiency of the firm's operations such as scrap rate, delivery time, inventory levels, and capacity utilization (Wong et al., 2009; Lai et al., 2012; Dou et al., 2013).

iv.

The social performance in this study was considered a concept to quantify outcomes of the GSCM practices about increasing product and company image, protecting employee health and safety, ensuring customer loyalty and satisfaction (Zailani et al., 2012b; Ashby et al., 2012).

2.4.2 Independent variables

Some scholars classified GSCM practices based on the type of supply chain activities. From this perspective, Zhu et al. (2005) investigated Chinese textile, automobile, power generation, chemical, electrical, and electronics industries and identified five types of GSCM practices. These include internal environmental management, green purchasing, cooperation with customers, investment recovery, and eco-design. Based on the reviewed literature, we classified GSCM practices into inter-organizational environment management (IEM), product eco-design (ECO), supplier integration (SI), customer cooperation (CC), and reverse logistics (RL).

2.4.3 Moderating variables

Unlike standard moderators, moderating variables in meta-analysis are often taken from control variables in empirical studies (Golicic and Smith, 2013). Therefore, moderating variables in a correlational analysis refer to a third variable that affects the zero-order correlation between the independent and the dependent variables (Hunter and Schmidt, 2004). Moderating variables in this study were coded based on the difference of relevant samples on the relationship of the adoption of GSCM practices and performance including (1) firm size, (2) industry type, (3) ISO certification, and (4) export orientation.

Firm size has been reported by several scholars as a significant factor that influences the adoption of GSCM practices (Grant et al., 2002; Klassen, 2000; Zhu et al., 2008; Mohanty and Prakash, 2013). However, the arguments regarding the relationship between size and GSCM practices in AEE are not conclusive. For instance, Lai and Wong (2012) indicated that the firm

size does not affect the adoption of GSCM practices. In contrast, Wu (2013) found that firm size is positively related to green purchasing and eco-design among Taiwanese apparel manufacturing companies. Therefore, the author concludes that there is a need to include the firm size as a moderator when analysing the adoption of GSCM practices.

Based on the literature review, the author found that most researchers have drawn samples from different industries and companies with different business orientations. Most reviewed papers collected their data from multiple sectors (e.g. Nagarajan et al., 2013; Huo, Zhao, and Zhou, 2014; Kim and Rhee, 2012). However, some studies drew their sample from one particular industry, mainly, the automobile (e.g. Yu et al., 2014) and electronics (e.g. Huang and Yang, 2014) industries. Delbufalo (2012) argued that multiple industries yield more variation in the data than a single industry. Therefore, this study seeks to examine whether the industry type moderates the relationship between GSCM practices and firm performance.

Moreover, some reviewed studies emphasized the highly correlated relationship between the GSCM practices and firm performance for companies that are ISO 14001 certified (e.g. Rao and Holt, 2005; Ann, Zailani, and Wahid, 2006; Kuei et al., 2013; Laosirihongthong et al., 2013). For instance, Lee et al. (2013) found a significant relationship between greening the supplier and environmental performance among ISO 14001 certified manufacturing firms in Malaysia. However, the high cost of obtaining ISO certification might result in the redirection of resources away from investing in more environmentally friendly processes (Ann et al., 2006). Therefore, this study also evaluated the samples from companies that are ISO certified and companies for which the ISO certification is not explicitly stated.

Additionally, some scholars hypothesized the impact of international customers on the adoption of GSCM practices. Examples of such investigations that drew samples from exporting companies and showed highly correlated relationship include Zhu and Sarkis (2004)

and Lai et al. (2014). As such, this study analyse the difference between samples of companies that are export-oriented and companies for which a specific orientation is not mentioned.

2.5 Meta-analysis process

This study adopted a fixed-effect model to analysis the relationships between GSCM practices and firm performances under similar conditions with similar subjects (Borenstein et al.,2007). To conduct the meta-analysis, this study followed a widely used procedure that was developed by Hunter and Schmidt (1990, 2004).

First, this study used Pearson product-moment correlations in each study as the effect size. Next, this study corrected each correlation using its reliabilities; if a study did not report reliabilities, the author used the most conservative value (0.70) as the threshold (Hunter and Schmidt, 1990). The next step was to calculate the 95% confidence interval around the correlation coefficient. Moreover, this study calculated Z-scores to assess the statistical significance of between-group differences of the effect size (Stam et al., 2014). Finally, a Q-statistic, which is a chi-square distributed statistic with $k - 1$ degrees of freedom, was used to assess the heterogeneity across studies (Hunter and Schmidt, 1990). Additionally, this study estimated the fail-safe N to assess the possibility of publication bias (Orwin, 1983). The fail-safe N (or N_{fs}) is a 'File drawer' analysis which determines how many studies with an effect size of zero would be required to yield a non-significant *p*-value (Orwin, 1983). In addition, this study used the comprehensive meta-analysis version 3 software to conduct the analysis.

2.6 Direct results of the GSCM practices-performance relationship

As can be seen from Table 2-2, the results of this meta-analysis on the GSCM practice-performance relationship involve 108 effects. Following the guidelines provided by Cohen and Cohen (1983) , a correlation effect size <0.10 is considered weak, 0.10–0.30 is moderate, and >0.30 is strong.

The finding indicates a strong and significant (r = 0.389, p =0.000) relationship between GSCM practices and overall firm performance (which comprises economic, environmental, operational, and social performance). This result indicates that although the initial investments for the adoption of GSCM practices are very high, benefits such as saving energy, reducing waste, and increasing operational efficiency and customer image can outweigh the costs (Gimenez and Tachizawa, 2012; Chan et al., 2012; Lee et al., 2013; Kuei et al., 2013; Abdullah and Yaakub, 2014).

Table 2-2 Results of meta-analysis

FIXED model	Total effect[1]	Sample size[2]	Effect size (*r*)	Standard error	95% confidence interval of *r*		Q test	Z value	*p* value	Fail-safe N
H1 Overall relationship	108	21885	0.356	0.012	0.344	0.368	1297.716	54.658	0.000	13125
H2 Economic performance	48	8818	0.382	0.018	0.364	0.400	599.318	37.475	0.000	6598
H2A IEM	14	2343	0.513	0.021	0.482	0.542	107.686	27,175	0.000	2567
H2B SI	9	1440	0.357	0.038	0.311	0.402	90.062	14.037	0.000	512
H2C ECOD	8	1250	0.385	0.109	0.337	0.432	207.014	14.231	0.000	374
H2D CC	9	1388	0.416	0.018	0.371	0.459	40.251	16,322	0.000	532
H2E RL	8	2397	0.231	0.008	0.193	0.269	22.741	4.275	0.000	152
H3 Environmental performance	25	6619	0.342	0.024	0.321	0.363	321.317	28.839	0.000	5848
H3A IEM	6	2555	0.293	0.080	0.257	0.328	135.763	15.212	0.000	510
H3B SI	7	1086	0.364	0.031	0.311	0.415	46.628	12.467	0.000	283
H3C ECOD	5	805	0.544	0.039	0.504	0.601	33.732	17.549	0.000	369
H3D CC	2	299	0.459	0.019	0.364	0.545	1.654	8.492	0.000	25
H3E RL	5	1874	0.273	0.017	0.231	0.315	22.154	12.090	0.000	126
H4 Operational performance	23	4171	0.352	0.007	0.325	0.379	77.720	23.566	0.000	3346
H4A IEM	8	1582	0.387	0.014	0.344	0.428	28.124	16.106	0.000	512
H4B SI	7	1451	0.313	0.018	0.265	0.359	29.409	12.239	0.000	293
H4C ECOD	2	322	0.433	0.015	0.339	0.518	1.307	8.230	0.000	24
H4D CC	4	599	0.338	0.010	0.265	0.408	5.374	8.533	0.000	77
H4E RL	2	217	0.267	0.046	0.138	0.387	3.319	3.975	0.000	6
H5 Social performance	12	2277	0.300	0.059	0.262	0.337	280.930	14.645	0.000	604

H5A IEM	3	533	0.573	0.052	0.515	0.630	17.266	15.009	0.000	158
H5B SI	2	384	0.025	0.026	-0.076	0.125	3.473	0.481	0.631	-1.75
H5C ECOD	1	190	0.175	0.000	0.033	0.310	0.000	2.418	0.016	-0.125
H5D CC	3	577	0.463	0.270	0.394	0.525	97.510	11.931	0.000	92
H5E RL	3	593	0.039	0.007	-0.042	0.120	2.557	0.950	0.342	0

1: Numbers of effect sizes used in each analysis
2: Number of companies included in total effect

2.6.1 GSCM practices and economic performance

The results of this meta-analysis showed that the majority of the selected indicators belong to this domain (48 effects), with a strong and positive relationship between GSCM practices and economic performance with effect size $r = 0.431$ ($p = 0.000$). Moreover, this result confirmed the findings of previous literature that investigating the adoption of GSCM practices can make companies reduce their inventory investments, increase recovery of assets, and contain costs and therefore lead to improved economic performance (Huang et al., 2012). This study also compared the impact from different indicators of GSCM practices on economic performance. In the sub-group analysis, this study found that intra-organization environmental practices (H2A, $r = 0.509$, $p = 0.000$) led to better economic performance than collaborative practices with customers (H2D, $r = 0.476$, $p = 0.000$) and suppliers (H2B, $r = 0.427$, $p = 0.000$). This result confirmed previous studies on the argument that the successful adoption of GSCM practices by a company depends on the intra-organizational environmental management (Kuei et al., 2013; Youn et al., 2013).

2.6.2 GSCM practices and environmental performance

The results showed a strong and positive effect size (H3, $r = 0.374$, $p = 0.000$) on the relationship with environmental performance with 25 effects in this domain. In subgroup analysis, there was a positive and significant effect on environmental performance with eco-design (H3C, $r = 0.500$, $p = 0.000$), supplier integration (H3B, $r = 0.408$, $p = 0.000$), and customer cooperation (H3D, $r = 0.443$, $p = 0.379$), and a moderate correlation with intra-organizational environmental management (H3A, $r = 0.293$, $p = 0.000$) and reverse logistics (H5E, $r = 0.289$, $p = 0.000$).

The positive result between suppliers' integration and environmental performance suggests that focal companies could work with their suppliers to align all operational activities such as the process of production, service, and transportation (Wong et al., 2014). In doing so, manufacturers can discuss the green design of products with their suppliers in the early research and development stage (Tseng and Chiu, 2013). However, customers' cooperation showed a stronger impact than suppliers' integration on the environmental performance. One possible reason may be that most companies in the AEE are market-oriented (Guoyou et al., 2013).

2.6.3 GSCM practices and operational performance

Results related to intra-organizational environmental management suggested a significant effect size (H4A, r = 0.370, p = 0.000) on the relationship with operational performance. This result confirmed previous research on the argument that operational timesaving and quality improvements cannot be improved by the adoption of intra-organizational environmental management (Ann et al., 2006). The remaining correlations represent the strong and significant effect of eco-design (H4C, r = 0.433, p = 0.000), suppliers' integration (H4B, r = 0.465, p =0.000), and customer cooperation (H4D, r = 0.375, p =0.000) on operational performance. These results may collectively indicate that for a focal firm, new product eco-design and collaboration with customers and suppliers are key contributors to operational performance (Yang et al., 2010).

In addition, there is a moderate and significant impact (H4E, r = 0.267, p =0.000) of reverse logistics on operational performance. This moderate result may indicate that recycling and collecting reusable parts can reduce the operational cost in materials sourcing. Therefore, manufacturers in AEE may need to investigate the end-of-life and recycled products in customers' product return programs (Abdulrahman et al., 2014). From this perspective, better operational performance can be achieved by reducing waste and improving material disposal (Mitra and Datta, 2014).

2.7 Moderating results of the GSCM practices-performance relationship

Table 2-3 presents the effect of industry type, ISO-certification, export-orientation, and firm size on the relationship between the adoption of GSCM practices and firm performances. The results showed that the automotive industry had the strongest relationship between GSCM practices and firm performance ($r = 0.453$, $p = 0.000$). This result is similar to that of a previous meta-analysis by Golicic and Smith (2013), who found that the automotive industry had the strongest effect among various industries in all regions. The reason is that the automotive industry often faces significant attention for its environmental activities (Golicic and Smith, 2013).

Moreover, ISO-certified companies ($r = 0.304$, $p = 0.000$) showed a lower correlation coefficient than non-ISO-certified companies ($r = 0.400$, $p = 0.000$). This result is in contrast with those of previous studies that showed that ISO-certified companies are more likely to have adopted GSCM practices (Ann et al., 2006; Rao and Holt, 2005; Zailani, ElTayeb, Hsu, and Tan, 2012). One possible reason for our result is that manufacturing companies in AEE are heavily dependent on overseas markets with several critical environmental challenges during the export process. Therefore, manufacturers in AEE can benefit from the adoption of GSCM practices with or without an ISO certification.

With regard to companies with business orientation, this study found that there is a stronger correlation for export-oriented companies ($r = 0.391$, $p = 0.000$) than for manufacturing companies with an unspecified export status ($r = 0.348$, $p = 0.000$). In addition, in contrast with previous literature, this meta-analysis also showed that there is a stronger effect in large companies ($r = 0.428$, $p = 0.000$) than in SMEs ($r = 0.380$, $p = 0.000$) on the GSCM practices-performance relationship. Previous literature found that the size of companies does not affect the relationship between the adoption of GSCM practices and firm performance (Wong et al., 2012; Zhu et al., 2010).

Table 2-3. Moderator analysis

FIXED model	Number of articles	Sample size[1]	Effect size (*r*)	Standard error	95% confidence interval of *r*		Q test	Z value	*p* value	Fail-safe N
Auto	5	3,266	0.453	0.059	0.425	0.480	139.834	27.554	0.000	964
Electronics	7	6,393	0.377	0.009	0.356	0.398	61.194	31.589	0.000	1669
Various industries	38	16,021	0.380	0.068	0.366	0.393	1051.039	50.200	0.000	6487
ISO certified	7	3,267	0.304	0.071	0.272	0.335	197.126	17.809	0.000	799
Not specified	43	22,413	0.400	0.016	0.389	0.411	1082.314	63.020	0.000	1860
Export oriented	4	1,626	0.391	0.022	0.380	0.390	24.989	14.505	0.000	157
Not specified	46	24,054	0.348	0.017	0.304	0.402	1284.668	63.625	0.000	8536
Companies of all sizes	43	21,102	0.380	0.059	0.368	0.391	1206.618	57.617	0.000	7920
SMEs	7	4,578	0.428	0.018	0.404	0.452	94.247	30.784	0.000	1455

1: Number of companies

2.8 Summary

A meta-analysis was conducted (Hunter and Schmidt, 1990, 2004) to develop and refine GSCM practices and their impact on economic, environmental, social, and operational performance. Through a systematic literature review, we identified 50 articles that surveyed 11,127 manufacturing companies in the AEE and that were published between 1996 and 2015. Subsequently, a conceptual framework was developed with 130 effects from 25,680 effect sizes from reviewed papers in the meta-analysis. This meta-analysis of the extant literature on GSCM focuses on the manufacturing sector in the AEE. The meta-analysis revealed several relationships between GSCM practices and performance. The results of our meta-analysis indicated that GSCM practices led to better performance in three aspects: economic, environmental, and operational. More specifically, the GSCM practice-performance relationship was the strongest for economic performance, followed by operational and environmental performance. Surprisingly, GSCM practices did not have any significant impact on the social performance. Moreover, the results also indicated that several GSCM practice-performance relationships are moderated. This is an important finding for several reasons. First, our meta-analysis implies that the adoption of GSCM practices contributed to firm performance, but at different levels. Second, this finding also instils more confidence in the adoption of GSCM practices as a profitable environmental strategy that can be used to reduce environmental impact while increasing economic performance. In this regard, as the competition in the manufacturing industry increases among supply chains and decreases among individual firms, Peng and Lin (2008) stated that the adoption of GSCM practices is becoming an important and valuable strategy to reduce costs while satisfying different stakeholders' requirements. Our meta-analysis indicated that the adoption of GSCM practices is becoming more significant in contributing to firm performance as supply chains become more complex. As for globalization,

the adoption of GSCM practices will play a larger role in manufacturing companies in the AEE by not only reducing environmental impact but also contributing to firm performance.

Chapter 3: Literature review part 2- framework development on antecedents and Guanxi

3.1 Overview

Pervisou sections have comfimed the positive relationship between the adoption of GSCM practices and firm performance. This chapter presents a systematic review of literature and provides a theoretical framework on the effect of stakeholder driver and supply chain barrier on the adoption of GSCM practices, as well as the moderating effect of Guanxi on the given effects. Section 3.2 defines GSCM and discusses how it differs from SCM. Then, Section 3.3 discusses drivers for the adoption of GSCM practices as well as barriers that hinder their adoption. Section 3.4 explains the role of Guanxi in the adoption of GSCM practices. Next, Sections 3.5 and 3.6 provide a systematic literature review with descriptive results on the phenomena of GSCM practices. Moreover, Sections 3.7 and 3.8 discuss the theoretical background of GSCM practices and Guanxi. Sections 3.9, 3.10, and 3.11 discuss the development of the hypotheses on the effects between stakeholders' drivers and supply chain barriers on the adoption of GSCM practices as well as the moderating role of Guanxi in the given effects. Finally, Section 3.12 presents a conceptual framework.

3.2 From SCM to GSCM

SCM has been described by different researchers from different perspectives. Chopra and Meindl (2007) stated that SCM includes purchasing, in-bound logistics, production, distribution, outbound logistics, marketing, and reverses logistics. Handfield and Nichols (1999) noted that SCM refers to the responsibility for all movements and activities of raw materials from the suppliers to the final customers of organizations. Nichols et al. (1999) defined SCM as containing all kind of activities related to product flow and transportation. The flow starts with purchasing raw materials to delivering the final product to the end user, and it includes

the downstream and upstream flow of information and materials in the supply chain (Hajikahani et al., 2012).

The concept of GSCM is based on the concept of SCM. GSCM considers and focuses on the protection of the environment in the whole SCM process, including raw material acquisition, production, packaging, delivering, and recycling (Zhu and Cote, 2004). Moreover, Zhu, Sarkis, and Lai (2006) indicated that when facing environmental challenges such as energy shortage and serious pollution, enterprises should try to make their supply chain green by exploring and building networks of suppliers to purchase environment-friendly materials or finding some methods which can greatly reduce waste and make operations more efficient. In addition, GSCM is oriented toward eco-efficiency by proactively managing the same or even increased levels of product flows while reducing environmental degradation, resource consumption, and costs. It involves preventive approaches for environmental protection from materials sourcing to end-of life product acquisition and processing (King and Lenox, 2001).

At present, there is increasing public attention on environmental issues worldwide (Zhu and Sarkis, 2004). Usually, people consider production and manufacturing processes as the main cause of environmental damage (Beamon, 1999). Therefore, scholars argue that companies have to make all production processes environmental friendly, including raw material purchasing, product manufacturing, product delivery to customers, recycling, and remanufacturing (Zhu and Cote, 2004). Accordingly, enterprises should change their traditional production and operation systems to reduce waste and avoid pollution. The first step enterprises should take is to green their SCM from product design to recycling (Mahler, 2007). Therefore, the concept of GSCM was proposed by Porter and Van der linde (1995), and it has been implemented by many enterprises.

3.3 Antecedents for GSCM

Previous literature on GSCM in China focuses on the general phenomenon and the crucial relationships that manifest in the transition from traditional SCM to GSCM (e.g. Zhu and Sarkis, 2004; Kuei et al., 2013; Lai et al., 2012). Although the transition from traditional SCM to GSCM has been occurring owing to many factors such as the drivers that motivate manufacturers to adopt GSCM practices, some barriers also hinder the implementation of GSCM practices (Porter and Van der Linde, 1995; González-Torre et al., 2010).

Previous literature indicated that companies in the AEE have started adopting GSCM practices owing to increased motivational drivers from related stakeholders such as customers (Zhu et al., 2005a; Lai and Wong, 2012), legislative authorities (Birkin et al., 2009; Liu et al., 2012), and suppliers (Lee, 2008; Yen and Yen, 2012). In this regard, the stakeholder theory is appropriate to explain the relationships between drivers and the adoption of GSCM for two reasons. First, stakeholders are increasingly demanding that companies in China address and manage environmental issues (Zhu et al., 2013). Second, GSCM practices require intra-organisational collaborations with all stakeholders in a highly competitive environment (Walker and Jones, 2012). In this regard, the stakeholder theory aims to group and identify the input and output environments of a company (suppliers and consumers), its competitive environment (companies producing similar services or products), and its regulatory environment (DiMaggio and Powell, 1983; Delmas and Toffel, 2004). Thus, these stakeholder groups are included in this study, as previous research suggests that the characteristics of specific groups impact the willingness of the focal company to adopt GSCM practices (Kassinis and Vafeas, 2006).

Moreover, some barriers can be anticipated in the adoption of GSCM owing to the expected transition. Industries must therefore equip themselves to overcome these barriers. To the best of our knowledge, only Abdulrahman (2014) investigated barriers for reverse logistics in the

context of Chinese manufacturing sectors. This inspired this study to consider barriers to the adoption of GSCM practices within the scope of the AEE manufacturing supply chains. However, during the adoption of GSCM practices, barriers are impossible to eradicate (González-Torre et al., 2010). Therefore, it is more practical to reduce the effects of supply chain barriers on the adoption of GSCM practices, such as complex regulations and adoption costs (González-Torre et al., 2010).

3.4 The role of Guanxi in GSCM

Researchers indicated that relational governance plays a significant role in achieving a competitive advantage, including the maintenance of the relationship of a company with other supply chain partners (Wang and Wei, 2007; Cheng, 2011). While relational governance in the West is administered by legislation and regulations, in AEE, it is driven by morality and social norms (Arias, 1998) and governed by Guanxi (Yen, Yu, and Barnes, 2007). Therefore, the role of relational governance is replaced by Guanxi in AEE. For instance, a Chinese supply chain manager might make a purchase from a supplier because this supplier has helped the manager's children get into a prestigious school (Dunfee and Warren, 2001). In contrast, in the West, people tend to separate personal and business relationships in terms of reciprocity (Lin and Si, 2010).

Chua, Morris, and Ingram (2009) found that the most renowned relational approach for managers in China is to develop and maintain Guanxi ties in their business networks. From this perspective, one of the most important relational characteristics of the AEE culture is the prevalence of Guanxi, which affects firms' business decisions and behaviours (Lee et al., 2001; Luk et al., 2008; Park and Luo, 2001). In this content, Guanxi refers to the cultural characteristic of interpersonal relationship ties that exist within a society.

In the supply chain context, researchers have highlighted the significance of Guanxi in buyer-supplier relationships (Metters et al., 2010). For example, Barnes et al. (2011) indicated that

Guanxi is crucial for developing business relationships in AEE for Western investigators. Zhao et al. (2008) also argued that Guanxi has a positive effect on buyer-supplier relationships in China via the reciprocal exchange of favours and obligations. However, there is scarce literature that discusses the role of Guanxi in the GSCM context. In fact, studies on the effects of Guanxi in the GSCM context are at initial stage, and they simply highlight Guanxi's importance without detailing how Guanxi influences the adoption of GSCM.

To the best of the knowledge, only two studies in the systematic literature review explored the role of Guanxi in GSCM (Cheng et al., 2012; Luo et al., 2014). However, the results of these two studies are contradictory. Cheng et al. (2012) found that better Guanxi links with suppliers would have a positive effect on the adoption of GSCM practices because higher levels of Guanxi would increase a buyer's transaction-specific investments and valuable resources while reducing a supplier's opportunistic behaviours. However, Luo et al. (2014) found that higher levels of Guanxi among the focal company and their suppliers reduced the focal company's willingness to implement GSCM practices. Luo et al.'s (2014) finding is in line with Peng and Luo (2000), who showed that Guanxi hindered the buyers' adoption of SCM practices because it required the buyers to spend too much time and effort in maintaining social ties. Therefore, the investment of GSCM practices was insufficient owing to the tremendous time and effort being invested into building and maintaining Guanxi links (Luo et al., 2014).

As existing literature offers contradictory results on Guanxi and the adoption of SCM or GSCM practices, it is important to clarify the role of Guanxi in the adoption of GSCM in the AEE manufacturing sectors. Therefore, this study explores the role of Guanxi on the antecedents-adoption of GSCM practices.

3.5 Systematic literature review

This study adopt a systematic approach to review the GSCM literature in AEE (Tranfield et al., 2003; Denyer and Tranfield, 2009). Figure 3-1 shows the three key areas in our review. The GSCM adoption process is usually initiated by drivers (Lee and Klassen, 2008; Lee, 2008); therefore, the author selected drivers as the focal area of this study, accompanied by barriers that hinder GSCM adoption (Govindan et al., 2014). As the role of Guanxi has been noted in SCM literature as a critical relationship governance mechanism for achieving business success in Asia (Carr and Pearson, 1999; Cheng, 2011), this study also explores the role of Guanxi in the adoption of GSCM practices by considering the complex relationships among drivers, barriers, and GSCM practices.

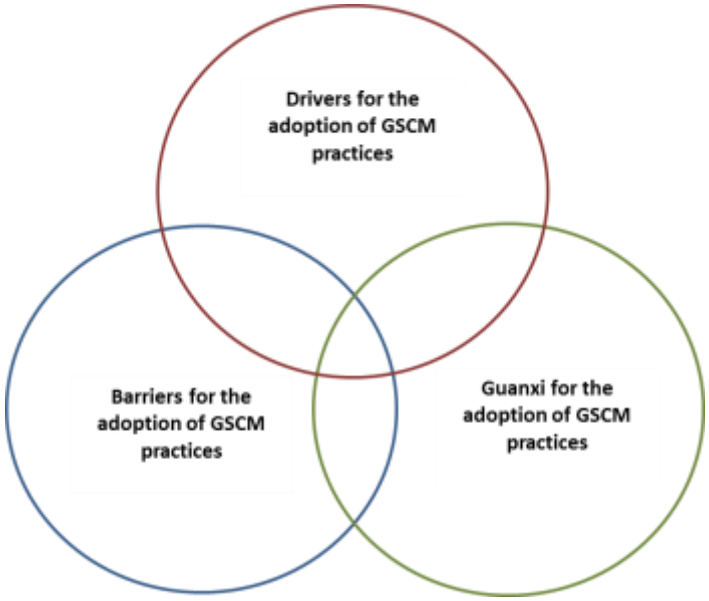

Figure 3-1. The scope of the literature research

This study searched five well-known databases that index the majority of academic literature in operations management in two rounds: from December 2014 to March 2015 and from September to October 2016. These databases include ABI/INFORM, Scopus, Emerald, Business Source Premier, and Science Direct. The search included articles with search terms appearing in the title, abstract, and keywords. Table 3-1 lists the keywords used in our search.

The author divided the search terms into four groups by country/region and scope. From this perspective, the author categorised words with similar meanings related to influential factors into drivers, enablers, and pressures. For instance, to find articles that discuss influential factors, we used 'AND' combined with the search terms under region/country and GSCM practices with any search term under the section of influential factors. Moreover, the '*' sign was used at the end of some search terms to expand the scope of the search, because some studies use slightly different keywords for the same concept (e.g. 'relatio*' to cover both 'relational' and 'relation').

Table 3-1.The keywords used for searching the literature

AND				
Region/Country	GSCM practices		Influential factors	Guanxi
	AND		OR	
China	green	practice*	influen*	guanxi
India	sustainab*	activities	driver	personal relatio*
Thailand	environment*	operation*	enabler	informal relatio*
Malaysia	Purchas*	logistic*	pressure	personal network
South Korea	Supplier*	product	influence	inter-personal relatio*
Indonesia	Reverse logistics	manufact*	barrier	
Taiwan	Eco-design	Adopt	obstacle	
Asia			preventer	
Emerging economies			antecedent	
*: any string of characters				

Moreover, four inclusion/exclusion criteria implemented to ensure that the author obtained the best available evidences for this review (Tranfield et al., 2003). For a paper to qualify for this literature review, it should focus on (1) the AEE, (2) supply-chain-based activities with

management focus, (3) manufacturing sector, and (4) be published in a CABS[1]-listed journal. These criteria are outlined below:

1. An emerging economy is a region with social or business activity in the process of rapid growth and industrialisation (Meyer and Thaijongrak, 2013). AEE were selected based on either nominal or inflation-adjusted GDP from BRIC and MIKT countries as well as MSCI Emerging Markets Index (MSCI Research, 2014). The final selection included China, India, South Korea, Malaysia, Taiwan, Thailand, and Indonesia.
2. For supply-chain-based activities, we were concerned with the management of all activities transforming natural resources, raw materials, and components into finished products delivered to the end customers.
3. Manufacturing industry in this study includes companies which produce goods by labour and machines, tools, chemical and biological processing, or formulation (Zhu et al., 2011b).
4. Because the concept of GSCM is evolving rapidly, we selected articles based on the quality of the journal to include the most relevant articles. Therefore, the studies included in our review were limited to peer-reviewed journals published in English. Furthermore, the initial proposal limited searches to journals in the CABS Academic Journal Guide 2015[2] to ensure the quality of the articles.

3.6 Descriptive review results

By using all combinations of search terms in the operations and SCM fields, this search found 359 results from peer-reviewed journals. A total of 270 papers remained after crosschecking and removing duplicate results. We then read the titles, abstracts, and keywords and applied

[1] Chartered Association of Business Schools http://charteredabs.org/
[2] http://charteredabs.org/academic-journal-guide-2015/

the four inclusion-exclusion criteria to these papers, further reducing the number to 79. Finally, we read the full text of these 79 papers and examined whether their results and insights were actually relevant to our research question. After this final screening, 42 papers were included in this study. The details of these papers are summarized in Table 3-2.

Table 3-2. List of reviewed papers

	Paper	Type of factor (dependent variables)	GSCM practices (independent variables)	Other variables	Theoretical approach	Method	Data	Region
1	(Zhu et al., 2005)	Regulation, Export Stakeholders, Internal	Internal EM, Green purchasing Customer cooperation Investment recovery Eco-design	None	Not specified	Factor analysis	Mail survey with 314 companies	China
2	(Lee, 2008)	Buyer, Government Supplier	Willingness	Control variables (CV): Firm size Age of firm	Not specified	Factor analysis	Mail survey with142 SMEs companies	South Korea
3	(Lee and Klassen, 2008)	Buyers monitoring Internal championing Regulation	Internal: product, process, organization External: purchasing, supplier External activities	None	Not specified	Content analysis	Case study with 2 large buying companies	South Korea
4	(Zhu, Sarkis, Cordeiro, and Lai, 2008)	Organization learning Management support	Investment recovery Eco-design	CV: Firm size, industry level, pressure of regulation, market, cost, suppliers	Resource-based view Institutional theory	Hierarchical regression	Mail survey with 314 companies	China
5	(Birkin et al., 2009)	Regulation, Stakeholders Social response Competitive benefit	Employee relation Environment awareness	None	Not specified	Content analysis	Survey and interview with 20 companies	China
6	(Cheung et al., 2009)	Internal External	Green supplier	None	Not specified	Content analysis	Interview with 9 companies	China
7	(ElTayeb et al., 2010)	Regulation, Customer Social Expected benefit	Green purchasing	CV: Type of industry, number of employees and suppliers, ownership, participation in green associations	Not specified	Factor analysis	Mail survey with 132 ISO-certified companies	Malaysia
8	(Cheng, 2011a)	Relationship risk	Sharing knowledge	Moderator variables (MV): Relational benefit Guanxi	Not specified	Structural equation modelling	Mail survey with 436 companies	Taiwan
9	(Lin and Ho, 2011)	Technology Organizational Environment	Green logistics	None	Not specified	Factor analysis	Mail survey with 332 companies	China
10	(Zhu et al., 2011b)	International regulation Domestic regulation	Customer cooperation Green purchasing Investment recovery	None	Not specified	Structural equation modelling	Mail survey with 379 companies	China
11	(Chan et al., 2012)	Internal External	Customer cooperation Green purchasing Investment recovery	CV: Social desirability bias Employee size Operating experience Industry type MV: Competitive intensity	Resource-based view	Path analysis	Mail survey with 194 companies	Taiwan
12	(Huang et al.,2012)	Task environment	Reverse logistics	None	Not specified	Structural equation modelling	Mail survey with 349 companies	Taiwan
13	(Lai and Wong, 2012)	Customer, Economic	Green logistic	CV: Type of ownership MV: Environment regulation	Not specified	Structural equation modelling	Survey with 134 companies	China

	Paper	Type of factor (dependent variables)	GSCM practices (independent variables)	Other variables	Theoretical approach	Method		Region
14	(Lai et al., 2012)	Customer, Economic Environment	Green logistic	None	Not specified	Structural Equation Modeling	Survey 134 companies	China
15	(Liu et al., 2012)	Internal External	Internal Green purchasing Eco-design Investment recovery	CV: Firm size Industry sector	Stakeholder theory Institutional theory	Factor analysis	Mail survey with 165 companies	China
16	(Miao et al., 2012)	Regulation, Stakeholders Business ethic, Clan culture	Supplier selection Delivery to customers Environmental protection Humanity employees Philanthropy	None	Not specified	Factor analysis	Factor analysis	China
17	(Wu et al., 2012)	Organization, Social capital, Government involvement	Green purchasing Eco-design Customer cooperation Investment recovery	CV: Firm size, Industry position MV: Market pressure Regulation pressure Competitive pressure	Social capital theory Institutional theory	Hierarchical regression	Web-Survey with 104 companies	Taiwan
18	(Yen and Yen, 2012)	Supplier, customer, regulation, environment, internal	Supplier collaboration Green purchasing	None	Not specified	Factor analysis	Mail survey with 239 companies	Taiwan
19	(Zailani et al., 2012)	Regulation, Customer	Eco-design	None	Institutional theory	Structural Equation Modeling	Mail survey with 132 ISO-certified companies	Malaysia
20	(Zhu et al., 2012a)	International Domestic Foreign-owned	ISO14001, TQEM, eco-auditing respectively	CV: ISO 9000 Firm size, state owned, industry control	Institutional theory	Logistic regression analysis	Survey with 377 companies	China
21	(Zhu et al., 2012b)	Stakeholder	Eco-labeling	None	Utilizing innovation theory	Modeling with the bass model	number of ISO 14001 firms and number of China's Environmental Label	China
22	(Guoyou et al., 2013)	Foreign customer, Foreign investor Stockholder	Green product innovation Green process innovation	CV: Industry Firm size	Stakeholder theory	Regression analysis	Survey with 4156 companies	China
23	(Hsu et al., 2013)	Regulation, community Regulation Customer Competitor Social-culture	Green purchasing Eco-design Investment recovery	None	Institutional theory	Structural Equation Modeling	Mail survey with 132 companies	Malaysia
24	(Mohanty and Prakash, 2013)	External Internal	Inbound ,outbound Compliance, ecological, technology greening Reverse logistics	CV: Firm size Firm type Natural of industry	Not specified	Multiple regression analysis	Survey with 114 companies	India
25	(Wu, 2013)	Internal Supplier Customer	Green product innovation Green process innovation	CV: Firm size MV: Demand uncertainty Technology uncertainty	Contingency theory	Hierarchical regression	Mail survey with 211 companies	Taiwan

	Paper	Type of factor (dependent variables)	GSCM practices (independent variables)	Other variables	Theoretical approach	Method		Region
26	(Ye et al., 2013)	Top manager posture	Reverse logistics	None	Institutional theory	Structural Equation Modeling	Mail survey with 209 companies	China
27	(Zhu et al., 2013a)	Domestic Institutional	ISO14001, TQEM,	CV: Firm size Foreign-owned ISO 9000	Institutional theory	Path analysis	Survey with 396 companies	China
28	(Zhu et al., 2013b)	Institutional	Internal EM, Green purchasing Customer cooperation Investment recovery Eco-design	None	Institutional theory	Logistic regression analysis	Survey with 377 companies	China
29	(Abdulrahman et al., 2014)	Management, financial Policy, infrastructure	Reverse logistics	CV: Foreign-owned Domestic company	Not specified	Structural Equation Modeling	E-mail Survey with 239 companies	China
30	(Govindan et al., 2014)	Financial, involvement and support, technology, knowledge, outsourcing	Green purchasing	None	Not specified	Analytic Hierarchy Process	Mail Survey with 103 companies	Indian
31	(Hung et al., 2014)	Structural capital Relation capital Cognitive capital	Sharing information of green practice	None	Social capital theory	Partial Least Square	Mail Survey with 160 companies	Taiwan
32	(Huo et al., 2014)	Local competitors International competitors	Internal information sharing Sharing with suppliers Sharing with customers	Firm size	Stage theory	Structural Equation Modeling	Mail Survey with 617 companies	China
33	(Lee et al., 2014)	Green bullwhip	Replace, Accommodate, Negotiate and Collaborate	None	Agency theory	Content analysis	Case study with 3 companies	South Korea
34	(Lo, 2014)	Internal, external	Intern EM, Green purchasing, eco-design, green manufacturing, green logistics	Mediator variables (MEV): Supply chain position	Not specified	Content analysis	Case study with 12 companies	Taiwan
35	(Luo et al., 2014)	Buyer-seller relationship	Green Collaboration practices	MEV: Guanxi CV: Firm type and age, number of employees	Transaction cost theory	Partial Least Square	Survey with 222 companies	China
36	(Mathiyazhagan et al., 2014)	Regulation, competition, customer, social, financial, production and operation	Green supply chain practices	None	Not specified	Analytic Hierarchy Process	Survey with 53 companies	India
37	(Mitra and Datta, 2014)	Collaboration with supplier and customer Supply chain structure-related barriers	Eco-design Green logistics	None	Transaction cost theory	Structural Equation Modelling	Survey with 82 companies	India
38	(Rauer and Kaufmann, 2014)	Environmental standards-related barriers Dynamic Capabilities	GSCM	None	Grounded theory	Grounded theory	27 interviews with experts from 10 companies	China

	Paper	Type of factor (dependent variables)	GSCM practices (independent variables)	Other variables	Theoretical approach	Method		Region
39	(Wu et al., 2014)	Attribute of strategy	Green strategy	None	Not specified	Hierarchical regression	Survey with 172 companies	Taiwan
40	(Dubey et al., 2015)	Leadership	Supplier relationship management, total quality management	MV: Institutional pressure	Institutional theory	Hierarchical regression	Survey with 187 and 174 companies	Indian
41	(Huang et al., 2015)	Internal driver External pressure	GSCM	CV: SMEs	Institutional theory	ANOVA	Mail Survey with 202 MSEs companies	China
42	(Lee, 2015)	Social capital: structural and relation	GSCM	None	Social capital theory	Structural Equation Modeling	Mail survey with 207 companies	South Korea

3.6.1 Trend of publications

Figure 3-2 shows the distribution of the papers published between 2005 and March 2015 (the cut-off date of the survey). To the best of our knowledge, the first research into influential factors for the adoption of GSCM practices in the AEE was reported by Zhu et al. (2005), who demonstrated that manufacturers in China have increased their environmental awareness owing to regulatory, competitive, and marketing drivers. However, this awareness had not been translated into the adoption of GSCM practices (Zhu et al., 2005).

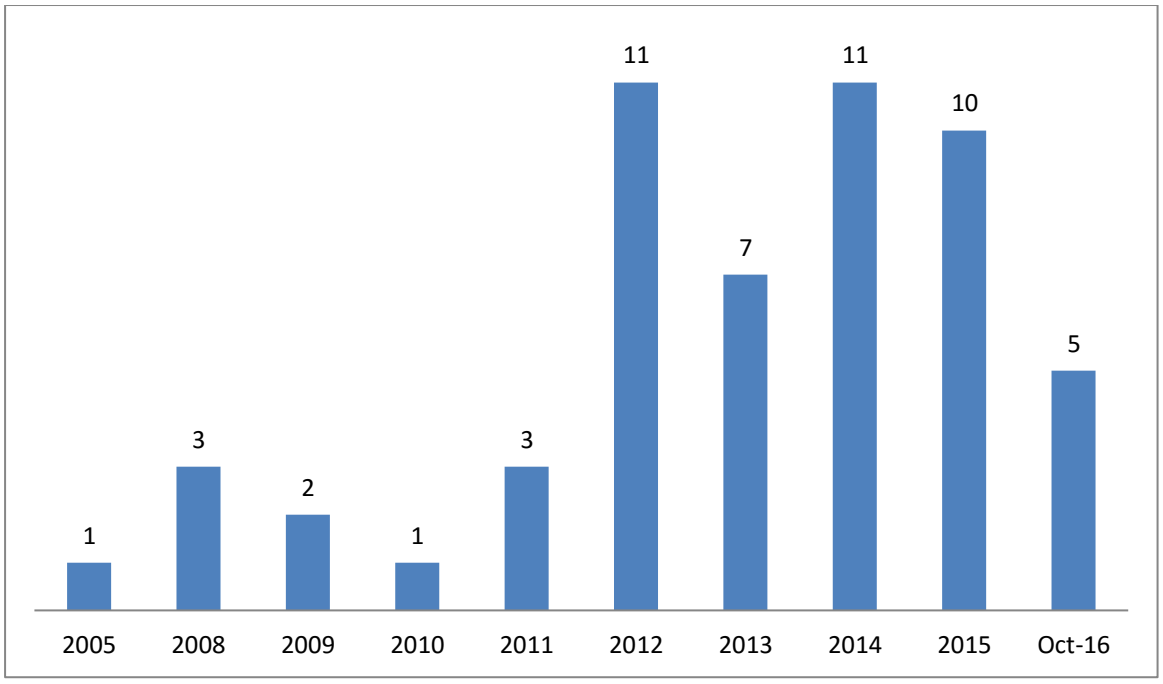

Figure 3-2.Number and distribution of reviewed papers between 2005 and March 2015

3.6.2 Geographic profiles

Figure 3-3 shows profiles of the countries studied in the papers that our survey reviewed. The majority of publications about the AEE have focused on China (21 papers) and Taiwan (9 papers), and we found no papers focused specifically on Thailand or Indonesia. Unsurprisingly, given its role as the world's new factory, the manufacturing sector in China has received the most attention (50%). This is likely due to the Chinese government's adoption of innovative industrial development approaches, such as the circular economy strategy in 2008, to balance

economic development and the environmental burden caused by its burgeoning manufacturing sector (Huang et al., 2012). In addition, these studies focused mainly on investigations of large, foreign, or state-owned manufacturing firms in China because the manufacturing sector in China is under pressure from both international and domestic forces to conserve resources and reduce their environmental impact (Zhu et al., 2010; Lai and Wong, 2012).

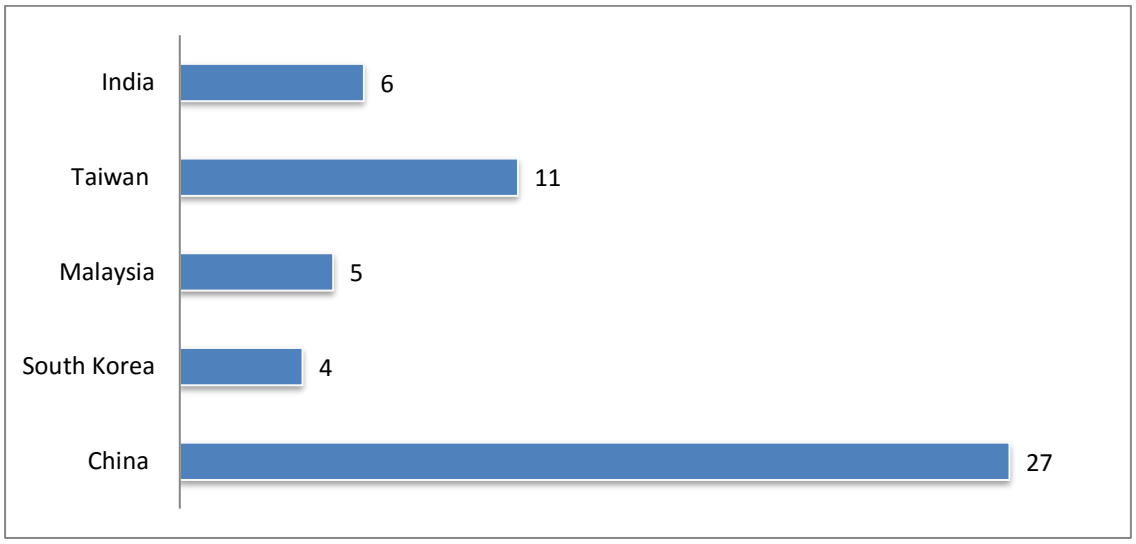

Figure 3-3.Geographic distributions of the countries which are studied in the reviewed papers

3.6.3 Publication distributions

Table 3-3 presents the CABS ranking for each of the accessed journals. Most papers on GSCM in the AEE were published by the International Journal of Production Economics (eight papers), followed by the International Journal of Operations and Production Management (five papers).

Table 3-3. Number of papers in the review by journal

Journal name	Number of papers	CABS ranking (2015)	Journal name	Number of papers	CABS ranking (2015)
International Journal of Production Economics	12	3	Production and Operations Management	2	4
International Journal of Operations and Production Management	6	4	Supply Chain Management: An International Journal	5	3
Production Planning and Control	3	3	Ecological Economics	1	3
Transportation Research, Part E: Logistics and Transportation Review	3	3	Industrial Marketing Management	1	3
Business Strategy and the Environment	3	2	Journal of Business Ethics	1	3
Corporate Social Responsibility and Environmental Management	2	1	Journal of Business Research	1	3
International Journal of Production Research	3	3	Journal of Purchasing and Supply Management	1	3
Journal of Environmental Management	2	2	Technological Forecasting and Social Change	1	3
Journal of Manufacturing Technology Management	2	1	Technology Analysis and Strategic Management	1	2
Omega	2	3	Journal of Supply Chain Management	2	3

3.6.4 Theoretical background

With regard to the theoretical approach of the reviewed papers shown in Table 3-4, it is interesting to know that 22 out 42 papers did not explicitly specify an underpinning theory in their research. Some commonly used theories were institutional theory (14 papers) and stakeholder theory (four papers). Most studies used institutional theory to identify external drivers including suppliers, customers, competitors, and regulations. The classification is not

mutually exclusive; a paper can be in more than one category based on its content (this information can also be seen in Table 3-2).

Table 3-4. Number of papers by theory

Theory	Number of papers
Not specified	22
Institutional theory	14
Resource-based view	3
Stakeholder theory	2
Social capital theory	3
Transaction cost theory	2
Innovation theory	1
Contingency theory	3
Stage theory	1
Strategic choice theory	1
Agency theory	1

Even though institutional theory is the most common underlying theory in GSCM studies; however, this study uses stakeholder theory to explain the motivation to adopt GSCM practices in China. There are two reasons why stakeholder theory is appropriate for explaining the motivational drivers for GSCM. First, stakeholders are increasingly demanding that companies in the AEE address environmental issues. Second, GSCM practices require inter-organizational collaboration with all stakeholders in a highly competitive environment (Walker and Jones, 2012). Stakeholder theory aims to identify and group the input and output environments of each company (chiefly suppliers and consumers), its competitive environment (companies that produce similar products or offer similar services), and its regulatory environment (DiMaggio and Powell, 1983; Delmas and Toffel, 2004). These stakeholder groups are thus included in this study because previous research suggests that the characteristics of specific groups impact the willingness of a focal company to adopt GSCM practices (Kassinis and Vafeas, 2006).

3.6.5 Scopes of review

Figure 3-4 illustrates the growing trend of publications that focus on at least one of the three areas among drivers, barriers, and Guanxi for the adoption of GSCM practices in AEEs. The number of studies that examined drivers for the adoption of GSCM practices showed the largest increase, growing steadily from 2005 to 2009 and even more rapidly from 2010 to 2015. The role of drivers in the adoption of GSCM practices was studied in six papers in the earlier period, perhaps because only very few AEE manufacturing companies had implemented GSCM practices at that time (Zhu et al., 2005); researchers may have wanted to identify which practices were worth adopting rather than what drove their adoption.

Drivers related to the adoption of GSCM practices showed a clear increase recently, with 33 papers published since 2010. Meanwhile, literature studying barriers to adoption began to emerge in 2013 without overlapping the research studying the role of drivers. Finally, the influence of Guanxi on the adoption of GSCM practices was only discussed in two papers after 2010 (see above), showing a lack of research progress rather than lack of progress from drivers to barriers to Guanxi compared to drivers and barriers. The overlap between Guanxi and drivers in two periods (2010–2012 and 2013–2015) suggests an inclusive relationship between Guanxi and GSCM drivers. However, while it is not clear how Guanxi is associated with the drivers of GSCM practices, further research is needed on the intersection of drivers, barriers, and Guanxi in relation to the adoption of GSCM practices in the AEE.

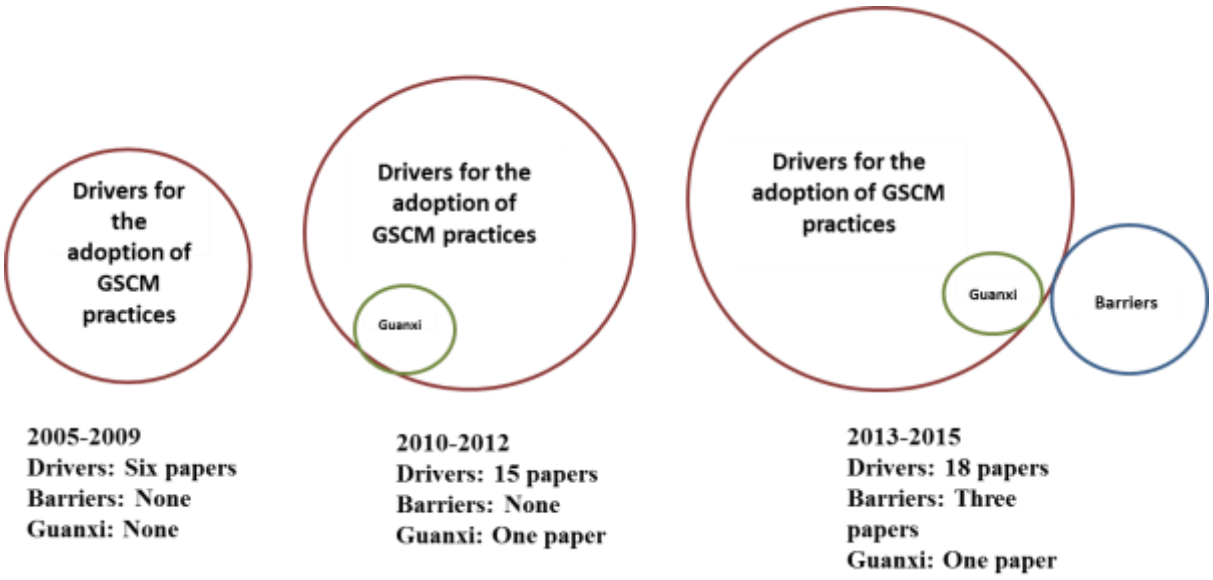

Figure 3-4.Trend of publications on the GSCM in three areas

3.7 Review results on GSCM practices in AEE

Majority of the reviewed papers discussed GSCM practices as a set of managerial practices which integrate environmental issues into SCM. These practices include internal environmental management, green purchasing, supplier selection, eco-design, customer cooperation, and investment recovery. As a pioneer in the field, Zhu et al. (2005) identifield five GSCM practices including internal environmental management, eco-design, green purchasing, cooperation with customers, and investment recovery in the Chinese textile, automobile, power generation, chemical, electrical, and electronics industries.

Only four of the reviewed papers classified GSCM practices into specific categories (Lee and Klassen, 2008; Guoyou et al., 2013; Wu, 2013; Zhu et al., 2013). Lee and Klassen (2008) and Zhu et al. (2013) categoried GSCM based practices beyong company boundaries owing to the varying degree of efforts required for implementation within the company and across the supply chain. For instance, Lee and Klassen (2008) classfield intra-organizational green activities into internal GSCM practices and green activities relating to direct collaboration with stakeholders into external GSCM practices. Similarly, Zhu et al. (2013) grouped each of the

five GSCM practices into one of two categories: internal practices that can be managed and implemented by individual manufacturers and external practices that require the cooperation of external stakeholders.

Huo et al. (2014) and Zhu et al. (2013) highlighted the positive relationship between internal practices and external practices. Specifically, Zhu et al. (2013) found that the adoption of internal GSCM practices siginificantly increased the adoption of external GSCM practices. Similarly, Huo et al. (2014) collected data from 617 Chinese manufacturing firms and indicated that information sharing within the focal company countributed to external information sharing with supply chain partners. This positive relationship can be explained by stage theory, which holds that internal practices are a prerequisite for external collaborations (Zhao et al., 2011). In this perspective, external GSCM practices requires coordination with internal environmental management through the support of top managers, and cross-functional cooperation (Zhu et al., 2013).

To reflect the focal company's direct involvement with suppliers and customers, this study classified GSCM practices into two categories: green customers' cooperation (GCC) (Hung et al., 2014; Luo et al., 2014) and green suppliers' integration (GSI) (Cheung et al., 2009; Dubey et al., 2015). The terms integration and cooperation are often used to describe a process whereby different supply chain partners are encouraged to work together toward the same goals and objectives in relation to new or existing practices (Graham and McAdam, 2016). GCC practices are those related to the direct involvement of customers, such as collaboration with customers for eco-design, packaging, transportation, reverse logistics, and information sharing (Hung et al., 2014; Luo et al., 2014). GSI practices are treated as the direct involvement of suppliers to jointly develop environmental solutions such as green purchasing (Cheung et al., 2009; Dubey et al., 2015).

3.8 Review results on GSCM and Guanxi

Guanxi has been identified as an effective tool (Peng and Luo, 2000) and as a key source of sustainable competitive advantage for doing business in the AEE (Fock and Woo, 1998; Tsang, 1998). In the SCM context, Lee and Humphreys (2007) highlighted that Guanxi had a positive role on supplier development, strategic purchasing, and the growth of integrated supplier relationships. Moreover, Liu et al. (2009) found that the strong Guanxi tie between buyers and sellers contributed to beneficially dyadic relationships. However, research on the relationship between Guanxi and GSCM practices in the AEEs is sparse. As noted above, this study only found two papers that discussed the role of Guanxi in the GSCM context. The first study, by Cheng et al. (2012), suggested that Guanxi increases the effectiveness of communication during the adoption of GSCM practices. They collected data from 436 manufacturing compnaioes in Taiwan and showed that Guanxi has a positive role in the relationship between relational risk and environment knowledge sharing with customers and suppliers. Later, Luo et al. (2014) indicated that Guanxi mediated the buyer-seller relationship and the adoption of GSCM practices. However, they also demostrated that stronger Guanxi among supply chain partners reduced the willingness of focal compnaies to adoption GSCM practices. The reason may be that focal compnaies spend too much time and money to maintain Guanxi ties with their supply chain partners tended to have less resources remaining to invest on the adoption of GSCM prctices (Luo et al., 2012).

To achieve a competitive advantage, GSCM adoption requires the collboration of all relevant supply chain parties (Zhu and Sarkis, 2004). Scholars have demonstrated the significant role of Guanxi in maintaining business relationships in the AEE (Lovett et al., 1999; Gao and Ballantyne, 2012). In this study, Guanxi refers to the cultural characteristic of interpersonal linkages between two people (Zhao et al., 2006). In the supply chain context, the Guanxi tie between a supplier's sales representatives and a buyer's procurement managers is often

considered of great importance in determining the performance of the business relationship (Barnes et al., 2011; Yen and Abosag, 2016). In this regard, the concept of Guanxi is very much embedded within the social exchange theory (Blau, 1964), which emphsied exchange of favours among personal networks. However, developing and maintaining Guanxi tie in the AEE differ from social exchanges in Western cultures. For instance, rather than immediately returning favours, the concept of Guanxi encourages people to bank a favour as saving and returns this favour when necessary (Yen et al., 2011). Moreover, in the West, social and business networks are often separated, threfore, favour exchange within one's personal network is often unrelated to business (Cai, Jun, and Yang, 2010). However, people in the AEE are often considering their work is part of the 'extended self' (Guo et al., 2010). Therefore, the exchange of favours is often practiced in one's business and personal networks, resulting in a substantial blurring of any ostensible line between the two. Consequently, the concept of Guanxi in AEE countries tends to have a meaningfully stronger effect on business transactions than social exchange theory does in the West.

Manufacturers have paid substantial attention to the anticipated reaction of their customers owing to the sensitive nature of exchanging favours with supply chain partners in the AEE (Zhao et al., 2008). For instance, if a customer's procurement manager places an order with a focal company, the sales representative of the focal company will be expected to respond with a gift, favour, or concession to that customer. If such reciprocity is not honoured over time, the Guanxi dyad established between the company's sales representative and the customer's procurement manager will become strained, thereby damaging the business relationship between the focal firm and the customer (Lee et al., 2001) and leading to poor financial performance (Yen and Abosag, 2016).

3.9 Hypothesis development on stakeholders' drivers

By using stakeholder theory, we identified four types of stakeholders whose behaviours can drive the adoption of GSCM: customer requirements, supplier advice on GSCM practices, communities' pressures, and competitor actions. The stakeholder theory is considered appropriate for explaining the forces of GSCM in this study for two reasons. First, stakeholders are increasingly demanding that companies in China address and manage environmental issues. Second, GSCM practices require inter-organizational collaborations with all stakeholders in a highly competitive environment (Walker and Jones, 2012). In this regard, the stakeholder theory aims to group and identify the company's input and output environments (suppliers and product consumers), competitive environment (companies producing similar services or products), and regulatory environment (DiMaggio and Powell, 1983; Delmas and Toffel, 2004). Thus, these stakeholder groups are included in this study, as previous research suggests that the characteristics of specific groups impact the willingness of the focal company to adopt GSCM practices (Kassinis and Vafeas 2006).

3.9.1 Suppliers' advices

The relationship between suppliers' advices on the adoption of GSCM practices showed contradictory results in the literature reviewed. Seven found that advices from suppliers on adopting GSCM practices had a positive effect on the adoption of GSCM practices (Huang et al., 2015; Huang et al., 2012; Hung et al., 2014; Wu et al., 2012; Yen and Yen, 2012; Zhu et al., 2005; Zhu et al., 2012). For instance, Huang et al. (2012), Wu et al. (2012), and Yen and Yen (2012) indicated that closer relationships with suppliers provided more opportunities for knowledge sharing, thereby assisting companies in recombining and utilizing their required resources. Thus, Zhu et al. (2005) suggested that the adoption of both GCC and GSI practices can be promoted by suppliers' advices. However, Miao et al. (2012) found that supplier advices did not significantly affect green logistics practices at Chinese manufacturing companies. More

specifically, they found that supplier advices were related solely to corporate philanthropy. One of the possible explanations is that most firms surveyed in their study were relatively large in terms of size and domestic sales. In this respect, Zhu et al. (2007a) demonstrated that most large and successful enterprises are facing intense environmental pressures from the action of their suppliers. Another reason may be that suppliers are located at upstream of the supply chain and could not really be defined as a driving force (Huang et al., 2015). In this way, focal frims are perfer to collaborate with customers to achieve more effective GSCM practices (Walker et al., 2008). Nevertheless, we consider supplier advice to be a driver froce due to that they have the power to encourage the willingness of adopting GSCM practices (Carter and Dresner, 2001). Therefore, this study proposes the following hypotheses:

H1a. Suppliers' advices have a positive effect on the adoption of GCC practices.

H1b. Suppliers' advices have a positive effect on the adoption of GSI practices.

3.9.2 Customers' requirements

As one of the major stakeholders, customers have significant pressure for sustainability and environmental performance from the focal company (ElTayeb and Zailani, 2009). The reviewed articles showed that AEE manufacturers that deal with customers from Western countries had a higher willingness to meet consumers' social expectations and norms (Lin and Ho, 2011; Miao et al., 2012). This may be because many theAEE manufacturers are suppliers for large multinational corporations (MNCs) based in Western countries; pressure from these MNCs could be the most effective way to improve GSCM practices in the AEE (Anbumozhi and Kanda, 2005). For example, shoes produced in Fujian from Southeast China could not be exported to Japan and European countries because the glue used when manufacturing those shoes did not meet these countries' environmental requirements (Zhu et al., 2010). Moreover, some in developed countries have started to assess the environmental certification of their

suppliers and second-tier suppliers in the AEE (ElTayeb et al., 2010). From this perspective, the requirements of international customers, particularly from Western countries, for green products have become one of the most significant factors that force companies to adopt GSI practices.

In addttion, the younger generations of Chinese customers are more aware of the environmental impact of products, production processes, and raw materials; they have begun to exhibit a purchasing preference for their domestic green products (Zhu et al., 2011a). Similarly, Hsu et al. (2013) also found that although the environmental awareness of customers in Malaysian are generally lag behind European and Japanese consumers, however, younger Malaysian consumers are developing heightened environmental awareness and often prefer products with green components. Such purchasing behaviours from young customers may motivate domestic companies to adopt GSCM practices for their long-term benefit. Therefore, this study proposes the following hypotheses:

H2a. Customers' requirements have a positive effect on the adoption of GCC practices.

H2b. Customers' requirements have a positive effect on the adoption of GSI practices.

3.9.3 Communities' pressure

Communities are becoming increasingly important in encouraging the adoption of GSCM practices in the AEE (Birkin et al., 2009). Here, 'communities' refers to organizations or persons involved in the compnany's operations indirectly but with professional knowledge of the compnany (Nelson et al., 1999). Notwithstanding this growing importance, the studies reviewed indicated a limited focus on communities as GSCM drivers. Only four studies mentioned that communities may influence decision-making regarding the adoption of GSCM practices (Guoyou et al., 2013; Liu et al., 2012; Mohanty and Prakash, 2013; Zhu et al., 2013). Guoyou et al. (2013), Liu et al. (2012), and Zhu et al. (2013) found that community pressure

alone could not drive munuafcuring firms to adopt GSCM practices in China. The reason may be that the most common role for communities is to complain about illegal activities related to environmental issues rather than to lobby for proactive efforts like GSCM practices (Guoyou et al., 2013). Another reason may be that environmentally oriented communities remain in their infancy in AEE and lack the social, legal, and political support that they generally have in many Western nations (Liu et al., 2012). However, communities are becoming increasingly important as GSCM practices are adopted in other developing countries. For instance, Mohanty and Prakash (2013) conducted a survey in India and found that communities are the major reason for companies adopting GSCM practices. Therefore, this study considers community pressure as a reason for companies in China adopting GCC and GSI practices. Therefore, this study proposes the following hypotheses:

H3a. Communities' pressures have a positive effect on the adoption of GCC practices.

H3b. Communities' pressures have a positive effect on the adoption of GSI practices.

3.9.4 Competitors' actions

Miao et al. (2012) observed that competitors' pressures did not affect the adoption of GSCM practices in China. The reason for this difference might be that the relatively large size and sales of Chinese firms make them less susceptible to influence by their competitors (Wu et al., 2012). However, the literature showed that the AEE manufacturing sector often learns from successful competitors in the same industry (Lee et al., 2013) to gain a competitive advantage in the global market (Birkin et al., 2009; Huang et al., 2012; Liu et al., 2012). In this respect, Huo et al. (2014) demonstrated that most large and successful enterprises in Taiwan are facing intense environmental pressure from their competitor actions. Hsu et al. (2013) found that environmental pressures from competitors were also intense in Malaysia, especially among large companies. Large companies in Malaysia have learned how to evaluate their immediate,

second-tier, and third-tier suppliers from leading multinational firms operating in the same industry, which motivates focal companies to adopt GSCM practices (Hsu et al., 2013).

Furthermore, Lee et al. (2013) and Zhu et al. (2013) found that competitor actions encouraged organizations to learn about the actions of successful competitors in the same industry. In this regard, previous literature indicates that Chinese manufacturing companies often learn from their competitors to gain competitive advantages in the global market (Huang et al., 2012). For instance, joint ventures in China adopted GSI practices because their parent companies in Western countries achieved benefits from such adoption (Zhu et al., 2013).Therefore, this study proposes the following hypotheses:

H4a. Competitors' actions have a positive effect on the adoption of GCC practices.

H4b. Competitors' actions have a positive effect on the adoption of GSI practices.

3.10 Hypothesis development on supply chain barriers

There is a growing interest in examining the factors that hinder the adoption of GSCM practices (Govindan, 2014). Previous studies on barriers in developing countries focused on the Indian context. Luthra et al. (2011) identified 11 barriers hindering GSCM adoption from an Indian perspective. Mathiyazhagan et al. (2014) conducted an analytical hierarchy approach study in the Indian manufacturing sector with 26 barriers. Similarly, Govindan et al. (2014) identified 47 barriers through a questionnaire-based survey in India. According to González-Torre et al. (2010), barriers are factors that hinder the implementation of GSCM. Based on the reviewed papers, we grouped supply chain barriers into two categories: perceived high costs and complexity of regulations.

3.10.1 Perceived high costs

According to Govindan et al. (2014) and Abdulrahman et al. (2014), the perceived high costs of environmental adoption is another key barrier that hinders GSCM adoption. Govindan et al. (2014) found that Indian manufacturing industry it was unable to fulfil its economic needs; therefore, it did not spend enough to implement both GCC and GSI practices. Similarly, Abdulrahman et al. (2014) argued that high costs and lack of financial return were the major barriers for green reverse logistics in the Chinese manufacturing industry. GCC and GSI practices may be regarded by managers as difficult to implement and of lower priority than other initiatives that offer more tangible financial returns on investment (Zilahy, 2004). Moreover, as GCC and GSI practices can easily be imitated, it is often questioned whether these practices actually create value for customers and contribute to either competitive advantage or financial performance (González-Torre et al., 2010). In summary, we propose the following hypotheses:

H5a. Perceived high costs have a negative effect on the adoption of GCC practices.

H5b. Perceived high costs have a negative effect on the adoption of GSI practices.

3.10.2 Complexity of regulations

A number of studies also indicated that the complexity of regulations can hinder the adoption of GSCM. For example, Rauer and Kaufmann (2014) found that international firms from developed countries often have stringent environmental requirements for their upstream suppliers in emerging economies. Similarly, Abdulrahman et al. (2014) indicated that, unlike foreign-owned companies in China, domestic companies consider the lack of enforceable laws as a major barrier that hinders the adoption of GSCM principles. In line with this argument, bureaucracy has also been cited as a barrier to adopting GSCM (González-Torre et al., 2010; Zilahy, 2004). Bureaucratic barriers include situations in which special permissions and

rezoning are needed to develop GSCM infrastructures. In summary, we propose the following hypotheses:

H6a. Complexity of regulations has a negative effect on the adoption of GCC practices.

H6b. Complexity of regulations has a negative effect on the adoption of GSI practices.

3.11 Hypothesis development on the moderating role of Guanxi

As we discussed in previous sections, organizations tend to adopt GSCM practices with pressure from stakeholders when they perceive that their adoption of environmentally friendly practices will add value to Guanxi ties and further their collaborative business performance (Luo et al., 2012). Nonetheless, it would be difficult for a company to ignore the pressure from stakeholders perceived to be significant to the company's Guanxi ties (Cheng, 2011), because it affects a company's willingness to maintain a long and positive relationship with its stakeholders (Gwinner et al., 1998).

Suppliers often provide extended information to focal companies (Tsang, 2002). Good Guanxi ties may help focal companies take advice from suppliers to implement GSCM practices. In this regard, the amount of advice that focal companies can acquire from suppliers depends on their suppliers' willingness to share (Paiva et al., 2008). Suppliers may want to keep their unique information from focal companies to maintain their own competitive advantages in the market (Zhou et al., 2014). However, when the suppliers have good Guanxi ties with the managers in focal companies, they are more likely to engage in information sharing in a much more spontaneous manner. Therefore, good Guanxi ties help improve the opportunities for taking valuable advice from suppliers on the adoption of GCC and GSI practices.

Moreover, although there is no specific literature discussing the moderating role of Guanxi in suppliers' advice on the adoption of GCC practices, this study still argues that better Guanxi

ties will strengthen this relationship. Luo et al. (2008) justified this finding by suggesting that focal companies can use their strong Guanxi ties with suppliers to influence customer orientation, which may subsequently influence the adoption of GCC practices. Specifically, strong Guanxi ties with suppliers help focal companies understand market conditions and customer needs (Tsang, 1998). In the regard, strong Guanxi ties between focal companies and their suppliers enable managers to create a better plan for responding to customers' needs and market conditions. Moreover, this access also enables focal companies to respond promptly to market changes and customer needs with regard to green products and green practices (Paiva et al., 2008). From this perspective, along with timely information about real customer needs, focal companies could more effectively cooperate with customers for adopting GCC practices.

Consequently, we propose the following hypotheses:

H7a. The effect of suppliers' advices on the adoption of GCC practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

H7b. The effect of suppliers' advices on the adoption of GSI practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

We argued that customers' requirements would encourage the adoption of GSCM practices. However, this positive effect may become stronger when moderated by Guanxi ties. The reason is that maintaining good Guanxi ties with suppliers requires focal companies to allocate additional responsibilities and to dedicate more resources (Lechner et al., 2010). In this situation, maintaining good Guanxi ties with suppliers distracts focal companies from their customers and reduces their effort of diverting resources into GSCM practices. Moreover, strong Guanxi ties may reduce companies' motivations to meet customer requirements (Villena

et al., 2011). In contrast, Luo (2015) indicated that a close relationship between a focal company and its suppliers could improve efficiencies in meeting customer needs by collaborating with suppliers for demand forecasting. Similarly, Frohlich and Westbrook (2001) argued that material transfer from the focal companies to the customers must be supported by information flow in the whole supply chain. Therefore, building strong Guanxi ties with suppliers would help focal companies build stronger platforms for better communication with customers. In addition, given that China is an international production base, suppliers often have a better understanding of the demands and preferences of international customers than do the focal companies themselves (Cao, 2015). Therefore, establishing Guanxi ties may improve interactions with customers in the international market. The following hypotheses have been developed to address this:

H8a. The effect of customers' requirements on the adoption of GCC practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

H8b. The effect of customers' requirements on the adoption of GSI practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

Although there is no specific literature addressing Guanxi's role in the relationship between communities' pressures and focal companies' adoption of GSCM practices, this study still argues that better Guanxi ties will strengthen this relationship, for two reasons. First, previous research has highlighted that various community activities contribute to the understanding of advanced practices for focal companies (Guoyou et al., 2013; Liu et al., 2012). A good Guanxi tie between focal companies and their suppliers provides a better ability to enhance knowledge-sharing and trust-building (Zhan et al., 2016), which may eventually enhance the adoption of

GSCM practices by focal companies when they are subjected to community pressure. Second, owing to underdeveloped market structures, poorly specified property rights, and unstable formal institutions, Guanxi often governs business transactions in China (Cai and Yang, 2014). In this regard, a focal firm with stronger Guanxi ties is more likely to adopt GSCM practices for fear of risking its multiple Guanxi ties or damaging its established long-term relationships owing to non-compliance. Therefore, while pressures facilitate a focal firm's adoption of GSCM practices, good Guanxi ties may further enhance this effect. It is thus hypothesized that:

H9a. The effect of communities' pressures on the adoption of GCC practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

H9b. The effect of communities' pressures on the adoption of GSI practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

The behavioural theory supports the argument of the role of Guanxi on the relationship between competitor actions and adoption of GSCM practices (Cheng et al., 2012; Luo et al., 2014). The basic argument of the behavioural theory is that when companies face a problem, they will search for solutions to resolve it (Cyert and March, 1963). When a manufacturing company perceives increased competitors pressure, it would like to identify the movements of these competitors in advance. However, it is difficult for a manufacturing company to find out the strategic moves of its competitors (Cao, 2015). Therefore, companies are usually very cautious about communicating with their competitors to avoid leaking strategy and technology information. However, companies are more willing to share their evaluations with suppliers. Therefore, good Guanxi ties with suppliers will help focal companies to obtain timely information about their competitors' moves (Cao, 2015). Moreover, it is impossible for a

manufacturing company to implement GSCM practices merely by imitating competitor actions; Chinese manufacturing companies will encounter difficulty in adopting GSCM practices if their supply chain partners are unwilling to likewise conform to these practices (Luo, 2015). In this regard, focal companies may convince their suppliers to collaborate in the adoption of GSCM practices through good Guanxi ties. Therefore, we propose the following hypotheses:

H10a. The effect of competitors' actions on the adoption of GCC practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

H10b. The effect of competitors' actions on the adoption of GSI practices is moderated by Guanxi such that the positive association will become stronger when a high level of Guanxi is present.

We also propose that Guanxi will moderate the negative relationship between the perceived high costs and the adoption of GSCM practices. First, Wiegel and Bamford (2014) indicated that by having appropriate Guanxi ties with GSCM partners, providers can also reduce the transaction costs involved. Therefore, focal firms will naturally find it easier to seek funding support from others to reduce the high cost of adopting GSCM. On the other hand, firms with low levels of Guanxi are considered less resourceful; this may further delay their adoption of GSCM practices owing to their lack of funding support.

Guanxi is considered a key asset in China because it underpins reputations and provides social control (Granovetter, 1992). When companies perceive high costs for the adoption of GSCM practices, good Guanxi ties could increase their confidence in the potential collaboration with customers and suppliers (Park and Luo, 2001). Opportunistic behaviours are not accepted with Guanxi norms (Zhao et al., 2008); with strong Guanxi ties, opportunistic behaviours are reduced because they contradict the interests of the respective organizations (Park and Luo,

2001). From the perspective of social exchange theory, Guanxi facilitates communication and understanding between focal companies and their supply chain partners. Therefore, strong Guanxi ties in China function as a safeguard that provides control for business collaborations (Zhao et al., 2008).

Moreover, Park and Luo (2001) argued that strong Guanxi ties could afford more benefits for businesses in China than transactional relationships. When a focal company collaborates with its customers and suppliers with strong Guanxi ties for the adoption of GSCM practices, it believes that doing so is important enough to warrant the efforts. Therefore, although the adoption costs are high, the company may be willing to sacrifice short-term benefits to achieve long-term gains through these Guanxi ties (Zhao et al., 2006; Zhao et al., 2008). In summary, we propose the following hypotheses:

H11a. The effect of perceived high costs on the adoption of GCC practices is moderated by Guanxi such that the negative association will become weaker when a high level of Guanxi is present.

H11b. The effect of perceived high costs on the adoption of GSI practices is moderated by Guanxi such that the negative association will become weaker when a high level of Guanxi is present.

Different countries will obviously have varying opinions about the barriers against GSCM implementation (Mathiyazhagan et al., 2014). In contrast to developed countries, most business markets in developing countries are governed by socio-political institutions such as governments, business groups, nongovernmental organizations, and local communities (Zhao et al., 2008). Because developing countries suffer from unstable and unreliable regulation systems, Chinese manufacturers tend to obtain their legitimacy by using their Guanxi network in the local government to deal with the complexity of regulations (Chen et al., 2011). To some

extent, Guanxi reflects the degree of success in the Chinese market (Park and Luo, 2001). Wang et al. (2016) found that government intervention and Guanxi are two of the most powerful institutional factors in China. The dynamic and rapid changes in China have led to the development of these complex social norms, as well as of complicated and opaque legal systems (Salmi, 2006; Su et al., 2009; Zhuang et al., 2014).

Therefore, we propose that Guanxi will moderate the negative relationship between the complexity of regulations and the adoption of GSCM practices. First, Guanxi is already extremely common in China. Thus, companies in China often rely on their Guanxi ties to acquire valuable information on the adoption of GSCM practices (Luk et al., 2008). Second, to reduce the negative impact of the complexity of regulations on GSCM practices, strong Guanxi ties may facilitate communications, negotiations, coordination, and information exchange (Zhuang et al., 2014) when focal companies collaborate with their customers and suppliers. In short, strong Guanxi ties could help manufacturing companies to better understand and clarify regulatory requirements. In summary, we propose the following hypotheses:

H12a. The effect of the complexity of regulations on the adoption of GCC practices is moderated by Guanxi such that the negative association will become weaker when a high level of Guanxi is present.

H12b. The effect of the complexity of regulations on the adoption of GSI practices is moderated by Guanxi such that the negative association will become weaker when a high level of Guanxi is present.

3.12 The research framework

The above hypotheses are integrated into the research framework shown in Figure 3-5, which outlines the critical relationships among significant GSCM dimensions.

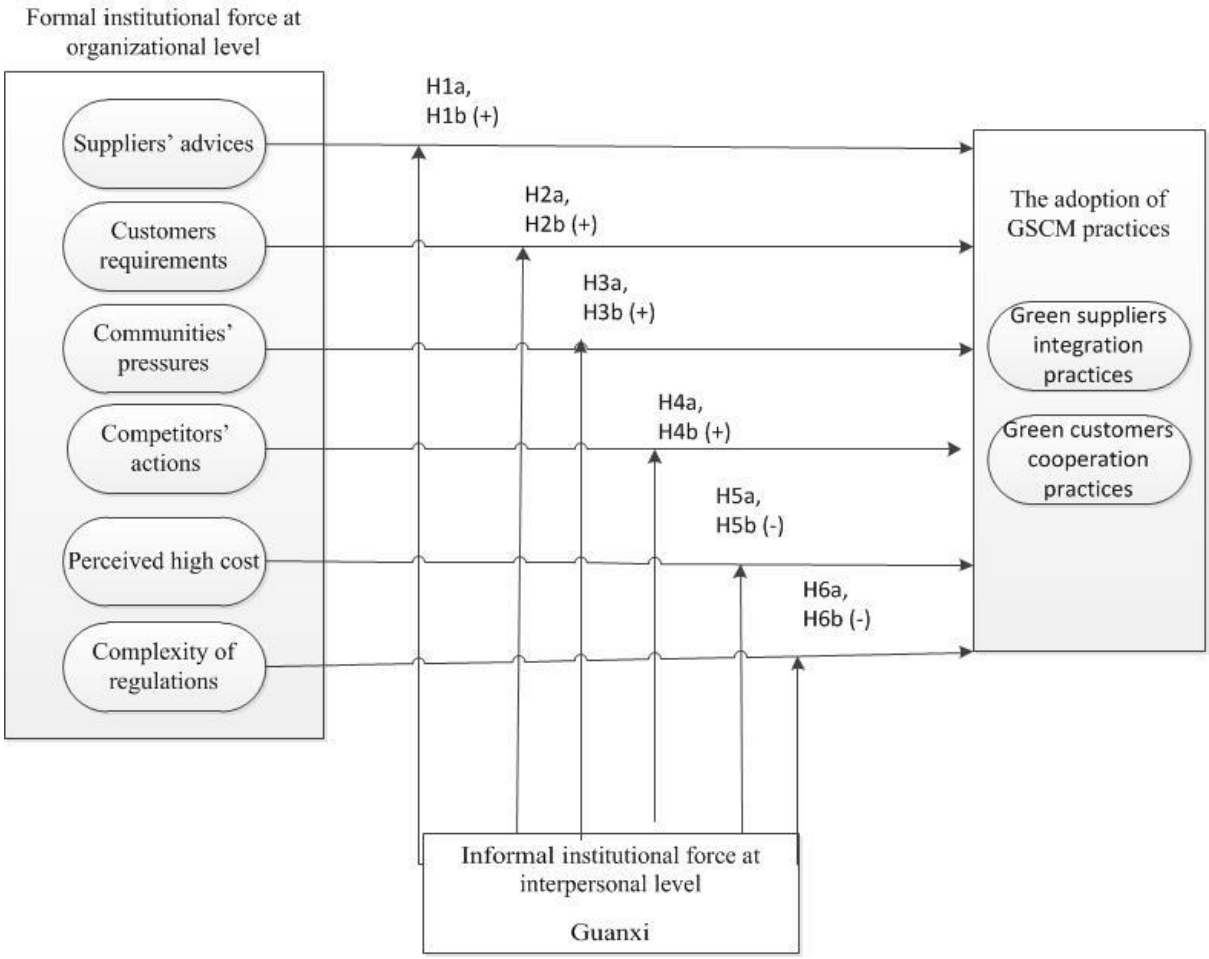

Figure 3-5.The conceptual framework

3.13 Summary

This chapter presented a systematic review of literature on GSCM in AEE. Based on the literature review, a research framework was developed, including the effect from stakeholders' drivers and supply chain barriers on the adoption of GSCM practices. Furthermore, hypotheses were developed based on the moderating of Guanxi. Moreover, two core theories, stakeholder theory and social exchange theory, were used to guide and support the development of hypotheses.

Chapter 4: Research methodology

4.1 Introduction

The previous chapter described the development of a conceptual framework along with a list of hypotheses that were developed on the basis of a systematic literature review. This current chapter describes the methodology used in this study. The aim is to identify the most suitable methodology to validate the proposed conceptual framework. Thus, one requires a proper understanding of how to conduct the empirical work and why particular procedures were selected in the study to obtain valid findings. To facilitate this understanding, this chapter describes different research philosophies, approaches, strategies, and methods and justifies the methodology adopted in this study.

4.2 Research philosophy

The research philosophy refers to the manner in which a researcher determines how research should be conducted to develop the nature of knowledge (Collis and Hussey, 2014). Knowledge development is useful from the viewpoint of understanding a particular problem in a specific research context. In this regard, two main research philosophies are explained in this section: positivism and interpretivism (Bryman and Bell, 2007). Positivism refers to independent instruments that researchers can use to objectively describe and measure properties of social reality and beyond (Bryman and Bell, 2011). According to Collins and Hussey (2014), positivism is based on a few principles such as the facts or cause-effect relationships in social science. In this regard, in the social sciences, positivism is a quantitative approach that can be applied to test theories and hypotheses to increase our understanding of human attitudes and behaviours (Bryman and Bell, 2011).

Whereas positivism assumes that everything can be explained through models and quantitative analysis, interpretivisim explains phenomena by circumstances (Collis and Hussey, 2014). Interpretivism acknowledges the differences among people and objects in the social and natural

sciences (Bryman and Bell, 2011). Therefore, it requires the research to grasp the subjective meaning of social science to reflect these differences (Collis and Hussey, 2014). As a result, interpretivism assumes that people interact with their own subject and then co-create knowledge through their interactive dialogue (Orlikowski and Baroudi, 1991). Within this paradigm, researchers use a qualitative approach to understand social phenomena. Given that the present study is focused on measuring a social phenomenon based on an empirically validated conceptual model consisting of hypotheses, interpretivism is an unsuitable approach, as discussed in the next section.

Table 4-1 summarizes the features of these two different philosophies, as given in Collis and Hussy (2014, p. 62). Both philosophies have positive and negative effects on research. Therefore, it is essential to define both philosophies to select the most appropriate philosophy to conduct this research.

Table 4-1.Main features of positivism and interpretivism

Positivism	**Interpretivism**
Most likely to be used with quantitative data	Most likely to be used with qualitative data
Employs large samples	Employs small samples
Focuses on hypothesis testing	Focuses on hypothesis and theory generation
Data is highly specific and precise	Data is rich and subjective
Findings are reliable and precise based on low validity and high reliability	Findings are reliable and precise based on high validity and low reliability
Results can be generalised to population from sample	Results can be generalised from one setting to another

Source: Collis and Hussy (2009, p. 62)

4.2.1 Rationale for adopting positivism

After considering the different assumptions underlying positivism and interpretivism, we selected the philosophy of positivism for this study. First, according to the ontological assumption which is concerned with the theory of reality regardless of our knowledge of it, this study is concerned with the nature of reality, like whether the relationship between stakeholders' drivers and the adoption of GSCM practices exists regardless of our awareness of its existence. Therefore, it requires a social fact. Second, the exploration of a relationship by researchers does not have any effect on the existence of the presence of the relationship (Bryman and Bell, 2011), which, in this study, is the relationship between stakeholders' drivers and supply chain barriers for the adoption of GSCM practices. Third, researchers can choose which philosophy to use based on the need for compatibility between the philosophy and the nature of research and the research problem (Collis and Hussey, 2014). Accordingly, in the context of the present study, positivism is consistent and supportive given the fact that the aim of this research is to validate the proposed theoretical framework and hypotheses empirically.

4.3 Research approach

Because we have adopted the positivism paradigm in this study, we need to decide which research approach to use in this study. Typically, two main research approaches are employed by researchers: quantitative and qualitative (Collis and Hussey, 2014).

4.3.1 Quantitative and qualitative approaches

The quantitative approach is associated mostly with positivism, which primarily attempts to test a theory to increase the predictive understanding of a phenomenon (Saunders et al., 2016). Moreover, quantitative approaches emphasise quantification in data collection and analysis (Bryman and Bell, 2011). As shown in Figure 4-1, a quantitative study typically has six stages: (1) theory selection, (2) hypothesis development, (3) data collection, (4) results, (5) hypotheses confirmation or rejection, and (6) revision of theory (Bryman and Bell, 2011).

Figure 4-1. Six stages of deductive approach

Source: Bryman and Bell (2011, p. 11)

In contrast, qualitative studies are associated with interpretivism, where researchers focus on the collection and analysis of opinions, words, and viewpoints rather than statistical data (Collis and Hussey, 2014). Qualitative research is associated with the inductive approach, where a new theory results from a research (Collis and Hussey, 2014). In the inductive approach, a researcher observes a specific phenomenon to generate a new theory (Bryman and Bell, 2011). The main differences between the quantitative and qualitative approaches are presented in Table 4-2, as referred from Saunders et al. (2016).

Table 4- 2.Quantitative and qualitative approaches in relation to this study

Areas	Quantitative	Qualitative	Present study
Characteristics	Examines the relationship between variables that are measured numerically and analysed statistically	Studies participant's meanings and their relationships by using a variety of data collection techniques to develop a new theory	Quantitative
Role of theory in Research	Deductive	Inductive	Deductive
Research philosophy	Positivism	Interpretivism	Positivism
Research strategy	Experimental surveys	Case study, grounded theory, narrative research, and ethnography	Experimental surveys

Source: Saunders et al., (2016, p. 127)

As shown in Table 4-2, Saunders et al. (2016) made a clear distinction between quantitative and qualitative approaches in four categories: characteristics, role of theory in research, research philosophy, and research strategy. This study adopted a quantitative approach, as discussed in the following section.

4.3.2 Rationale for adopting quantitative approach

Collis and Hussey (2014) demonstrated that a research approach should be selected based on the aim and objectives of the research project. The present study aimed to develop a conceptual framework with hypotheses to explain the adoption of GSCM practices based on existing

literature. The proposed conceptual framework aims to examine the empirical relationship between independent and dependent variables. Therefore, we adopted a quantitative approach for analysing the collected data to test the hypotheses (Saunders et al., 2016).

There are several reasons for adopting a quantitative approach. First, from a methodological perspective, the present study developed hypotheses from existing literature to explain causal relationships between independent and dependent variables. Second, from the ontology perspective, this study is concerned with the nature of reality. Therefore, the researcher is required to objectively observe the adoption of GSCM (Saunders et al., 2016). Finally, in line with the positivist approach, the phenomena associated with GSCM practices can be validated by observations and by measuring social phenomena (Saunders et al., 2016). Moreover, the quantitative approach supports the use of large samples to improve the generalisability of empirical results, which is an additional reason to select it for this research (Saunders et al., 2016). To sum up, given the nature of this research, the positivist approach with deductive and quantitative methods is more relevant than the interpretivism approach with inductive and qualitative methods.

4.4 Research design

This research attempts to examine exogenous independent variables such as drivers and barriers with endogenous variables for the adoption of GSCM practices and the role of Guanxi in the manufacturing sector in AEE. Toward this end, according to Saunders et al. (2016), a research design that refers to the general plan of the answer of the selected research question would be suitable. This would provide the researchers with a detailed plan that would guide them in completing their study. The detailed plan should consist of a clear objective based on the research questions, specify the sources of data collection, and list the methods used for data analysis and ethical issues (Saunders et al., 2016). The research plan employed herein comprises three stages: research design, data collection, and data analysis.

As shown in Figure 4-2, in the first stage of the research design, we conducted a systematic review of relevant articles published in CABS-ranked journals pertaining to GSCM in the manufacturing sector in AEE to identify the needs and research questions. A conceptual model was developed based on the 42 reviewed papers, and 10 hypotheses were formulated. Then, we selected a survey as the research method based on the positivism philosophy with the quantitative approach, as justified in the preceding section. With regard to the second stage of data collection, we conducted a pilot study and checked the reliability and validity of the questionnaire. We then amended the questionnaire suitably to arrive at the final questionnaire. Then, we conducted the data collection stage, which yielded 420 complete survey responses. Finally, in the third stage of data analysis, we used CB-SEM to analyse the collected data and test the theoretical relationships that informed the research framework.

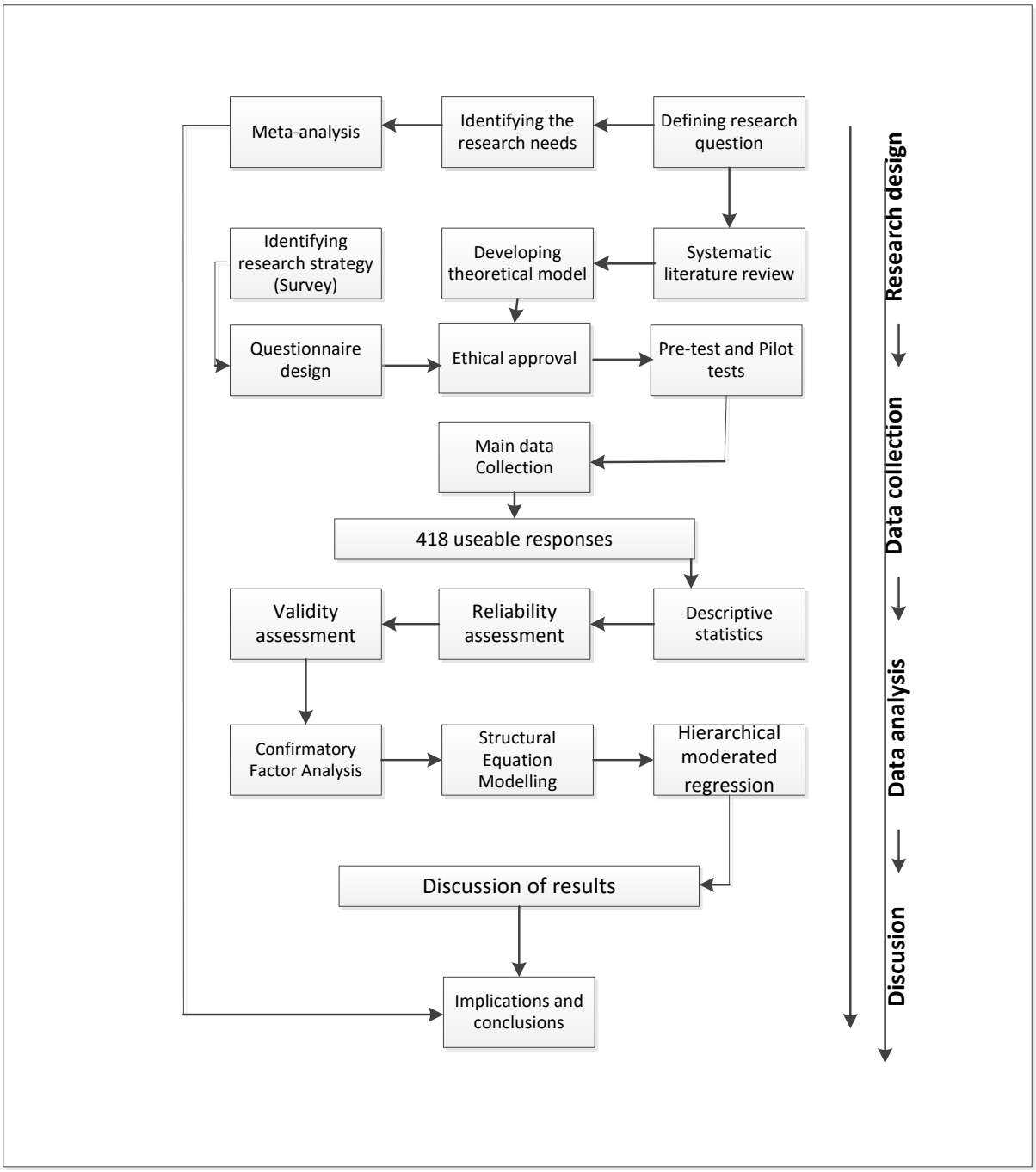

Figure 4-2.Research plan

4.5 Surveys

Surveys are an economical way of collecting data from a sample from the viewpoint of analysing the results statistically and generalizing them to a population (Collis and Hussey, 2014). Surveys are often linked to positivism and the deductive approach, which attempt to test theories or hypotheses, leading to their confirmation or revision/rejection (Bryman and Bell, 2011). There are several possible reasons for employing the survey method. First, it is helpful

for obtaining straightforward information from respondents (Bryman and Bell, 2011). Second, this method is inexpensive when obtaining data from a large sample (Collis and Hussey, 2014). A number of data collection methods can be used for surveying: postal, Internet-based self-completion questionnaires, and telephone and in-person interviews (Collis and Hussey, 2014). The face-to face method is suitable for participant and researchers with plenty of time (Saunders et al., 2016). Therefore, this method is not suitable for the present research because of time and cost considerations, given the large and geographically widespread sample (Collis and Hussey, 2014).

Using telephone interviews to conduct surveys allows one to collect large data with low cost (Saunders et al., 2016). However, the telephone method might lead to bias in terms of restricting the sample to persons who choose to respond in this way (Collis and Hussey, 2014). Therefore, this method is also not suitable as the main method for the present study; nonetheless, we did use it as a supporting method. To encourage responses, we made reminder phone calls a week after sending the survey to the contact persons at the surveyed companies to elicit responses from the participants who had not answered. The detailed plan is shown in Figure 4-3.

<table>
<tr><th>Week 1</th><th>Week 2</th><th>Week 3</th><th>Week 4</th><th>Week 5</th><th>Week 6</th><th>Week 7</th><th>Week 8</th><th>Week 9</th><th>Week 10</th></tr>
<tr><td colspan="2">Pilot study Launched</td><td colspan="2">Pilot study data collection and analysis</td><td>Reflect update on pilot result</td><td>Main survey launched</td><td colspan="3">Reminder phone calls</td><td>Stop data collection</td></tr>
</table>

Figure 4-3.Data collection timeline

In this study, we employed an online questionnaire survey for data collection. The term ‘online’ refers to internal surveys hosted on a website. Participants can be recruited from potential participant databases available with search agencies or panel management companies (McDaniel and Gates, 2011). We selected this method because it allowed us to target a large

sample with low cost and high speed (Collis and Hussey, 2014). Furthermore, from the participants' viewpoint, it is convenient because they can freely fill in the questionnaire at any time (Bryman and Bell, 2011).

Online survey tools include the use of pop-up instruction boxes, dropdown menus, and choice of colour and font (Saunders et al., 2016). Furthermore, graphical images, animations, and links on the survey website can be customised based on the survey topic (McDaniel and Gates, 2011). A well thought out visual layout and optimum website design could enhance the participants' experience (McDaniel and Gates, 2011), thereby yielding better committed responses. Furthermore, online questionnaire surveys can also be conducted using mobile devices. Smartphones and tablets offer many possibilities for data collection in terms of both portability and immediacy, without placing temporal or spatial limitations (Gray, 2014). Such devices help researchers to reach and engage with participants who may be difficult to access via other forms of survey (McDaniel and Gates, 2011). Furthermore, online questionnaire surveys have been used widely in literature (Bryman and Bell, 2011). Table 4-3 summarises the advantages and disadvantages of online surveys.

Table 4-3. Advantages and disadvantages of online surveys

Advantages	**Disadvantages**
Speed: relatively quicker than other methods	Sampling frames: researchers do not know whether participants are really representative of the target population
Cost: no printing, stationery, and postage costs	Access to the web: researchers may not be able to engage participants to access the survey website
Response quality: design features can make surveys more appealing and interesting	Technical problems: virtually no uniform standards for online surveys exist

Source: Collis and Hussey (2014, p. 174)

There are three important stages in conducting a survey: sampling, data collection, and instrument development (Collis and Hussey, 2014). Sampling aims to generalize a finding from a chosen smaller group of a population to the entire population (Gray, 2014). Data collection refers to choosing a suitable method such as postal or Internet self-completion questionnaires

and telephonic and in-person interviews (Collis and Hussey, 2014). Instrument development aims to elicit quality information to answer the research questions.

4.6 Sampling strategy

Sampling involves determining a suitably sized sample within a population because collecting data from the entire population is practically impossible (Hair et al., 2010). A sample is a representative part of a population, whereas a population is defined as the universe of units from which a sample is selected (Saunders et al., 2016).

4.6.1 Population

The population of this study includes manufacturing companies in China. Herein, the manufacturing industry includes companies that produce goods for use or sale by using labour and machines, tools, and chemical and biological processing or formulation (Zhu et al., 2011b). There are two reasons for conducting this survey in the manufacturing sector in China. First, China is a global production base, exporting a wide variety of merchandise and accounting for 40% of the worldwide manufacturing outputs of different products (Zhu et al., 2011b). Moreover, China is currently the world's largest and fastest-growing emerging economy. However, China has paid a high price for environmental issues, equivalent to 8% of its annual gross domestic product (Zhao et al., 2007). Second, environmental management has been observed to be a critical factor affecting the prosperity of Chinese manufacturing enterprises. In particular, China contains seven of the world's 10 most polluted cities, and it is the world's largest and second-largest producer of ozone-depleting substances and greenhouse gas emissions, respectively (Birkin et al., 2009). The continued environmental deterioration and resultant heightened regulatory control and public scrutiny, as mentioned, have posed new operating challenges to firms conducting business in China. These challenges make the country an ideal setting to conduct this study.

4.6.2 Sampling

There are two approaches for sampling: probability and non-probability. Probability sampling is often adopted when each unit in the population has a known chance of being selected; the non-probability approach is used in the exploratory phase and/or pre-testing of survey questionnaires (Saunders et al., 2016). Table 4-4 shows the differences between probability and non-probability sampling approaches (Saunders et al., 2016).

Table 4-4.Differences between probability and non-probability sampling approaches

Probability (random) sampling	Non-probability (non-random) sampling	This study
Can be generalized to the population defined by the sampling frame	Cannot be generalized beyond the sample	Result needs to be generalized to the population
Allows use of statistics, tests, and hypotheses	Exploratory research, generates hypotheses	Hypotheses tests
Can estimate population parameters	Population parameters are not of interest	Estimate population parameters
Eliminates bias	Adequacy of the sample cannot be known	Eliminate bias
Must have random selection of units	Cheaper, easier, and quicker to carry out	Ensure random selection of units

Source: Saunders et al. (2016, p. 118)

We employed probability sampling herein given the need to test hypotheses by statistical tests and to draw inferences about the population. In particular, the primary goal of a quantitative approach is to collect a sample that can represent a population. The sample in this study includes manufacturing firms located in major eco-industrial parks in China. These companies were selected because they are likely to have started adopting GSCM practices (Zhu and Geng, 2013; Huo et al., 2014). This is because the eco-industrial parks were developed based on the concept of circular economy, and they use ISO14001 certification as a management approach. Moreover, the term ‘firm’ refers to companies as well as individual units or sites within companies. Therefore, the unit of analysis herein is the individual firm.

The researchers identified companies from national-level eco-industrial parks by accessing the official website of the Ministry of Environment Protection of the People's Republic of China. Table 4-5 shows 26 national-level eco-industrial and ISO-14001 demonstration industrial parks.

Table 4-5. List of eco-industrial parks (ISO 14001 parks given in Tables 4-6, 4-7, 4-8, and 4-9)

Location	**Name of park**
Jiangsu province	Suzhou Industrial Park
	Suzhou Hi-tech Industrial Zone
	Wuxi New District eco-industrial Park
	Yangtze River International Chemical Industrial Park
	Yangzhou Economic-Technological Development Area
	Park of Zhonggu Economic Development District of Changzhou
	Jiangyin Torch Hi-Tech Industrial Development Zone
Tianjin	Tianjin Economic-Technological Development Area
	Binhai Hi-tech Industrial Development Area
Shandong province	Yantai Economic & Technological Development Area
	Weifang Binhai Economic-Technological Development Area
	Rizhao Economic and Technological Development Area
	XiangGuang eco-industrial park
	Linyi Economic and Technological Development Area
Hunan province	Changsha Economic & Technical Development Zone
Zhejiang province	Ningbo Economic & Technical Development Zone
	Kunshan Economic & Technical Development Zone
Shanghai	Shanghai Xinzhuang industrial park
	Jinqiao export processing zone
	Caohejing Hi-Tech Park
	Shanghai Chemical Industrial Zone
	Zhangjiang Hi-Tech Park
	Minhang Economic & Technical Development Zone
Beijing	Beijing Economic-Technological Development Area
Guangdong province	Guangzhou Economic & Technical Development Zone
Liaoning province	Shenyang Economic & Technical Development Zone

Source: Ministry of Environment Protection of the People's Republic of China

As shown in Figure 4-4, Jiangsu, Shandong, Shanghai, and Guangdong are the four provinces selected for this study because they represent different levels of economic development and geographical diversity. Shandong is an industrial area in East China. Guangzhou is located in the affluent Pearl River Delta (in southern China), which is a major industrial zone that accounts for one-third of China's export trade value (Zhu et al., 2013). Shanghai and Jiangsu

are located in the Yangtze River Delta (in eastern China), and both provinces are characterised by a high degree of economic development. This geographical choice allowed us to cover China's most polluted areas, which have attracted much attention from Chinese environmental agencies (Liu, 2014).

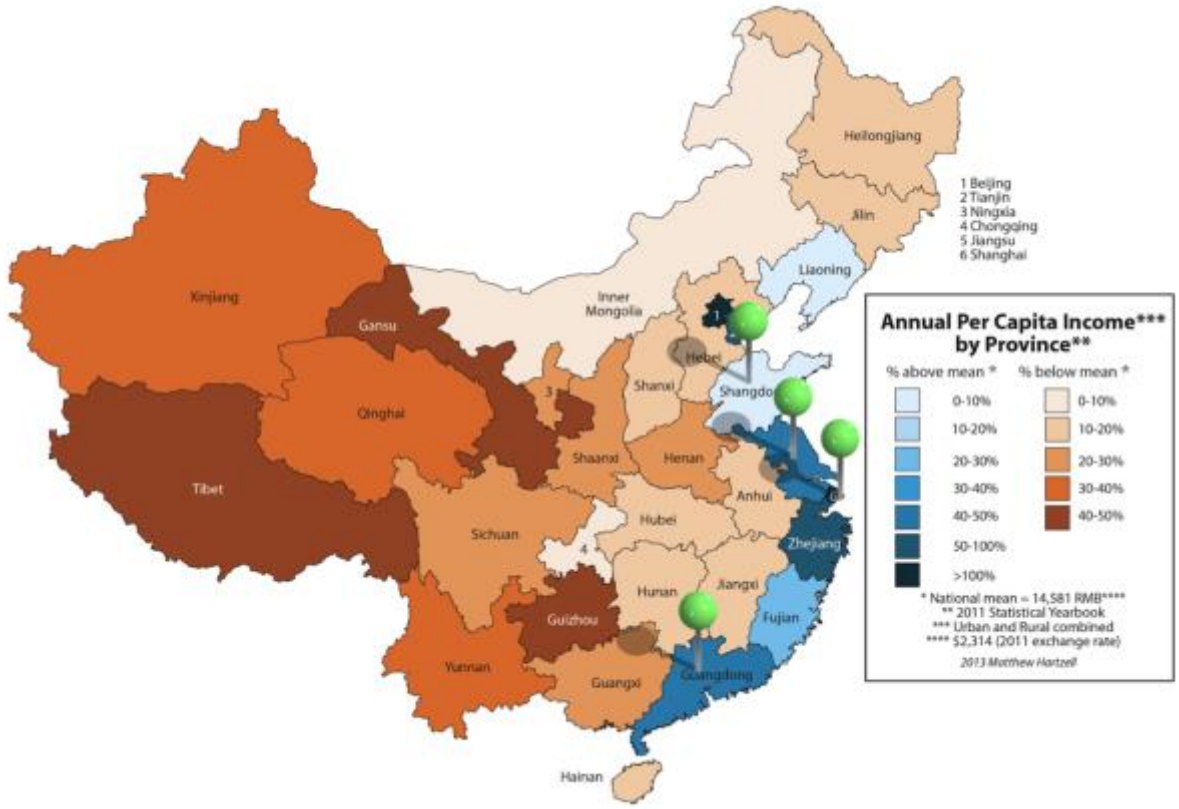

Figure 4-4.Selected provinces (Source: Haztell (2014))

In this study, the sampling frame is identifiled after the determination of the population and sampling techinique (Collis and Hussey, 2014). A sampling frame is 'the listing of all units in the population from which the sample will be selected' (Bryman and Bell, 2007, p. 182). The sampling frame in this study is companies listed in the four identified provinces. We could not find the lists of registered companies from the official websites of Yangzhou Economic-Technological Development Area, Park of Zhonggu Economic Development District of Changzhou, and Jiangyin Torch Hi-Tech Industrial Development Zone. Therefore, four out of seven eco-industrial parks with accessible contact lists were selected from Jiangsu province. Table 4-6 lists the accessible source for each industrial park.

Table 4-6. Selected parks in Jiangsu province

Location	Name	Certification of park	Accessible sources	Sourced from
Jiangsu province	Suzhou Industrial Park	ISO-14001	List of 351 ISO-14001-certified companies	Official website
			Lists of 102 companies on the Fortune Global 500 list	
			List of all registered companies (2021 companies)	
	Suzhou Hi-tech Industrial Zone	ISO-14001	List of 273 ISO-14001-certified companies	Local environmental protection bureau official website
			List of 75 circular economy pilot companies	
			List of 132 cleaner production companies	
			List of 88 companies on the Fortune Global 500 list	Official website
			List of all registered companies (1230 companies)	
	Wuxi New District eco-industry Park	ISO-14001	List of 60 companies on the Fortune Global 500 list	Official website
			List of all registered companies (560 companies)	
	Yangtze River International Chemical Industrial Park	ISO-14001	List of 40 world-leading chemical companies	Official website
Total companies: 4932 (as on 26/08/2015)				

Two industrial parks were chosen from Shandong province because Rizhao Economic and Technological Development Area, XiangGuang Eco-industrial Park, and Linyi Economic and Technological Development Area have not listed registered companies on their websites. Table 4-7 shows the accessible sources of the two industrial parks selected from Shandong province.

Table 4-7. Selected parks in Shandong

Location	Name	Certification of park	Accessible sources	Sourced from

Shandong province	Yantai Economic & Technological Development Area	ISO-14001	List of 700 exporting companies	Local custom website
	Weifang Binhai Economic-Technological Development Area	ISO-14001	List of 62 'key' companies	Official website
Total companies: 762 (as on 26/08/2015)				

We selected four industrial parks from Shanghai. Jinqiao export processing zone was not selected because its website does not list registered companies, whereas Zhangjiang Hi-Tech Park mainly hosts software development companies. Information about the selected industrial parks is given in Table 4-8.

Table 4-8. Selected parks in Shanghai

Location	**Name**	**Certification of park**	**Accessible sources**	**Sourced from**
Shanghai	Shanghai Xinzhuang industrial park	ISO-14001	List of 99 ISO-14001-certified companies	Official website
			List of all registered companies (350 companies)	
	Caohejing Hi-Tech Park	ISO-14001	List of 32 ISO-14001 certified company	Official website
			List of all registered companies (1301 companies)	
	Shanghai Chemical Industrial Zone	ISO-14001	List of 17 cleaner production companies	Official website
	Minhang Economic & Technical Development Zone	ISO-14001	List of 42 cleaner production companies	Official website
Total companies: 1841 (as on 26/08/2015)				

As shown in Table 4-9, one industrial park was selected from Guangdong province.

Table 4-9. Selected parks in Guangdong

Location	Name	Certification of park	Accessible sources	Source form
Guangdong province	Guangzhou Economic & Technical Development Zone	ISO-14001	List of all registered companies (458 companies)	Official website

This study first tried to identify all contact details from the lists on the official websites of each industrial park. However, in most cases (10 out of 11 industrial parks), email addresses were unavailable in the official lists. Therefore, the 'Sanjintong' database was used to obtain the listing of all manufacturing companies in the selected industrial parks. This database was chosen because it includes detailed information about companies listed in the local yellow pages and on major B2B websites (Alibaba and HC360). In addition, this database has details about key personnel (senior manager and purchasing manager), including their names, titles, phone numbers, and email addresses. As shown in Table 4-10, this study identified 2143 companies across the 11 industrial parks from the 'Sanjintong' database.

Table 4-10. Data from 'Sanjingtong' database

Industrial park	Number of companies with detailed information
Suzhou Industrial Park	504
Suzhou Hi-tech Industrial Zone	252
Shanghai Xinzhuang Industrial Park	157
Caohejing Hi-Tech Park	210
Wuxi New District Eco-industry Park	80
Yangtze River International Chemical Industrial Park	68
Shanghai Chemical Industrial Zone	55
Minhang Economic & Technical Development Zone	25
Yantai Economic & Technological Development Area	342
Guangzhou Economic & Technical Development Zone	440
Weifang Binhai Economic-Technological Development Area	82
Total number	2143 (as on 26/10/2015)

Finally, we randomly sent emails to 1000 companies across the 11 industrial parks. For random selection, we used the website 'randomizer' (https://www.randomizer.org) to identify unique numbers.

The detailed plan is summarised in Table 4-11.

Table 4-11. Data collection plan

	Action	Time
Step 1	Download information about all 2143 companies from the 'Sanjingtong' database	1 h
Step 2	Get a set of 1000 unique numbers between 1 and 2143 using Randomiser website	1 h
Step 4	Send email to contact persons of the selected 1000 companies	2 days
Step 5	Make reminder phone calls after 10 days	2 days

To reduce common method bias, we constructed a two-part questionnaire. Part I focused on the organizational characteristics, antecedents for GSCM adoption, and adoption of GSCM practices. Part II focused specifically on Guanxi. Part I targeted persons holding top positions

in the supply chains of the companies and possessing good knowledge of the companies' internal and external processes, such as supply chain managers, CEOs/presidents, vice presidents, and marketing and purchasing directors. People in top management positions usually play vital roles in the design of environmental policy (Chan, 2010). As for Part II, purchasing managers were required to answer questions about Guanxi because Guanxi refers to personal networks, and purchasing managers are highly connected with their suppliers and would thus be the most knowledgeable about the focal firm's ties with and acquisition of specific knowledge from suppliers (Luo et al., 2014; Zhou et al., 2014).

4.6.3 Control variables

For firm size, we adopted the guide provided by the Chinese Ministry of Industry and Information Technology: firms with more than 1000 employees were considered large, those with 1000–300 employees were considered medium, those with 300–20 employees were considered small, and those with fewer than 20 employees were considered micro. For ownership type, this study adopted the categorization used by Zhu et al. (2012), who confirmed a positive relationship between the types of ownership and the adoption of GSCM practices: foreign owners or joint ventures, private domestic manufacturers, and state-owned enterprises. Finally, for supply chain position, this study followed the classification provided by Van Hoek (1999): upstream, midstream, and downstream. Considering the control variables of firm size, ownership, and supply chain position indicated that most of the selected industry parks (except Yangtze River International Chemical Industrial Park and Shanghai Chemical Industrial Zone) comprise various companies of different sizes, ownership types, and manufacturing focus.

4.7 Sample size

It is important to determine the sample size to reflect the population after selecting a sampling approach. The sample size should be large enough to address the research question and to represent the population fairly (Collis and Hussey, 2014). We used CB-SEM to analyse the

conceptual framework, and this method warrants a large sample size. A minimum sample size of 200 is required to guarantee SC-SEM (Hair et al., 2010). We identified a total of 2143 companies. Saunders et al. (2016,p.118) indicated that for a population of 2000, at 95% confidence level, the sample size should be 322. Therefore, based on this argument and the use of the CB-SEM technique, the sample size required is 300–400.

4.7.1 Backup plan

If an adequate sample cannot be collected in the first round of data collection, the process summarized in Table 4-11 must be repeated.

4.8 Questionnaire development

To achieve a good response rate with reliable and valid responses, questionnaire design requires extra care because data can typically be collected only once (Collis and Hussey, 2014). Considering this, it is important to design a user-friendly questionnaire to ensure that the response rate is high. Bryman and Bell (2011) have made a few recommendations on user-friendly questionnaire design, such as creating acctractive layout, keeping short length , having clear instructions and providing a covering letter for the questionnaire.

Accordingly, we designed the questionnaire carefully to be user-friendly to obtain reliable and valid data for empirical testing. The questionnaire contains five sections: companies' general information and control variables, adoption of GSCM practices, drivers for the adoption of GSCM practices, barriers to adoption of GSCM practices, and Guanxi among companies and their supply chain partners.

There are two types of questions in a questionnaire: closed and open (Collis and Hussey, 2014). Closed questions are widely used in positivistic studies because such questions are answered by choosing alternatives from a predetermined list (Collis and Hussey, 2014). We used closed questions to facilitate easier and quicker responses. Rating questions (e.g. Likert-type questions)

and categorical questions were included in this questionnaire. All rating questions were based on a five-point scale to elicit a range of opinions from the participants.

4.9 Research instrument and measurement scale

In the literature review chapter, we described the development of the hypotheses to be tested empirically in this study. Measurement scales were selected to examine the drivers of, barriers to, and Guanxi in relation to GSCM practices. Churchill (1979) suggested two steps to develop measurement scales. First, measurement scales can be adopted from previous research to ensure content validity. Second, the measurement items for each construct were selected by literature reviews for the generation of measurement scales. The measurement items in this study were adopted from a systematic review of sustainability, SCM, and social science literature on GSCM practices in the AEE.

In this study, a total of nine constructs—customers' requirements, suppliers' advices, communities' pressure, competitors' actions, GSI practices, GCC practices, perceived high costs, complexity of regulations, and Guanxiwere formed along with 45 measurements. In survey questionnaires, a Likert scale is commonly used to measure perception and attitudes (Saunders et al., 2012). Therefore, we used the Likert scale (Bryman and Bell, 2011) for rating the questions or for collecting respondents' opinions. A five-point rating scale was used in this study: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4= agree, and 5 = strongly agree. We used a five-point rating scale because five points tend to give a good balance between having adequate points of discrimination without providing too many response options (Bryman and Bell, 2011).

4.9.1 Measurement scale for adoption of GSCM practices

GSCM practice adoption can be grouped into two categories: GCC practices and GSI practices. Table 4-12 summarises the measurement scale for GCC practices. Six items were adopted to measure these practices. The items were adopted from Zhu et al. (2005) and Wu et al. (2012).

Table 4-12.Measurement scale for GCC practices

Variable	Item code	Items	References
Customer cooperation practices	CC1	Company cooperates with customers for eco-design (eco-design is a practice that aims to reduce the environmental impact of a product over the product lifecycle)	Zhu et al. (2005)
	CC2	Company cooperates with customers for cleaner production (cleaner production is a practice that aims to minimize waste and emissions and maximize product output)	
	CC3	Company cooperates with customers for green packaging (green packaging reduces environmental impact and ecological footprint during the development and use of packaging)	
	CC4	Company cooperates with customers for using a lower amount of energy during product transportation	Wu et al. (2012)
	CC5	Company cooperates with customers for using a lower amount of energy during production	
	CC6	Company provides logistics service to facilitate product returns by customers	

Table 4-13 summarises the measurement scale for GSI practices. Six items were adopted to measure these practices. The items were adopted from Zhu et al. (2005), ElTayeb et al. (2010), Wu et al. (2012), Yen and Yen (2012), and Hung et al. (2014).

Table 4-13.Measurement scales for GSI practices

Variable	Item code	Items	References
Supplier integrati	SI1	Company ensures that purchased products do not contain environmentally undesirable items such as lead or other hazardous or toxic materials	Zhu et al. (2005)

on practices	SI2	Company collects information about its suppliers' environmental aspects, activities, and/or management systems	Wu et al. (2012)
	SI3	Company runs an environment audit programme to test first-tier suppliers' environmental management	ElTayeb et al. (2010)
	SI4	Company runs an environment audit programme to test second-tier suppliers' environmental management	
	SI5	Company requires suppliers to have a standard environmental management certification such as ISO 14001	Zhu et al. (2005), Hung et al. (2014)
	SI6	Company conducts frequent face-to-face meetings with key suppliers for tackling environmental issues	Yen and Yen (2012)

4.9.2 Measurement scale for stakeholders' drivers

There are four categories of stakeholder drivers related to the adoption of GSCM practices: suppliers, customers, communities, and competitors. As shown in Table 4-14, four items were adopted to measure suppliers' advices. These items were adopted from Zhu et al. (2005) and Miao et al. (2012).

Table 4-14.Measurement scale for suppliers' advices

Variable	**Item code**	**Items**	**References**

Supplier advice	SU1	Supplier's advices in developing environmentally friendly goods affects company's adoption of GSCM practices	Zhu et al. (2005)
	SU2	Supplier's advice in developing environmentally friendly production affects company's adoption of GSCM practices	
	SU3	Supplier's advices in developing environmentally friendly packaging affects company's adoption of GSCM practices	
	SU4	Company has environmental partnerships with suppliers	Miao et al. (2012)

Table 4-15 shows the measurement scale for customer requirements. Five items were adapted to measure customers' requirements. These items were adopted from Lee (2008), Lai and Wong (2012), and Miao et al. (2012).

Table 4-15.Measurement scale for customers' requirements

Variable	**Item code**	**Items**	**References**
Customer requirements	CU1	Customers provide company with environmental training, education, or technical assistance	Lee (2008)
	CU2	Company's major customers would not consider company as a qualified supplier if company did not meet their environmental performance requirements, e.g. product does not contain recyclable or reusable content	
	CU3	Company receives requirements from consumer associations to be more environmentally conscious	Lai and Wong (2012)
	CU4	Company's major customers frequently encourage the company to adopt GSCM practices	
	CU5	Company's customers are one of the important reasons pushing the company to pursue environmental management	Miao et al. (2012)

To measure communitycommunities' pressures, we adopted three items, as listed in Table 4-16. These items were adopted from ElTayeb et al. (2010), Liu et al. (2012), Ye et al. (2013), and Zhu et al. (2013).

Table 4-16.Measurement scale for community pressure

Variable	**Item code**	**Items**	**References**
Community pressure	CM 1	There is a general belief in the company's industry that adopting GSCM practices can help achieve business objectives in a better way	ElTayeb et al. (2010), Liu et al. (2012)
	CM 2	Neighbouring communities put pressure on our companies about the environmental impact of the company's activities	
	CM 3	Media follow the company's industry closely with respect to environmental issues	Ye et al. (2013)

As shown in Table 4-17, four items were adopted to measure competitors' actions. These items were adopted from ElTayeb et al. (2010), Hsu et al. (2013), and Ye et al. (2013).

Table 4-17.Measurement scale for competitors' actions

Variable	**Item code**	**Items**	**References**
Competitor actions	CP1	Successful firms in company's industry adopt GSCM practices	ElTayeb et al. (2010)
	CP2	GSCM practices are generally considered to provide considerable marketing benefits in the company's industry	Hsu et al. (2013)
	CP3	Competitors' earlier implementations of GSCM practices provide a benchmark and guidance for company's adoption of GSCM practices	
	CP4	Competitors have strong influence on company's adoption of GSCM practices	Ye et al. (2013)

4.9.3 Measurement scale for barriers to adoption of GSCM practices

There are two categories of barriers to adoption of GSCM practices: perceived high costs and complexity of regulations. As shown in Table 4-18, five items were adopted to measure perceived high costs. These were adopted from Min and Galle (2001) and Govindan et al. (2014). In the current study, the scale for the perceived high cost of adoption of GSCM practices changed as follows: not very costly, not costly, normal, costly, and very costly. For instance, the original question was 'the cost of switching to the new system is very high'. In our study, this question was modified to 'please indicate the cost of switching to the new system' to avoid the influence of negative questions on respondents' opinions.

Table 4-18.Measurement scale for barrier of perceived high costs

Variable	**Item code**	**Items**	**References**
Perceived high costs	HC1	Please indicate the initial capital costs of implementing GSCM	Min and Galle (2001)
	HC2	Please indicate the costs of dealing with disposal of hazardous waste	
	HC3	Please indicate the costs of recruiting extra personnel for environment purposes	
	HC4	Please indicate the costs of adopting GSCM practices compared with return-on-investment	Govindan et al. (2014)
	HC5	Please indicate the costs of switching to the new system for adoption of GSCM practices	

To measure the complexity of regulations, six items were adopted, as shown in Table 4-19. These were adopted from Abdulrahman et al. (2014), Chen et al. (2011), and Liu (2014). The current study changed the scale for the complexity of regulations for the adoption of GSCM practices as follows: not very complex, not complex, normal, simple, and very simple. This avoided the influence of negative questions on respondents' opinions.

Table 4-19.Measurement scale for complexity of regulations

Variable	Item code	Items	References
Complexity of regulations	CR1	Laws, regulations, and directives on environment	Abdulrahman et al. (2014)
	CR2	Economic policy support from government for solving environmental issues	
	CR3	Environmental policy support from government	
	CR4	Level of economic support from government for resolving environmental issues through the legal approach	Chen et al. (2011)
	CR5	Level of regulatory support from government for resolving environmental issues through the legal approach	Liu (2014)

4.9.4 Measurement scale for Guanxi

As shown in Table 4-20, five items were adopted to measure Guanxi based on relations and favours. These items were adapted from Cheng (2011), Yen et al. (2011), and Luo et al. (2014). The current study changed the scale for the Guanxi as follows: not very often, not often, normal, often, and very often/not very close, not close, normal, close, and very close/and not very important, not important, normal, important, and very important to avoid the influence of negative questions on respondents' opinions.

Table 4-20.Measurement scale for Guanxi

Variable	Item code	Items	References
Guanxi	GX1	Rate the frequency of an annual dinner or other social activities between you and your supplier	Cheng (2011)
	GX2	Rate the level of relationship between you and your supplier	
	GX3	Rate the importance of your feelings toward your supplier before making important purchasing decisions	Luo et al. (2014)
	GX4	Rate the level of help you would provide to your supplier when he/she is in need	Yen et al. (2011)
	GX5	Rate the frequency of you and your supplier doing favours for each other.	

As a result, 45 items in nine constructs were included for data collection by survey and analysis.

4.9.5 Non-response bias

According to Collins and Hussy (2014), checking for non-response ensures that the results of respondents are the same as those of the people who declined to participate in the survey. It aims to generalise the research findings to the population from which the sample was drawn, despite part of the sample did not respond to the questions (Collins and Hussy, 2014). Toward this end, early respondents and late respondents are compared of the data set.

4.10 Questionnaire translation

To gather accurate data from the Chinese manufacturing sector, it was necessary to translate this survey questionnaire from English to Chinese. Most old managers in China were not familiar with English because they did not learn English in school. Consequently, this questionnaire would have been inaccessible to most managers in Chinese manufacturing companies.

4.10.1 Back translation method

We adopted a back-translation method, as recommended by Harkness et al. (2004). This method required us to translate the items in the questionnaire back and forth between English and Chinese until both versions converged. This process required three different people for questionnaire translation, review, and adjudication. Translation requires skilled practitioners; questionnaire review needs a person' with language abilities as good as those of the translator and familiarity with the study topic; and adjudication requires a person who can make decisions for the final version.

Moreover, questionnaire development in this study occurred over three stages. First, translation from English to Chinese was provided by a skilled and experienced practitioner. This translation was corrected and verified by a specialist, who was a bilingual person working in SCM at Brunel University. Next, the Chinese version of the questionnaire was translated back

to English by a bilingual student other than the author from Brunel University. Thus, two similar English versions of the questionnaire were generated.

4.10.2 Pre-test approach

Although we took care to ensure accurate translation, pretesting was required to avoid nonsensical answers (Bryman and Bell, 2011). Therefore, we applied the random-probe technique suggested by Messick (1980). This approach selects random questions from the questionnaire and asks respondents to explore whether they understood the actual meaning of the questions. In doing so, we invited seven bilingual (English and Chinese) candidates to answer the questionnaire. All items were investigated by administering both the English and the Chinese versions of the questions to the seven respondents. The result of pre-testing demonstrated that the Chinese questionnaire was comprehensible to Chinese respondents.

4.11 Pilot testing

As shown in Table 4-21, it is important to conduct a pilot test before using a questionnaire for data collection. The purpose of the pilot test was to refine the questionnaire and enable the researcher to assess the validity and the reliability of the questions (Saunders et al., 2016). Validity refers to the process of seeking advice from experts on the representativeness and suitability of the questionnaire, whereas reliability is related to the consistency of responses to questions (Saunders et al., 2016).

Table 4-21.Purpose of pilot test

Purpose	Applicable to this study
Testing questionnaire wording	Yes
Testing questionnaire sequencing	Yes
Testing questionnaire layout	Yes
Gaining familiarity with respondent	No
Testing and training fieldworkers	No
Estimating response rate	Yes
Estimating questionnaire completion time	Yes
Testing analysis procedure	Yes

Source: Ticehurst and Veal (2000, p. 151)

We first validated the questionnaire by consulting two supply chain experts from Brunel University. Both respondents were asked about the clarity of the instructions, their opinions, and whether the layout was clear and attractive. Then, a pilot study was conducted in July 2015 based on the revised questionnaire. According to Bryman and Bell (2011), maximise the benefits of the pilot test, it is recommended to compose a small group of participants who resemble the population from which the sample for the complete study will be drawn.. Therefore, 100 questionnaires were distributed to companies located in Suzhou industrial park, one of the sampling areas. Table 4-22 shows the sampling strategy for the pilot test.

Table 4-22.Sampling strategy for pilot study

	Action	Time
Step 1	Download list of 15000 manufacturing companies in Suzhou	1 h
Step 2	Search for keyword “Suzhou industrial park” in the entire list, get 2000 results	1 h
Step 3	Get a set of 100 unique numbers between 1 and 2000 from Randomiser: 829, 352, 1948, 1349, 1984, 1796, 1145, 245, 171, 563, 71, 789, 1944, 776, 732, 1326, 425, 1244, 1021, 1697, 722, 3, 165, 1402, 1246, 1605, 385, 316, 1906, 1722, 611, 1060, 623, 272, 1638, 569, 1770, 2, 1195, 280, 200, 1212, 677, 1378, 1053, 1931, 914, 1227, 973, 1828, 1955, 509, 905, 1312, 1515, 1367, 406, 1457, 429, 705, 825, 763, 1720, 1526, 1668, 595, 130, 502, 1194, 958, 1506, 9, 279, 118, 1570, 715, 410, 1558, 353, 1407, 1187, 1003, 197, 153, 1594, 656, 1823, 180, 1019, 888, 1174, 1160, 36, 641, 479, 1124, 1792, 1422, 445, 170	1 h
Step 4	Send emails to contact persons of the selected 100 companies	1 day
Step 5	Make reminder phone calls after five days	2 days

After the above process, 52 responses were collected to check the clarity of the questionnaire. We ensured that each respondent had no problem with understanding or answering the questions in the pilot study. Then, the reliability of the items loading on the same construct was tested in terms of internal consistency, as shown in Table 4-23.

Table 4-23.Reliability Statistics

Construct name	Cronbach's alpha	Number of items
Customer cooperation practices	.792	6
Suppliers integration practices	.911	6
suppliers' advices	.838	4
customers' requirements	.753	5
communities' pressures	.716	3
competitors' actions	.725	4
perceived high costs	.364	5
complexity of regulations	.810	5
Guanxi	.829	7

Generally, Cronbach's alpha values greater than 0.7 are considered acceptable reliability levels in studies (Hair et al., 2014). In this study, eight out of nine constructs showed satisfactory reliability values, ranging from 0.716 to 0.911. However, the construct of high costs of adoption barrier showed a low value of 0.364, possibly because the questions pertaining to this construct were changed from previous studies (Govindan et al., 2014; Abdulrahman et al., 2014). The measurement scale ranged from 'strongly agree' to 'strongly disagree' in the original study. However, in the current study, we changed the scale for the cost of adoption of GSCM practices as follows: not very costly, not costly, normal, costly, and very costly. For instance, the original question was 'the cost of switching to the new system is very high'. However, in this study, this question was modified to 'please indicate the cost of switching to the new system' to avoid the influence of negative questions on respondents' opinions. In this way, respondents were able to choose the actual level of costs of adopting GSCM practices. However, the low reliability value indicated a problem in measurement consistency. Therefore, we invited three bilingual persons employed in SCM to revise the Chinese version of the questionnaire. Finally, the scales were changed to very cheap, cheap, normal, expensive, and very expensive for helping respondents to better distinguish and understand the ratings when answering the questionnaire.

Moreover, we tested for non-response bias by comparing the responses of early and late respondents. According to Collis and Hussey (2014), the responses of late respondents are expected to resemble those of non-respondents. In this study, those who filled in the questionnaire at the first mailing were considered early respondents, and those who filled in the questionnaire after the reminder phone calls (five days after the first mailing) were considered non-respondents. In the pilot study, 22 companies filled in the questionnaire in the first mailing, and 30 companies responded after reminder phone calls. One-way ANOVA was applied in this study to test weather there are any difference between early and late respondents (Grafton et al., 2010). We first compared the early and late respondents in terms of descriptive statistics: position in company, position in supply chain, industry type, numbers of employees, and company ownership type. The results of the tests are given in Table 4-24.

Table 4- 24. Hypotheses formulated from pilot study

Hypothesis	**p value**	**test conclusion**
H1 There is no significant difference between early and late respondents in terms of position in company	.312	Not Rejected
H2 There is no significant difference between early and late respondents in terms of position in supply chain	.410	Not Rejected
H3 There is no significant difference between early respondents and late respondents in terms of type of industry	.553	Not Rejected
H4 There is no significant difference between early and late respondents in terms of company size	.099	Not Rejected
H5 There is no significant difference between early and late respondents in terms of ownership of company	.172	Not Rejected

These results indicate that there is no significant difference between early and late respondents in terms of control variables. In addition, one-way ANOVA was also applied to two constructs: suppliers' advice and GSI practices. The two aforementioned constructs were selected because they have been tested for analysis of non-respondent bias in previous studies (e.g. Zhu and

Sarkis, 2006; Zhu et al., 2012). A comparison of early and late respondents in terms of supplier advice (Table 4-25) and GSI practices (Table 4-26) indicated no significant difference.

Table 4-25. ANOVA test for supplier advice

		Sum of Squares	df	Mean Square	F	Sig.
Effect of suppliers' advice in developing environmentally friendly goods on company's adoption of GSI practices	Between Groups	.842	1	.842	.957	.333
	Within Groups	43.985	50	.880		
	Total	44.827	51			
Effect of suppliers' advice in developing environmentally friendly production on company's adoption of GSI practices	Between Groups	.257	1	.257	.313	.579
	Within Groups	41.185	50	.824		
	Total	41.442	51			
Effect of suppliers' advice in developing environmentally friendly packaging on company's adoption of GSI practices	Between Groups	.765	1	.765	.711	.403
	Within Groups	53.755	50	1.075		
	Total	54.519	51			
Company's environmental partnerships with suppliers	Between Groups	.571	1	.571	.862	.358
	Within Groups	33.121	50	.662		
	Total	33.692	51			

Table 4- 26.ANOVA test for GSI practices

		Sum of Squares	df	Mean Square	F	Sig.
Company ensures that purchased products do not contain environmentally undesirable items	Between Groups	1.236	1	1.236	1.051	.310
	Within Groups	58.821	50	1.176		
	Total	60.058	51			

such as lead or other hazardous or toxic materials						
Company collects information about its suppliers' environmental aspects, activities, and/or management systems	Between Groups	.051	1	.051	.035	.852
	Within Groups	73.391	50	1.468		
	Total	73.442	51			
Company runs environment audit programme to test its first-tier suppliers' environment management practices	Between Groups	.177	1	.177	.120	.730
	Within Groups	73.573	50	1.471		
	Total	73.750	51			
Company runs environment audit programme to test its second-tier suppliers' environment management practices	Between Groups	.803	1	.803	.568	.454
	Within Groups	70.639	50	1.413		
	Total	71.442	51			
Company requires suppliers to have a standard environment management certification such as ISO 14001	Between Groups	4.946	1	4.946	3.675	.061
	Within Groups	67.285	50	1.346		
	Total	72.231	51			
Company has frequent face-to-face meetings with key suppliers for environmental issues	Between Groups	.673	1	.673	.477	.493
	Within Groups	70.558	50	1.411		
	Total	71.231	51			

4.12 Data analysis

We began data analysis with data cleaning to make sure that no missing value or outlier is present. SPSS was used to code the data, and screening was carried out to clean outliers. Then, SEM was conducted to validate the conceptual framework.

4.12.1 Data coding

Data coding refers to the translation of a questionnaire to numbers. This process guides researchers in translating responses to record them. We used Statistical Package for Social Sciences (SPSS) and analysis of moment structure (AMOS) to record data for transferring the responses to computer files. Moreover, to avoid errors in these procedures, we double-checked coded and recorded data on the computer files before data cleaning.

4.12.2 Reliability and validity

To ensure the items represented the constructs accurately, this study tested convergent and discriminant validity. Convergent validity refers to high variance in common from a particular construct (Hair et al., 2010). There are three tests for convergent validity: factor loading, average variance extracted (AVE), and composite reliability. Discriminant validity refers to a comparison of the AVE values of two constructs with the square of the correlation estimate between the two constructs. In this study, the discriminant validity is applied by comparing the average variance extracted (AVE) for any two constructs to exceed the squared value of the correlation estimate between these two constructs (Hair et al., 2014). In addition, Cronbach's alpha (α) was used to test the internal reliability in terms of whether the indicators constituting the scales were consistent. As a rule of thumb, a value of >0.90 indicates excellent reliability; 0.70–0.90, high reliability, 0.50–0.70 moderate reliability, and <0.50 low reliability (IBM SPSS Amos, 2012).

4.12.3 Covariance-based structural equation modelling (CB-SEM)

SEM is a popular tool among researchers in social sciences for testing theories with both experimental and non-experimental data (Ding et al., 1995; Schermelleh-Engel et al., 2003). CB-SEM is a family of SEM techniques described as 'a family of statistical models that seek to explain the relationships among multiple variables' (Hair et al., 2010, p. 634). CB-SEM examines a set of relationships between independent and dependent variables. We selected CB-SEM in AMOS to validate the hypotheses and the conceptual framework because it performs

multiple regression analysis among dependent and independent variables, which suits the aim of this study (Anderson and Gerbing, 1988).

4.12.4 Assessment of model fit

There are many methods to examine model fit in CB-SEM. However, many scholars recommend that at least four tests of model fit should be performed to ensure fitness in SEM (Hair et al., 2010). The most commonly used fit indices are chi-square, goodness of fit (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root mean square error approximation (RMSEA). Furthermore, the normed fit index (NFI) and Tucker-Lewis index (TLI) are also frequently used to test the model fitness (Hair et al., 2010). We measured seven model fit indices for CB-SEM. The definition and suggested rules of thumb for the seven model fit indices are listed in Table 4-27 (Hair et al., 2010; Collis and Hussey, 2014).

Table 4-27. Assessment of model fit

Model fit index	Definition	Rule of thumb ($p < .05$)
CMIN/DF Chi-square x^2	A statistical test to observe and estimate the difference between covariance matrices, which is the key value for assessing the goodness of fit of the CB-SEM model.	<2.83
GFI		≥.90

AGFI	An early attempt to produce a fit statistic and guidelines to ensure fit. The role of GFI and AGFI are close, and both are classified as absolute indices of fit.	≥.80
NFI	One of the original incremental model fit indices.	≥.90
CFI	An incremental fit index that is an improved version of NFI.	≥.90
TLI	This index is similar to the NFI conceptually, but not normed. It is a comparison of the normed chi-square values of the null and specified model, and it takes into account the model complexity to some degree.	≥.90
RMSEA	One of the most widely used measures that attempts to correct for and tendency of the x^2GOF test statistic to reject models with a large sample or a large number of observed variables.	<.08

Source: Hair et al. (2010)

4.12.5Hypothesis testing

SEM is a popular tool among researchers for testing hypotheses. However, SEM including both CB-SEM and PLS-SEM. PLS-SEM is 'a causal modelling approach aimed at maximising the explained variance of the dependent latent constructs' (Hair et al., 2011, p. 139). Consequently, , , it differs from CB-SEM's objective, whose main concern is to reproduce the theoretical covariance matrix rather than focusing on explained variance (Hair et al., 2011). In this study, the proposed hypotheses were examined by CB-SEM. The hypotheses were tested in terms of standardised estimate, critical ratio (t-value), and critical value (p-value). AMOS 18.0 for Windows was employed to examine the hypothesised model.

4.13 Ethical consideration

Ethical issues refer to the moral values and principles that form the basis of a code of conduct (Collis and Hussey, 2014). Ethical issues affect research with human subjects significantly. Researchers must consider ethical issues such as avoiding harm to participants, voluntary participation, confidentiality, and anonymity (Collis and Hussey, 2014). This study followed all ethical requirements in all phases of the research. The necessary ethical approvals were sought prior to commencing data collection. We informed all participants about the aim of the study and the need for their participation. Participation was voluntary, and the participants

could withdraw at any time during the survey. Moreover, if the participants did not want to continue or changed their mind, they could leave anytime during the survey. Additionally, we ensured the confidentiality and anonymity of the participants. The code of conduct for this study was guided by Brunel University Research Ethics committee. The guidelines of this committee require submission of a research ethics form containing signatures of both students and supervisors to the academic program office.

4.14 Summary

This chapter discussed the methodology employed in this study. This study adopted the positivism paradigm and quantitative research methods in addition to the probability sampling strategy. We collected data from manufacturing firms with environmental management certification (ISO 14000 or green labels) located in the major coastal regions of Tianjin, Hebei, and Jiangsu provinces in China. These three areas were selected because they have different levels of economic prosperity and geographic diversity. Moreover, we used 420 samples. A total of 9 constructs—customer requirements, supplier advice, community pressures, competitor actions, GSI practices, GCC practices, perceived high costs, complexity of regulations, and Guanxi—were formulated for the survey questionnaires, in addition to 54 measurement items rated on a seven-point Likert scale. The questionnaire was translated from English to Chinese by the back-translation method, and it was validated by the pre-test approach with six bilingual candidates. Thereafter, the CB-SEM technique in AMOS was used to assess the model fit and test the hypotheses.

Chapter 5: Data analysis

5.1 Introduction

This chapter presents the results of the study that was designed in the previous chapter. Statistical software such as Statistical Package for Social Sciences (SPSS) version 20.0 and Structural Equation Modelling (SEM) based on Analysis of Moment Structures (AMOS) version 20.0 were used to analyse the data. First, a preliminary examination of the data using outliers, normality, homoscedasticity, and multicollinearity examinations was presented, and then, the demographic profile of the participants was described. Then, the descriptive statistics of the survey constructs were outlined. Next, we discussed and assessed the reliability and validity of the measurement scale. Subsequently, confirmatory factor analysis (CFA) was performed. Finally, a structural model was used to test the direct hypothesized relationships, and hierarchical moderated regression was used to test hypothesized moderation.

5.2 Data management

This study collected data in two rounds: the first round was from 10 November 2015 to 31 December 2015, and the second round was from 15 January 2016 to 15 February 2016. To reduce the common method bias, this study constructed the questionnaire in two parts. Part I focused on the organizational characteristics, antecedents for GSCM adoption, and adoption of GSCM practices. Part II specifically focused on Guanxi. Part I targeted a person who holds a position at the top of a supply chain and who has good knowledge about the company's internal and external processes, such as supply chain manager, CEO/president, vice president, or director in charge of marketing and purchasing. In Part II, purchasing managers were required to answer questions about Guanxi. The reason is that Guanxi refers to a personal network. Thus, purchasing managers, who are highly connected with their suppliers, would be the most knowledgeable about the focal firm's ties with and acquisition of specific knowledge from suppliers (Luo et al., 2014; Zhou et al., 2014). This study collected 230 and 270 responses for Parts I and II, respectively. By comparing the companies provided by the respondents, a total

of 217 completed questionnaires were obtained from 217 companies. In round two, this study collected got 225 and 211 responses for Parts I and II, respectively. A total of 203 completed questionnaires were obtained. As a result, this study obtained a total of 936 responses for Parts I and II after combining respondents from the same company by comparing the companies provided by the respondents. A total of 420 usable responses were used in the data analysis.

5.2.1 Missing data analysis

Missing data is one of the most pervasive problems in data analysis. It occurs fairly commonly when a respondent does not provide the answer to one or more survey questions. As a result, missing data can affect the results for the research objectives (Hair et al., 2014). To find missing data, this study applied SPSS version 20 software and found that there are no missing values for all variables (Table 5-1).

5.2.2 Outliers

An outlier refers to an unusually high or low value in the data set. It generally has an extreme value and may cause the statistics to deviate (Tabachnick and Fidell, 2007). According to Hair (2014), a z-score of ±3.3 was used for identifying outliers in the data set for sample size larger than 80. In this test, 6 out of 9 constructs had outliers: suppliers' advices, customers' requirements, communities' pressures, competitors' actions, perceived high costs and complexity of regulations. According to Hair et al.'s (2014) recommendation, this study applied a graphical method with a box plot for detecting univariate outliers. As a result, two univariate outliers, communities' pressures and competitors' actions (marked with an asterisk), were found by the box plot test. Therefore, sample numbers 41 and 381 were removed from the data set. After the removal of these two outliers, no other outliers were found in the dataset. Therefore, a total of 418 samples remained for the rest of the data analysis.

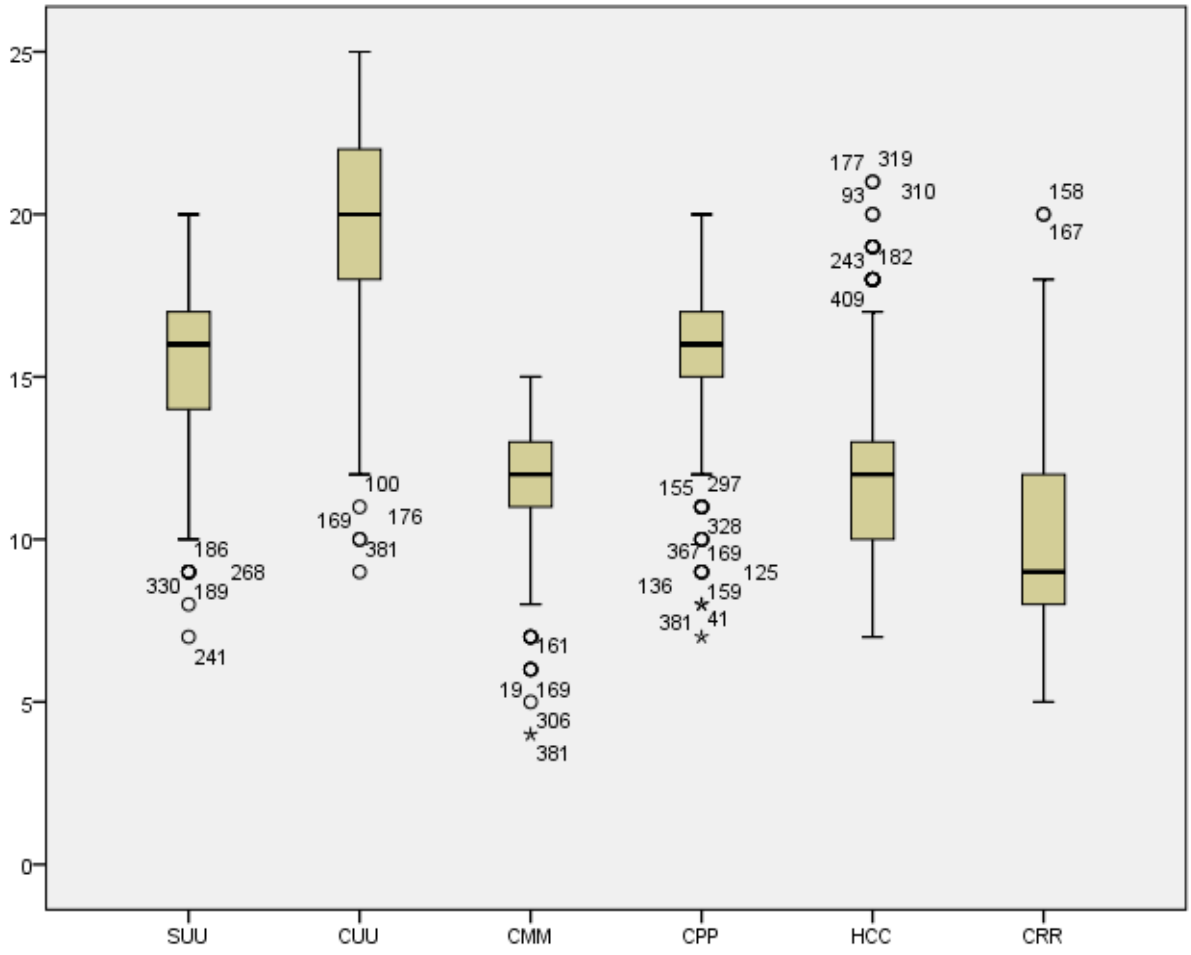

Figure 5-1. Box plot test

5.2.3 Normality

In statistics, a normality test is considered a fundamental assumption for measuring the variation of variables (Hair et al., 2014). This study first applied the Kolmogorov and Shapiro test to check normality. However, as shown in Table 5-1, the results were significant for all variables. This might be because of the sample size (420) and the fact that the Kolmogorov and Shapiro test are sensitive to sample sizes above 200 (Hair et al., 2014). Therefore, the significant result of the Kolmogorov and Shapiro tests cannot be considered as deviation of data from the normal distribution (Field, 2009).

Table 5-1. Tests of normality (Kolmogorov and Shapiro test)

	Kolmogorov-Smirnov[a]	Shapiro-Wilk

	Statistic	df	Sig.	Statistic	df	Sig.
GCC practices	.110	418	.000	.968	418	.000
SGI practices	.129	418	.000	.951	418	.000
Suppliers' advices	.246	418	.000	.875	418	.000
Customers' requirements	.164	418	.000	.932	418	.000
Communities' pressures	.174	418	.000	.932	418	.000
Competitors' actions	.184	418	.000	.918	418	.000
Perceived high costs	.142	418	.000	.946	418	.000
Complexity of regulations	.167	418	.000	.934	418	.000
Guanxi	.150	418	.000	.935	418	.000
a. Lilliefors Significance Correction						

Therefore, to ensure that the data was normally distrusted, the skewness and kurtosis were also used to check for the normality. As shown in the Table 5-2, all factors and indicators have skewness and kurtosis values less than 2.58, as recommended by Hair et al. (2010). Therefore, the results revealed that all variables were normally distributed.

Table 5-2.Tests of Normality (skewness and kurtosis test)

		GCC	GSI	SU	CU	CM	CP	HC	CR	GX
N	Valid	418	418	418	418	418	418	418	418	418
Skewness		-.494	-.697	-1.090	-.958	-.852	-1.061	.790	.871	-.786
Kurtosis		-.341	.027	.469	1.004	1.151	1.438	.663	.575	.009

5.2.4 Homoscedasticity

Homoscedasticity estimates the variance of dependent variables with independent variables (Hair et al., 2014). It refers to an assumption of linear regression that variances around the line between dependent and independent variables do not substantially change for all values of the independent variable (Tabachnick and Fidell, 2007). This study used Levene's test to assess the homoscedasticity. As shown in Table 5-3, the results of Levene's test indicated that two constructs did not achieve non-significant scores (i.e. $p > 0.05$): Communities' pressures (0.162)

and Competitors' actions (0.081). However, similar to the Kolmogorov and Shapiro test, Levene's test is also sensitive with respect to sample size above 200 (Hair et al., 2014). Therefore, this study has a sample size of 418, such that Levene's test does not represent the substantial non-normality within the sample.

Table 5-3. Test of homogeneity of variances

	Levene statistic	df1	df2	Sig.
GCC practices	3.911	3	416	.009
SGI practices	2.949	3	416	.033
Suppliers' advices	5.850	3	416	.001
Customers' requirements	3.101	3	416	.027
Communities' pressures	1.720	3	416	.162
Competitors' actions	2.264	3	416	.081
Perceived high costs	2.639	3	416	.049
Complexity of regulations	4.448	3	416	.004
Guanxi	3.872	3	416	.009

5.2.5 Linearity

Linearity refers to the correlation between variables as represented by a straight line (Hair et al., 2014). In data analysis, it is important to know the level of relationship of variables to identify any variability that may impact the correlation (Tabachnick and Fidell, 2007). There are many techniques based on correlation measures of association, including multiple regression, logistic regression, factor analysis, and structural equation modelling (Hair et al., 2014). According to Field (2009), linearity can be calculated by analysing the Pearson correlation. Linearity issues occur when the independent variables are strongly correlated (i.e. $r \geq 0.9$) (Hair et al., 2014). As shown in Table 5-4, the results of Pearson's correlation show that none of the independent variables are correlated at $r \geq 0.9$. Therefore, the result of Pearson's correlation test showed that the data has no collinearity issues.

Table 5-4. Pearson's correlation test of independent variables

		SU	CU	CM	CP	HC	CR
SU	Pearson's correlation	1	.545**	.380**	.586**	-.198**	-.462**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	418	418	418	418	418	418
CU	Pearson's correlation	.545**	1	.525**	.592**	-.293**	-.498**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	418	418	418	418	418	418
CM	Pearson's correlation	.380**	.525**	1	.443**	-.161**	-.369**
	Sig. (2-tailed)	.000	.000		.000	.001	.000
	N	418	418	418	418	418	418
CP	Pearson's correlation	.586**	.592**	.443**	1	-.254**	-.513**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	418	418	418	418	418	418
HC	Pearson's correlation	-.198**	-.293**	-.161**	-.254**	1	.370**
	Sig. (2-tailed)	.000	.000	.001	.000		.000
	N	418	418	418	418	418	418
CR	Pearson's correlation	-.462**	-.498**	-.369**	-.513**	.370**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	418	418	418	418	418	418

**. Correlation is significant at the 0.01 level (2-tailed).

5.3 Demographic profile

In this study, data was collected from 11 industrial parks located in four provinces (Jiangsu, Shandong, Shanghai, and Guangdong) in China. This study collected data in two rounds: the first round was from 10 November 2015 to 31 December 2015, and the second round was from 15 January 2016 to 15 February 2016. A total of 2143 questionnaires were distributed to managers of manufacturing companies in China. From these, 420 completed questionnaires were returned, for a response rate of 21%. Of these 420 questionnaires, 418 were considered useable after excluding outliers. The demographic profiles of the sample are presented below.

Table 5-5 shows the designation of the participants. The demographic details of the respondents indicated that 47% were middle managers, 23% were senior managers, 12% were CEOs, and 18% were department managers.

Table 5-5. Position in company (based on part I)

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	CEO	51	12	12.1	12.1
	Senior Manager	95	23	22.6	34.8
	Middle Manager	197	47	46.9	81.7
	Department Manager	75	18	18.3	100.0
	Total	418	100.0	100.0	

Table 5-6 shows the companies' position in the supply chain of the participants. This was a multiple choice question, and respondents could choose more than one answer. The demographic details of the respondents showed that 78.6% were located in the midstream supply chain, 31.1% were in the upstream supply chain, and 45% were in the downstream supply chain

Table 5-6. Position in the supply chain

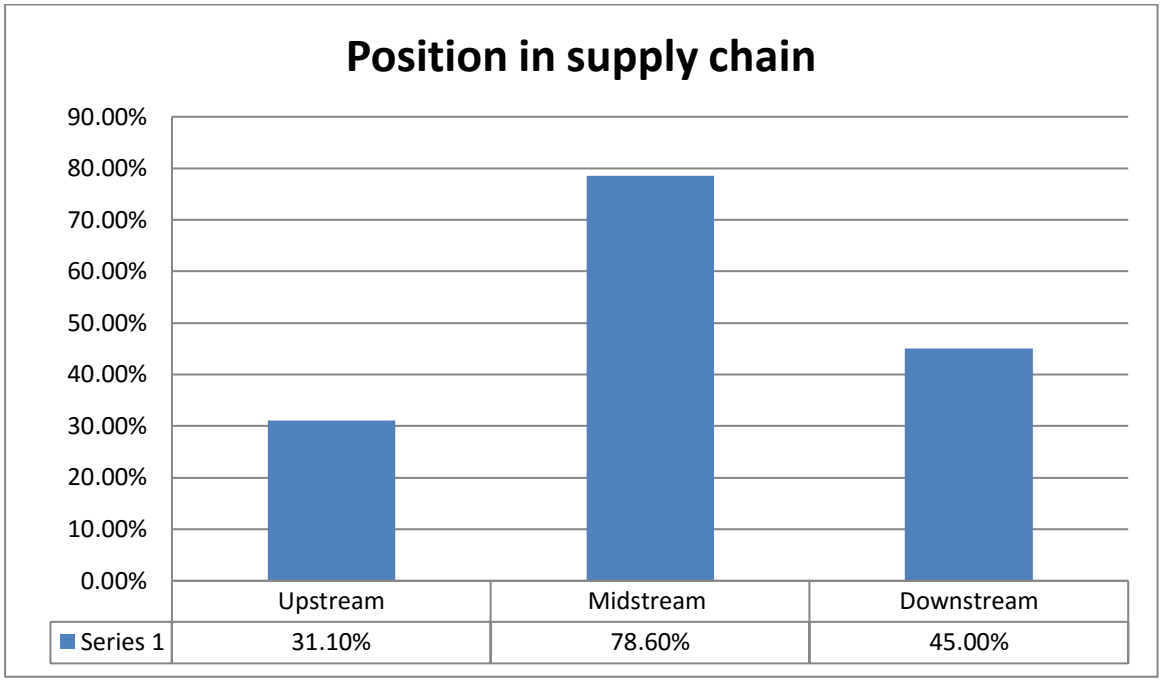

Table 5-7 shows the type of industry of the participants. It was found that 36.7% of the companies belonged to the Electronics and electrical industry, followed by Automobile (19%), Building materials (18%), Chemical/petroleum industry (10%), Metallurgy (7%), Iron and steel (4%), and other industries (6%), including food, pharmaceutical, and construction industries.

Table 5-7. Industry type

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Automobile	79	19	18.8	18.8
	Metallurgy	29	7	6.9	25.7
	Building materials	74	18	17.6	43.3
	Chemical/petroleum	40	10	9.5	52.9
	Electronic and electrical	152	36	36.7	89.5
	Iron and steel	17	4	4.0	93.6
	Other	27	6	6.4	100.0
	Total	418	100.0	100.0	

Table 5-8 shows the numbers of employees in the respondents' companies. It was found that 1.4% of the respondents' companies had less than 20 employees, 46.7% had 20–300 employees, 38.8% had 300–1000 employees, and 13.1% had more than 1000 employees.

Table 5-8. Number of employees

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Under 20	6	1.4	1.4	1.4
	20–300	195	46.7	46.7	48.1
	300–1000	162	38.8	38.8	86.9
	Above 1000	55	13.1	13.1	100.0
	Total	418	100.0	100.0	

Table 5-9 shows the ownership of the respondents' company. Most (48.1%) organisations were private, nearly 31% were joint ventures, 12.9% were foreign-owned, and 8.1% were state-owned.

Table 5-9.Ownership

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Foreign-owned	54	12.9	12.9	12.9
	Joint ventures	130	31.0	31.0	43.8
	Private	200	48.1	48.1	91.9
	State-owned	34	8.1	8.1	100.0
	Total	418	100.0	100.0	

Table 5-10 shows the business scope of the respondents' companies. It was found that 56.2% of companies operated in both domestic and international markets, 36% focused only on domestic markets, and 7.9% focused only on international markets.

Table 5-10. Business scope

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Domestic	151	36.0	36.0	36.0
	International	32	7.9	7.9	43.8
	Both	235	56.2	56.2	100.0
	Total	418	100.0	100.0	

Table 5-11 shows the companies' locations. The locations were almost equally split, with 36% of companies in Guangdong province, 22.1% in Jiangsu province, 20% in Shandong province, and 21.9% in Shanghai.

Table 5-11. Locations

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Shandong	83	20.0	20.0	20.0
	Guangdong	150	36.0	36.0	56.0
	Jiangsu	93	22.1	22.1	78.1
	Shanghai	92	21.9	21.9	100.0
	Total	418	100.0	100.0	

5.4 Descriptive statistics

Descriptive statistics were produced from survey measures to ensure the consistency of the measurements. All items were rated on a five-point Likert scale with a score of 5 indicating strongly agree/very costly/very complex/very often/very close/very important and a score of 1 indicating strongly disagree/not very costly/not very complex/not very often/not very close/not very important. As shown in Table 5-12, the mean scores for all nine variables are as follows: green customers' cooperation = 3.40, green supplier integration = 3.58, supplier advice = 3.90, customer requirements = 4.0, community pressure = 4.0, competitor actions = 4.0, perceived high costs = 2.4, complexity of regulations = 2.0 and Guanxi = 3.8. These descriptive statistics indicate that participants have positive responses to the constructs of the model because all

means were greater than 3.0, except for perceived high costs and complexity of regulations. The average of the means for all constructs together is greater than 3 (which indicates neutrality), implying that the respondents mostly agree with the items. Moreover, the small standard deviation score of all constructs in the descriptive statistics also signifies that the participants mostly agree with the items.

Table 5-12. Descriptive statistics

Variables	N	Mean	Std. Deviation	Variance
GCC practices	418	3.40	.74326	.552
GSI practices	418	3.58	.77215	.596
Suppliers' advices	418	3.90	.59827	.358
Customers' requirements	418	4.00	.52285	.273
Communities' pressures	418	4.00	.59203	.350
Competitors' actions	418	4.00	.52304	.274
Perceived high costs	418	2.40	.52759	.278
Complexity of regulations	418	2.00	.54284	.295
Guanxi	418	3.80	.56752	.322
Valid N (listwise)	418			

Moreover, this study also used descriptive statistics for all items. Table 5-13 shows the means and standard deviations for all items. The analysis results showed that the means for all items were greater than 2, except for complexity of regulations (CR1 = 1.8 and CR3 = 1.94; these were close to 2). Moreover, all items showed small standard deviation, indicating that the participants were mostly satisfied with the items.

Table 5-13. Descriptive statistics for all items

Indicator	N	Mean	Std. Deviation	Variance
CC1	418	3.23	1.010	1.019
CC2	418	3.33	1.089	1.186
CC3	418	3.43	1.091	1.191
CC4	418	3.53	1.093	1.194
CC5	418	3.47	1.057	1.118
CC6	418	3.39	1.177	1.385
SI1	418	3.58	1.131	1.280
SI2	418	3.65	1.075	1.155
SI3	418	3.53	1.093	1.194
SI4	418	3.40	1.098	1.205
SI5	418	3.77	1.116	1.246
SI6	418	3.50	1.128	1.272
SU1	418	3.76	.814	.662
SU2	418	3.88	.944	.890
SU3	418	3.82	.935	.875
SU4	418	4.00	.803	.645
CU1	418	3.85	.894	.800
CU2	418	3.83	.962	.926
CU3	418	4.00	.932	.868
CU4	418	4.08	.787	.619
CU5	418	4.05	.796	.633
CM1	418	4.11	.746	.557
CM2	418	3.71	1.011	1.022
CM3	418	3.95	.854	.729
CP1	418	4.04	.733	.538
CP2	418	4.06	.764	.583
CP3	418	3.84	.841	.707
CP4	418	3.93	.865	.748
HC1	418	2.39	.732	.536
HC2	418	2.24	.870	.757
HC3	418	2.55	.848	.718
HC4	418	2.52	.823	.677
HC5	418	2.37	.780	.608
CR1	418	1.80	.791	.626
CR2	418	2.00	.868	.753
CR3	418	1.93	.805	.648
CR4	418	2.21	.833	.694
CR5	418	2.07	.780	.609
GX1	418	3.61	.939	.881
GX2	418	3.89	.815	.664
GX3	418	3.89	.668	.446
GX4	418	4.01	.791	.626

GX5	418	3.52	.940	.883
GX6	418	3.57	.973	.946
GX7	418	3.80	.883	.780
Valid N (listwise)	418			

5.5 Reliability assessment

Reliability refers to the consistency of the measure of a concept (Bryman and Bell, 2011). Cronbach's alpha is one of the most common techniques used for testing the internal reliability of multiple-indicator constructs when factor analysis is used (Hair et al., 2014; Bryman and Bell, 2011). In this study, Cronbach's alpha was used to assess the reliability of scales as it measures the internal reliability of a scale. In general, researchers agree that Cronbach's alpha value should be above .70 (Hair et al., 2010). However, according to Nunnally and Bernstein (1994), Cronbach's alpha is sensitive to the number of items in a construct. For example, the value of Cronbach's alpha can increase when the number of items for measuring a construct increases, even with the same degree of inter-correlation (Nunnally and Bernstein, 1994). Therefore, Cronbach's alpha value of .60 (Hair et al., 2014) or .50 (Nunnally and Bernstein, 1994) can be acceptable, especially in an exploratory research or for constructs with a small number of indicators (Hair et al., 2010; Grafton et al., 2010; Cortina, 1993). Table 5-14 show the results of Cronbach's alpha for all constructs in this study. The results showed that all constructs except 'communities' pressures' showed a score greater than 0.7, indicating the high reliability of all constructs. However, even though communities' pressures had a Cronbach's alpha value of 0.431, Nunnally and Bernstein (1994) noted that Cronbach's alpha value could be low when a construct has a small number of items as a function of multidimensionality. This low reliability may negatively affect the validity of the measurement. However, measurement error does not necessarily result in attenuated correlations between variables (Nunnally and Bernstein, 1994). Therefore, the construct 'communities' pressures' was retained in this study.

Table 5-14. Reliability assessment

Variables	Number of items	Cronbach's alpha
GCC practices	6	.777
GSI practices	6	.796
Suppliers' advices	4	.628
Customers' requirements	5	.568
Communities' pressures	3	.431
Competitors' actions	4	.580
Perceived high costs	5	.658
Complexity of regulations	5	.684
Guanxi	7	.785

5.6 Validity assessment

It is important to examine the construct validity after ensuring the reliability of a construct (Hair et al., 2014). Construct validity refers to the extent to which a scale or set of measures accurately represents the concept of interest (Hair et al., 2014). Moreover, the construct validity is also defined as the issue of whether or not an indicator that is devised to gauge a concept really measures that concept (Collis and Hussey, 2014). For validating the research model, this study uses convergent validity and discriminant validity.

5.6.1 Convergent validity

Convergent validity refers to the evaluation of the extent to which variables of a specific construct that appear related are in fact related (Hair et al., 2014). Convergent validity can be empirically tested by factor loadings, average variance extracted (AVE), or composite reliability (Hair et al., 2014). The difference between Cronbach's alpha and convergent validity is that the former looks into one individual construct at a time whereas the latter looks at individual construct in comparison to other constructs in the proposed framework. Therefore, in this study, convergent validity is examined by factor loading, AVE, and composite reliability. As shown in Table 5-16, the factor loading of each item ranged from 0.46 to 0.77, and all loadings were significant ($p < 0.001$), demonstrating evidence of convergent validity (Wang et al., 2016). The AVE method can be used to calculate the average variance of an item's loading. An AVE value greater than 0.50 indicates a good level of convergent validity (Hair et al., 2014).

In addition, the composite reliability method refers to the measurement of the internal consistency and reliability of a scale.

5.6.2 Discriminant validity

Discriminant validity examines the level to which each construct is distinct from others (Hair et al., 2014). In this study, discriminant validity is applied by comparing the average variance extracted (AVE) for any two constructs to exceed the squared value of the correlation estimate between these two constructs (Hair et al., 2014). According to Fornell and Larcker (1981), the AVE value of variables should be greater than the squared correlation of that variable with any other variables in the model. Moreover, the discriminant validity can also be examined by comparing the square root of AVE of the correlation between variables in the model (Hair et al., 2010). As shown in Table 5-15, the square root of the AVE is greater than any of the other correlations among the variables. Therefore, this result showed that the variables are different, and it confirmed the discriminant validity of the measurement scale, indicating that convergent validity is ensured (Fornell and Larcker, 1981).

Table 5-15. Correlation matrix with the square root of the AVE

Construct	CC	SI	SU	CU		HC	CR	GX
GCC practices	**0.964**							
GSI practices	0.916	**0.742**						
Suppliers' advices	0.517	0.566	**0.793**					
Customers' requirements	0.777	0.629	0.682	**0.482**				
Communities' pressures	0.556	0.475	0.474	0.038	**0.761**			
Competitors' actions	-0.247	-0.158	-0.325	0.093	0.523	**0.633**		
Perceived high costs	-0.585	-0.599	-0.603	-0.597	-0.257	0.478	**0.589**	
Complexity of regulations	0.490	0.552	0.589	0.586	0.676	-0.097	-0.472	**0.685**

5.6.3 Measurement model evaluation

In this study, nine constructs with 45 items were evaluated using CFA. Each construct was loaded with its measurement item and was examined through CFA analysis. According to Hair et al. (2014), at least four goodness tests of model fit should be conducted for CFA. In this study, eight goodness of fit indices were used: chi square to (χ^2) to degree of freedom (df), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), incremental fit index (IFI), Tucker-Lewis Index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and root mean square residual (RMR) (Hair et al., 2014; Nunnally, 1994).

The results of the chi-square test showed that the model fit is 1:1.5, which is unsatisfactory and is below the suggested threshold of 1:3. However, the fact that it is unsatisfactory may be because chi-square statistics are very sensitive to the sample size (Hair et al., 2014; Nunnally, 1994), and the sample size in this study is large (420). Thus, GFI, AGFI, IFI, TLI, CFI, RMSEA, and RMR were conducted to determine the structural model fit. The analysis revealed good fit indices (χ2/df = 348/235= 1.45, CFI = 0.959, IFI = 0.960, GFI = 0.940, AGFI = 0.916, RMSEA = 0.034, and RMR= 0.035), thus ensuring unidimensionality in comparison with the recommended criteria. To improve the model fit, this study further refined the model by eliminating problematic items (Hair et al., 2014). As shown in Table 5-16, the final results of the indices suggest that the model fit is good (GFI = 0.940, AGFI = 0.916, IFI = 0.960, TLI = 0.947, CFI = 0.959, RMSEA = 0.034, and RMR = 0.0435).

Table 5-16. Model fit indices for the measurement model index

Index	**χ2/df**	**GFI**	**AGFI**	**CFI**	**IFI**	**TLI**	**RMSEA**	**RMR**
Criteria recommended by Hair et al. (2014) and Nunnally (1994)	1:3	≥0.90	≥0.90	≥0.90	≥0.90	≥0.90	<.05	<.08
This model	1:1.45 (348/235)	0.940	0.916	0.959	0.960	0.947	0.034	0.035

As shown in Table 5-17, the validity was analysed in this study using factor loadings, AVE, and composite reliability. This table shows that all items loaded on the specific factor that they were intended to measure and that the factor loadings were greater than 0.40, which was the threshold value proposed by Wang et al. (2016) in a similar study. After factor loading, nine items (four items for Guanxi measurements, two items for of communities' pressures and two items for perceived high costs) were deleted from the 44 original items because their values were lower than 0.4. In this regard, factor variance less than 40% cannot guarantee good convergent validity of a construct (Hair et al., 2014). After the factor loadings, the AVE and composite reliability were analysed, and six variables with 26 items were retained. Moreover, for the retained variables, the factor loadings all reached the level of significance, all constructs had composite reliability above 0.7, and all constructs had AVE values higher than the suggested threshold value of 0.50, indicating the convergent validity of the scale (Fornell and Larcker, 1981).

Table 5-17. Validity assessment

Constructs	Items	Loading	Cronbach's alpha	Composite reliability	Average variance extracted
GCC practices	CC1	.70	.777	0.759	0.540
	CC2	.64			
	CC3	.64			
	CC4	.65			
	CC5	.57			
	CC6	.46			
GSI practices	SI1	.56	.796	0.765	0.595
	SI2	.64			
	SI3	.63			
	SI4	.61			
	SI5	.60			
	SI6	.73			
Suppliers' advices	SU1	.74	.628	0.751	0.503
	SU2	.62			
	SU3	.51			
	SU4	.77			
Customers' requirements	CU1	.57	.568	0.698	0.533
	CU2	.58			
	CU3	.59			
Communities' pressures	CM2	.69	.631	0.645	0.574
	CM3	.66			
Competitors' actions	CP1	.58	.580	0.649	0.575
	CP2	.51			
	CP3	.54			
	CP4	.55			
Perceived high costs	HC1	.63	.658	0.771	0.500
	HC2	.64			
Complexity of regulations	CR1	.61	.684	0.701	0.501
	CR2	.63			
	CR3	.60			
Guanxi	GX1	.73	.827	0.760	0.565
	GX2	.68			
	GX3	.69			
	GX4	.67			
	GX5	.65			

5.7 Structural model

After the measurement model, the structural model was tested by AMOS 20.0.0. First, as suggested by Hair et al. (2014), the model fit was examined. This study used seven goodness of fit indices including GFI, AGFI, NFI, TLI, CFI, RMSEA, and RMR (Hair et al., 2014). GFI

attempts to reduce the level of sensitivity to the sample size, where values greater than 0.9 are considered as a good fit (Hair et al., 2010). AGFI, which is related to GFI, adjusts GFI through the ratio of the degree of freedom of the model (df) to the overall degrees of freedom available (Hair et al., 2010; Tabachnick and Fidell, 2007). AGFI values greater than 0.9 indicate a good model fit (Hooper et al., 2008). Moreover, NFI and TLI are similar. However, NFI compares the chi square values of the proposed framework to the chi square of the null model, whereas TLI compares the normed chi square values of the proposed framework to the chi square values of the null model (Hair et al., 2010). NFI and TLI values greater than 0.9 are considered to indicate good model fit (Hair et al., 2010). CFI is basically an improved version of NFI, except that it is less sensitive to sample size and can be well performed even with a small sample size (Tabachnick and Fidell, 2007). CFI values greater than 0.9 indicate good model fit (Hair et al., 2010). Furthermore, RMSEA indicates how well the model fits a population, and RMR is the square root of the mean of the squared deviations of individual covariance (Hair et al., 2010). RMSEA and RMR values less than 0.08 are considered to indicate good fit (Hair et al., 2010; MacCallum et al., 1996).

Table 5-18 shows the results of model fit.

Table 5-18. Model fit indices for measurement model

Index	**χ2/DF**	**GFI**	**AGFI**	**CFI**	**IFI**	**TLI**	**RMSEA**	**RMR**
Suggested threshold	1:3	≥0.90	≥0.90	≥0.90	≥0.90	≥0.90	<.05	<.08
This model	1:1.9 (304/169)	0.938	0.915	0.948	0.949	0.935	0.044	0.040

5.7.1 Hypotheses testing

Based on the structural model, the direct hypotheses in this study were tested by examining the path significance of the relationships through the standardised estimate, critical ratios (t-value), and p-value. A relationship is significant if the critical ratio (t-value) is above 1.96 and p-value

is ≤0.1 (Hair et al., 2014). Figure 5-2 shows the framework for testing direct relationships. Moreover, Table 5-19 shows a summary of the hypotheses assessment.

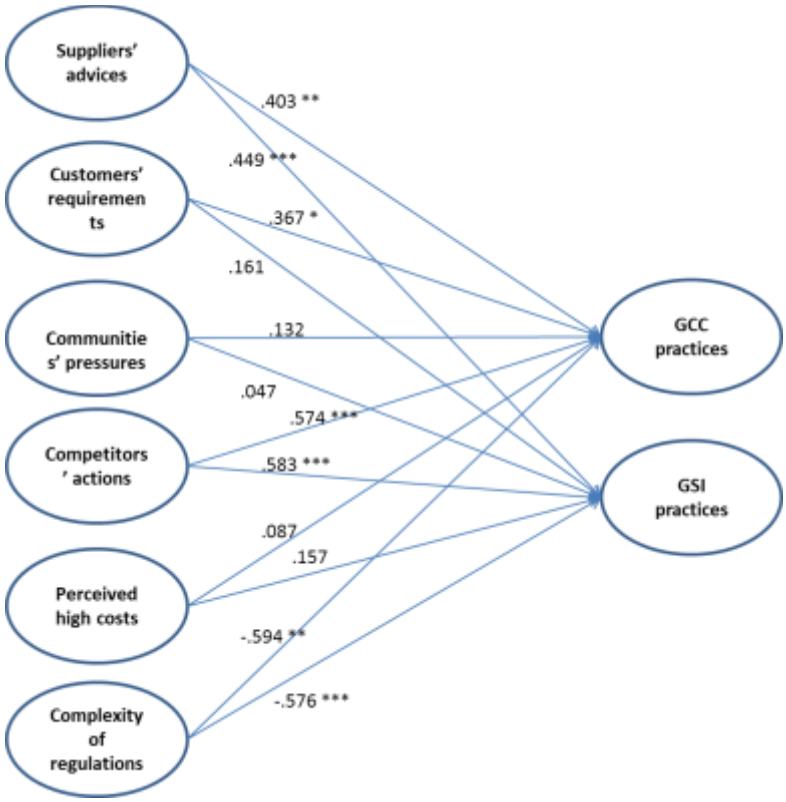

Figure 5-2. Model for direct hypotheses assessment

Table 5-19 shows the model fit indices for the structural model for direct hypotheses assessment.

Table 5-19. Model fit indices for structural model

Index	**χ2**	**DF**	**χ2/ DF**	**GFI**	**AGFI**	**CFI**	**IFI**	**TLI**	**RMSEA**	**RMR**
Suggested threshold	-	-	<3.0	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	<.05	<.0.08
Model 1	322	177	1.8	0.933	0.913	0.935	0.936	0.923	0.044	0.047

First, we proposed H1a, namely, that the suppliers' advices have a positive influence on GCC. The results support this hypothesis (estimate = .403, t-value = 3.036, $p < 0.05$), suggesting that suppliers' advices are significantly affects GSCM cooperation practices between focal

companies and their customers. H1b is also supported (estimate = .449, t-value = 3.553, p < 0.001), indicating that suppliers' advices on the adoption of GCC significantly affects the adoption of GSI. Similarly, the study results show a significant effect of customers' requirements on the adoption of GCC. Thus, H2a is supported (estimate = .367, t-value = 2.273, p = 0.001). However, customer requirements were found to have an insignificant impact on GSI, and thus, H2b is rejected (estimate = .161, t-value = 1.165, p = .244).

Furthermore, H3a and H3b predicted that communities' pressures have a positive and significant impact on customers' cooperation and suppliers' integration. However, the results fail to support both H3a (estimate = .132, t-value = .887, p = .375) and H3b (estimate = .047, t-value = .694, p = .488). This result indicates that communities' pressures does not affect the adoption of GCC and GSI. Moreover, we predicted that competitors' actions have a positive and significant impact on GCC (H4a) and GSI (H4b). The results support both H4a (estimate = .574, t-value = 3.843, p < 0.001) and H4b (estimate = .583, t-value = 4.353, p < 0.001).

Additionally, we predict that perceived high costs have an effect on GCC (H5a) and GSI (H5b). However, the results show that perceived high costs have an insignificant impact on both, and thus, H5a (estimate = .087, t-value = .672, p = .502) and H5b (estimate = .157, t-value = 1.245, p = .213) are rejected. Furthermore, the results support H6a (estimate = -.594, t-value = -3.245, p = .001), suggesting that complexity of regulations negative and significantly affects GCC. H6b also showed a negative and significant impact on GSI (estimate = -.576, t-value = -3.404, p < 0.001).

Table 5-20. Results of main effects

	Estimate	**S.E.**	**C.R.** (t-value) >1.96	**p-value < 0.1**	**Finding**
H1a Supplier's advices - GCC	.403	.133	3.036	**	Supported
H1b Supplier's advices- GSI	.449	.126	3.553	***	Supported
H2a Customers' requirements - GCC	.367	.161	2.273	*	Supported
H2b Customers' requirements - GSI	.161	.138	1.165	.244	Rejected
H3a Communities' pressures- GCC	.132	.149	.887	.375	Rejected
H3b Communities' pressures- GSI	.047	.068	.694	.488	Rejected
H4a Competitors actions - GCC	.574	.149	3.843	***	Supported
H4b Competitors actions- GSI	.583	.134	4.353	***	Supported
H5a Perceived high costs - GCC	.087	.130	.672	.502	Rejected
H5b Perceived high costs - GSI	.157	.126	1.245	.213	Rejected
H6a Complexity of regulations - GCC	-.594	.183	-3.245	**	Supported
H6b Complexity of regulations - GSI	-.576	.169	-3.404	***	Supported
*p < 0.10. **p < 0.05. ***p < 0.001.					

5.7.2 Hierarchical moderated regression

After examining the direct relationship within the conceptual framework, the next step was to examine the moderating effect of Guanxi on direct relationships. According to O'Brien (2007), a moderator is a variable which can affect the direction and strength of the direct relationship between an independent and a dependent variable. To test the moderating effect, this research uses variance partitioning procedures proposed by Jaccard et al. (2003) that have been used

previously in empirical operations management research (Wong et al., 2012; Zhu and Sarkis, 2007). In doing so, hierarchical moderated regression was used to test our hypothesis.

The variance partitioning procedures includes four steps:

Step 1: Three control variables—firm size, supply chain position, and ownership—were included in the regression.

Step 2: Four stakeholders' drivers—suppliers' advices, customers' requirements, competitors' actions and communities' pressures—and two barriers—high cost of adoption and complexity of regulations—were included in the regression.

Step 3: The moderator variable *Guanxi* was included in the regression.

Step 4: Four interactions of stakeholders' drivers with *Guanxi* (suppliers' advices × *Guanxi*, customers' requirements × *Guanxi*, communities' pressures × *Guanxi* and competitors' actions ×*Guanxi)* and two interactions of supply chain barriers with *Guanxi* (perceived high costs × Guanxi and complexity of regulations × *Guanxi*) were included in the regression.

As show in Table 5-21, Models 1 and 5 included only control variables only. In Models 2 and 6, we added the stakeholders' drivers, including customers' requirements, suppliers' advices, communities' pressures, competitors' actions. In Models 3 and 7, we added the moderator Guanxi. Finally, Models 4 and 8 provide the full model with all controls, independent variables, and interaction items.

Table 5-21. Hierarchical moderated regression analysis model for stakeholders' drivers

	GCC practices				**GSI practices**			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Step 1	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size
	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position
	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership
Step 2		Suppliers' advices (SU)	Suppliers' advices (SU)	Suppliers' advices (SU)		Suppliers' advices (SU)	Suppliers' advices (SU)	Suppliers' advices (SU)
		Customers' requirements (CU)	Customers' requirements (CU)	Customers' requirements (CU)		Customers' requirements (CU)	Customers' requirements (CU)	Customers' requirements (CU)
		Communities' pressures (CM)	Communities' pressures (CM)	Communities' pressures (CM)		Communities' pressures (CM)	Communities' pressures (CM)	Communities' pressures (CM)
		Competitors' actions (CP)	Competitors' actions (CP)	Competitors' actions (CP)		Competitors' actions (CP)	Competitors' actions (CP)	Competitors' actions (CP)
Step 3			Guanxi (GX)	Guanxi (GX)			Guanxi (GX)	Guanxi (GX)
Step 4				SU × GX				SU × GX
				CU × GX				CU × GX
				CP × GX				CP × GX
				CM × GX				CM × GX

To reduce multi-collinearity, the 'mean-centering' technique was used for the independent variables and moderators (Zhu and Sarkis, 2007). Most variance inflation factors of the moderated regression analysis are close to 1;, but the largest one is less than 10, where the

range of variance inflation factors is acceptable. In this study, the maximum variance inflation factor value in all regression models was 1.2, indicating that multi-collinearity is not a serious concern (O'Brien, 2007) given our dataset of 418 companies.

Table 5-22. Hierarchical moderated regression analysis for stakeholders' drivers

Variable entered		**Dependent variable**							
		GCC practices (n = 418)				**GSI practices (n = 418)**			
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Control	Firm size	.133**	.063	.084*	.083*	.136**	.065	.088*	.088*
	Supply chain position	.110*	-.009	-.003	-.012	.110*	-.016	-.009	-.012
	Ownership	-.013	-.015	-.016	-.016	-.056	-.062	-.063	-.057
Independent	Suppliers' advices (SU)		.112**	.079	.101*		.183***	.146**	.137*
	Customers' requirements (CU)		.241***	.230***	.190**		.221***	.209***	.175**
	Communities' pressures (CM)		.265**	.215***	.232***		.267***	.210***	.236***
	Competitors' actions (CP)		.085*	.054	.062		.033	-.002	.007
Moderator	Guanxi (GX)			.161**	.175**			.180***	.182***
Interaction	SU × GX				.102*				-.014*
	CU × GX				.170**				-.125*
	CP × GX				.058*				.090
	CM × GX				.047				-.017*
F for the step		4.174**	51.692***	10.243**	1.782	4.994**	53.860***	13.221***	1.138
F for the regression		4.174**	32.199***	30.087****	120.805***	4.994**	34.005***	32.290***	21.935***
Adjusted R^2		.022	.343	.357	.362	.028	.355	.374	.375

Main table contains standardized coefficient betas.
*p < 0.10.
**p < 0.05.

***p < 0.001.

As shown in Table 5-22, three control variables accounted for 22% of the variance in GCC in Model 1 and for 28% of the variance in GSI in Model 5. Both firm size (β = .133, p < .001) and supply chain position (β = .110, p < .1) have significant and positive effects on GCC practices. These two control variables also have significant and positive effects on GSI practices (β =.136, p < .005 and β = .110, p < .1, respectively). These results indicate that firm size and supply chain position have significant and positive effects on the adoption of GSCM practices. A possible explanation may be that companies with larger size and that are closer to customers have more willingness to adopt GSCM practices. Meanwhile, the control variable of ownership was insignificant for both GCC and GSI practices. Four stakeholders' drivers—suppliers' advices, customers' requirements, competitors' actions and communities' pressures—were added, and the variance in GCC and GSI practices increased to 34.3% (Model 2) and 35.5% (Model 6), respectively. These four stakeholders' drivers show positive impacts on both GCC and GSI practices, with the exception of competitors' actions, which was insignificant with regard to GSI. The explained variance of GCC and GSI practices increases after adding the moderator to 35.7% in Model 3 and 37.4% in Model 7. The moderator *Guanxi* had a significant and positive effect on GCC practices (β = .161, p < .005) and GSI practices (β = .180, p < .001). In Models 4 and 8, after adding the interaction terms, the variance of GCC and GSI practices increased from 22% to 36.2% and from 28% to 37.5%, respectively.

Table 5-23. Hierarchical moderated regression analysis model for supply chain barriers

	GCC practices	**GSI practices**

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Step 1	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size	Firm size
	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position	Supply chain position
	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership	Ownership
Step 2		Perceived high costs (HC)	Perceived high costs (HC)	Perceived high costs (HC)		Perceived high costs (HC)	Perceived high costs (HC)	Perceived high costs (HC)
		Complexity of regulations (CR)	Complexity of regulations (CR)	Complexity of regulations (CR)		Complexity of regulations (CR)	Complexity of regulations (CR)	Complexity of regulations (CR)
Step 3			Guanxi (GX)	Guanxi (GX)			Guanxi (GX)	Guanxi (GX)
Step 4				HC × GX				HC × GX
				CR × GX				CR × GX

As show in Table 5-23, Models 9 and 13 included control variables only. In Models 10 and 14, we added supply chain barriers including perceived high costs and complexity of regulations. For Models 3 and 7, we added the moderator Guanxi. Finally, Models 4 and 8 provide the full model with all controls, independent variables, and interaction items.

Table 5-24. Hierarchical moderated regression analysis for supply chain barriers

Variable entered	**Dependent variable**	
	GCC practices (n = 418)	**GSI practices (n = 418)**

		Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 17
Control	Firm size	.110*	.027	.030	.019	.110**	.013	.015	.007
	Supply chain position	.133**	.081*	.119**	.126**	.136**	.080*	.117**	.122**
	Ownership	-.013	-.033	-.031	-.032	-.056	-.076*	-.074*	-.074*
Independent	Perceived high costs (HC)		.027	.032	.044		-.014	-.009	-.001*
	Complexity of regulations (CR)		-.409***	-.269***	-.283***		-.433***	-.293***	-.291***
Moderator	Guanxi (GX)			.343***	.332**			.342***	.333***
Interaction	HC × GX				090*				.103*
	CR × GX				-.010				.045*
F for the step		5.191***	33.956***	5.215**	1.818*	4.627***	36.884***	7.247**	1.652*
F for the regression		5.191***	19.809***	18.957***	13.976***	4.627***	20.817***	20.145***	14.733***
Adjusted R^2		.065	.369	.375	.382	.057	.381	.390	.396

Main table contains standardized coefficient betas.
*p < 0.10.
**p < 0.05.
***p < 0.001.

As shown in Table 5-24, in Models 9 and 13, the control variables accounted for only 6.5% and 57% of the variance in GCC practices and GSI practices, respectively. Firm size and supply chain position showed significant and positive effects on GCC practices ($\beta = .110$, $p < .1$ and $\beta = .133$, $p < .05$, respectively) and GSI practices ($\beta = .110$, $p < 0.001$ and $\beta = .136$, $p < .05$, respectively). In addition, ownership had an insignificant effect on both GCC and GSI practices. In Models 10 and 14, by adding two supply chain barriers (perceived high costs and complexity of regulations), R^2 increased to 36.9% and 38.1% for GCC practices and GSI practices, respectively. The perceived high costs had an insignificant effect on GCC and GSI practices. The complexity of regulations had a significant and negative effect on GCC practices ($\beta = .409$,

$p < .001$) and GSI practices ($\beta = .443$, $p < 0.001$). R^2 after adding the moderator in Models 11 and 15 was 37.5% and 39% for GCC practices and GSI practices, respectively. The moderator *Guanxi* had a significant and positive effect on GCC practices ($\beta = .343$, $p < .001$) and GSI practices ($\beta = .342$, $p < .001$). In Models 12 and 16, after adding the interaction terms, R^2 increased to 38.2% and 39.6% for GCC practices and GSI practices, respectively.

In summary, as shown in Tables 5-22 and 5-24, the results across the 17 models are quite consistent, and the last model in both tables is superior to the other models. Thus, our findings reported below are based on the results of the last model: model 4 for stakeholders' drivers - GCC practices, Model 8 for stakeholders' drivers - GSI practices, Model 12 for supply chain barriers - GCC practices, and Model 17 for supply chain barriers - GSI practices. The results of these four models can show whether moderating effects exist in two ways: the first way is that, collectively, the incremental F for the step is significant, and the second way is that an individual interaction variable has a significant beta value (Zhu and Sarkis, 2004).

Following Aiken and West (1991), we provided the figures of the moderating impact of Guanxi. First, we split *Guanxi* into high (one standard deviation above the mean) and low (one standard deviation below the mean) levels. Then, we estimated the influence of the four stakeholder forces and two barriers at these two different levels.

We predicted that *Guanxi* strengthens the positive impact of suppliers' advices on the adoption of GCC practices in H7a. Model 4 indicates a significant and positive interaction of suppliers' advices with *Guanxi* ($\beta = .102$, $p < 0.05$), which supports H7a. Figure 5-3 shows the interactions. At high levels of Guanxi, the effect of supplier advice on the adoption of GCC practices is stronger.

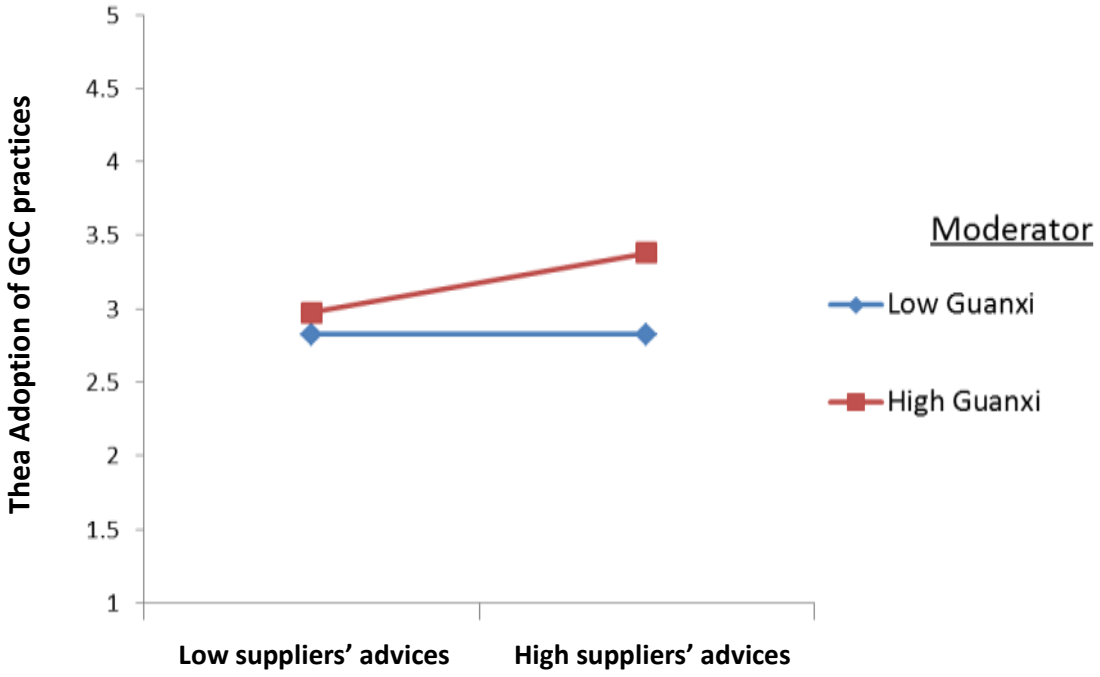

Figure 5-3. Effect of Guanxi on suppliers' advices- GCC practices

In H7b, we predicted that Guanxi strengthens the positive impact of suppliers' advices on the adoption of GSI practices. The moderating analysis showed that Guanxi has a negative and significant impact on the effect suppliers' advices on GSI practices ($\beta = -.014$, $p < 0.1$). Figure 5-4 shows these interactions. At high levels of Guanxi, the effect of suppliers' advices on the adoption of GSI practices is weaker. Therefore, H7b is rejected.

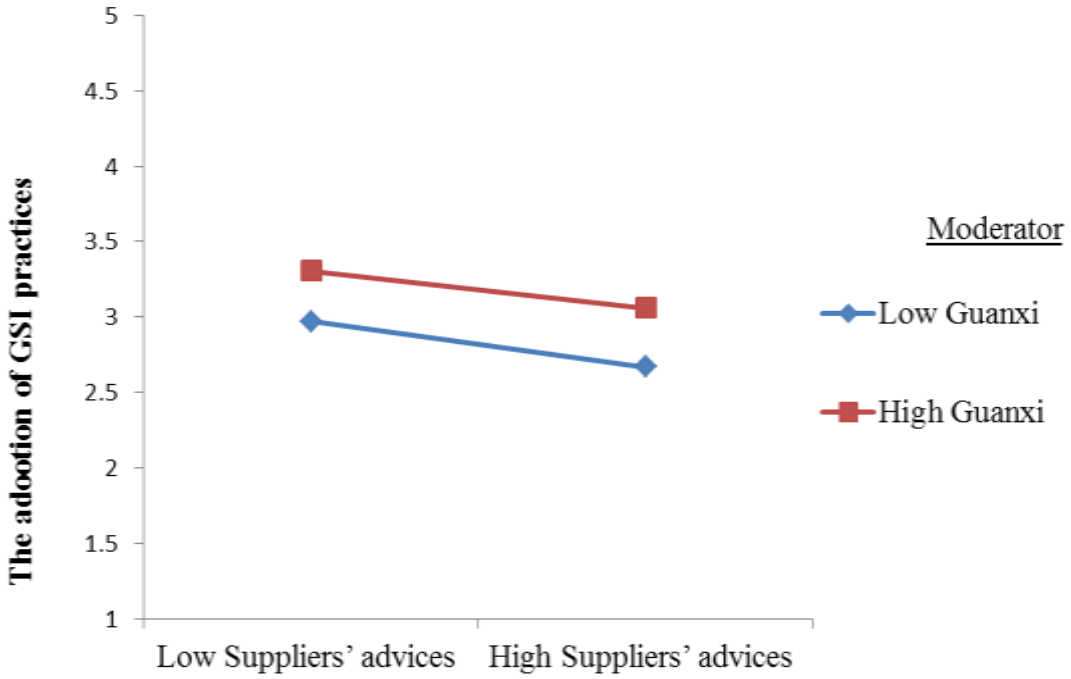

Figure 5-4. Effect of Guanxi on suppliers' advices- GSI practices

In H8a, we predicted that the effect of customer requirements on the adoption of GCC practices will be strengthened with the Guanxi. The interaction between customers' requirements and Guanxi is negative and significant (β = -.170, $p < 0.05$), and thus, we reject H8a. Figure 5-5 shows the conditional effects plot for Guanxi as a moderator of customers' requirements on the adoption of GCC practices. The plot shows that the positive effects between customers' requirements on the adoption of GCC practices are reduced when the level of Guanxi is high.

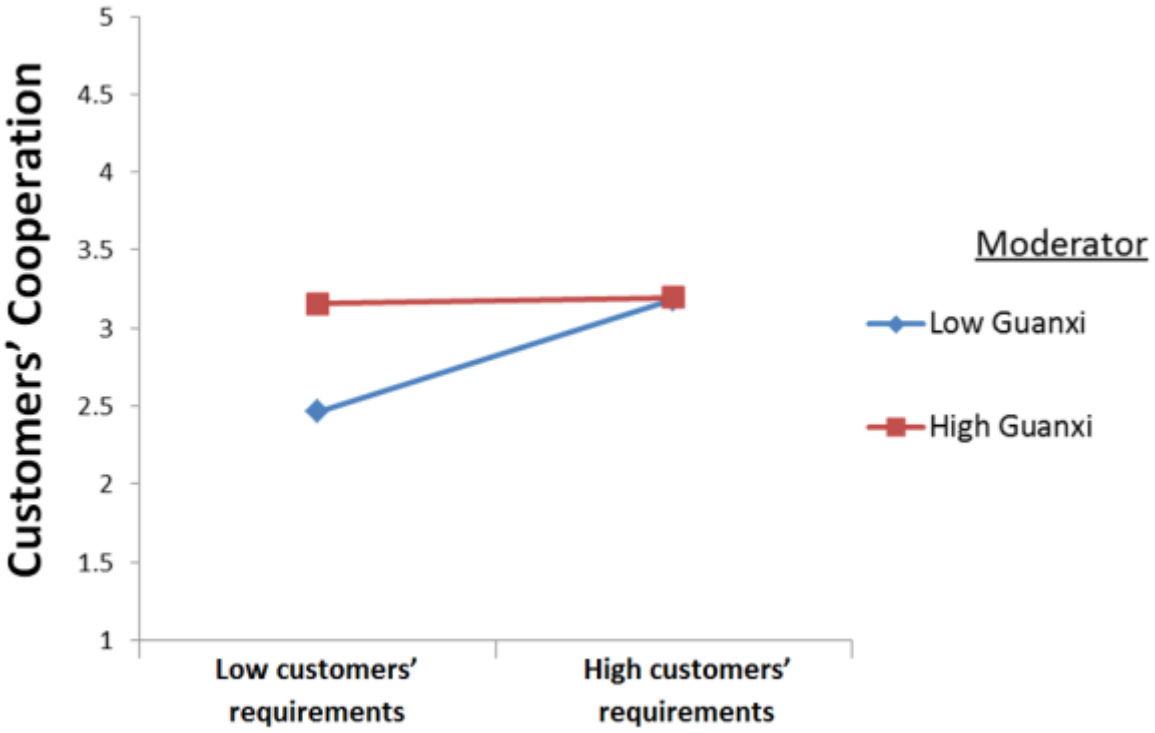

Figure 5-5. Effect of Guanxi on customers' requirements - GCC practices

H8b was supported because the interaction between customer requirements and Guanxi is positive and significant (β = .125, $p < 0.1$). As shown in Figure 5-6, at high levels of Guanxi, the effect of customers' requirements on the adoption of GSI practices is stronger.

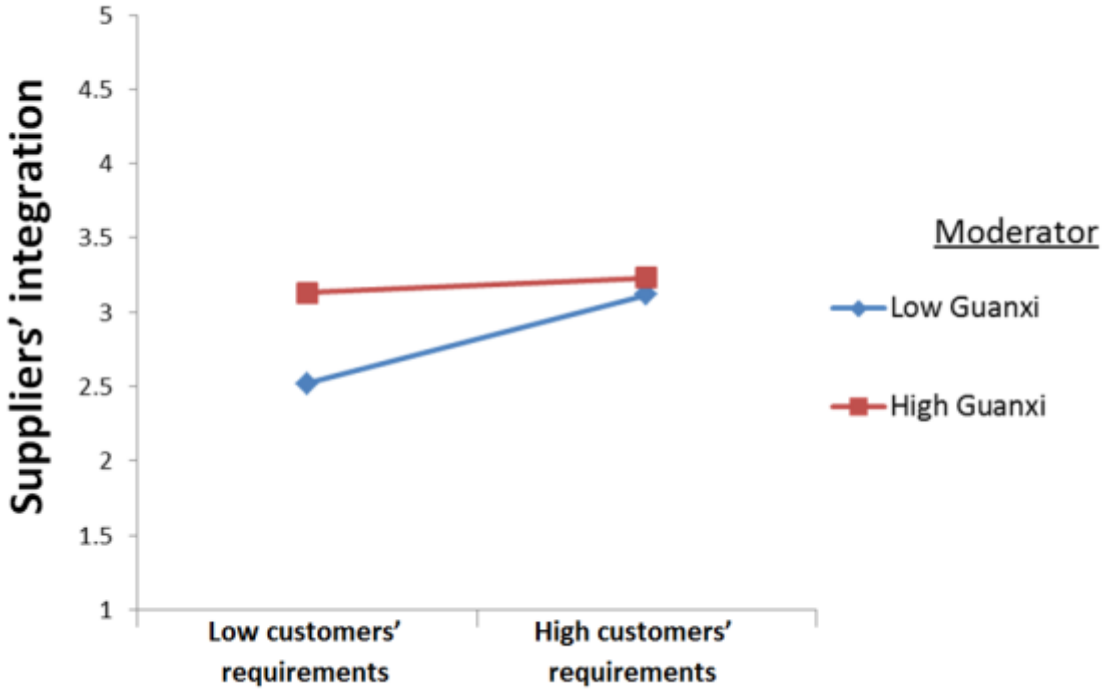

Figure 5-6. Effect of Guanxi on customers' requirements - GSI practices

H9a did not show that the positive effect of communities' pressures on GCC practices can be strengthened with the present of Guanxi (β = .047, ns). Moreover, H9b predicted that the positive effect of communities' pressures on GSI practices will be strengthened with the presence of Guanxi. The interaction of communities' pressures and Guanxi is negative and significant (β = -.017, $p < 0.1$). As shown in Figure 5-7, with high level of Guanxi, community pressure decreases, which contradicts our hypothesis. Therefore, H9b is rejected.

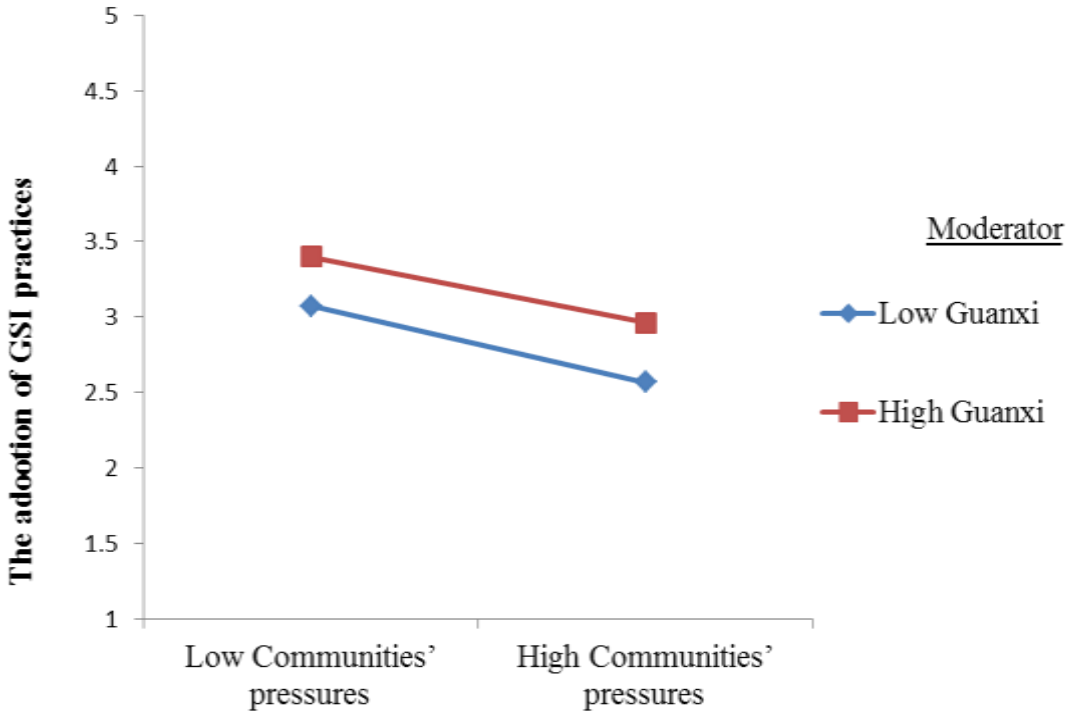

Figure 5-7. Effect of Guanxi on communities' pressures - GSI practices

We predicted that *Guanxi* strengthens the positive impact of competitor actions on GCC; however, the regression results indicated an insignificant interaction between competitors' actions and *Guanxi* (β = -0.09, ns), which fails to support H10a. In H10b, we predicted that *Guanxi* strengthens the positive impact of competitor actions on GSI. The moderating analysis showed that *Guanxi* has a positive and significant impact on competitor actions on GSI (β = .058, $p < 0.1$). Figure 5-8 shows the interactions. At high levels of *Guanxi*, the effect of competitor actions on the adoption of GCC practices is stronger.

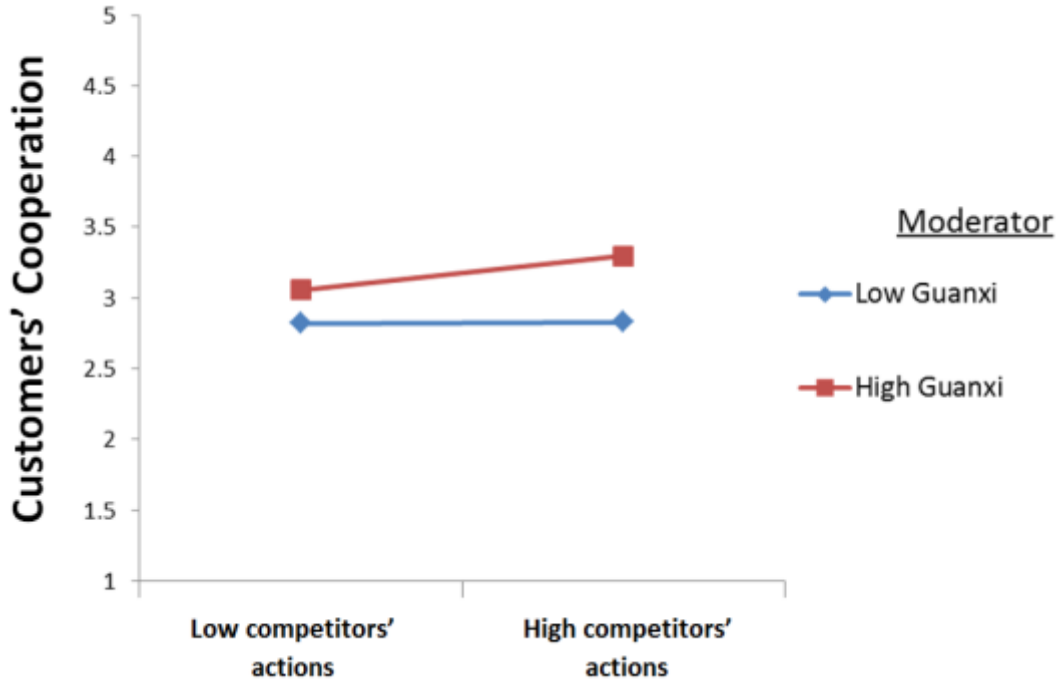

Figure 5-8. Effect of Guanxi on competitors' actions -GCC practices

We predicted that *Guanxi* reduces the negative impact of perceived high costs on GCC adoption. Model 12 showed a significant and positive interaction between perceived high costs of adoption and *Guanxi* ($\beta = 0.09$, $p < 0.1$), thus supporting H11a. Figure 5-9 shows the interactions of *Guanxi* and perceived high costs. In each case, the effect of perceived high costs on GCC was clearly amplified by the level of *Guanxi*. At high levels of *Guanxi*, the effect of perceived high costs on GCC adoption became much weaker. When the level of *Guanxi* was low, the effect of perceived high costs on GCC became stronger. Therefore, *Guanxi* reduced the negative impact of perceived high costs on GCC.

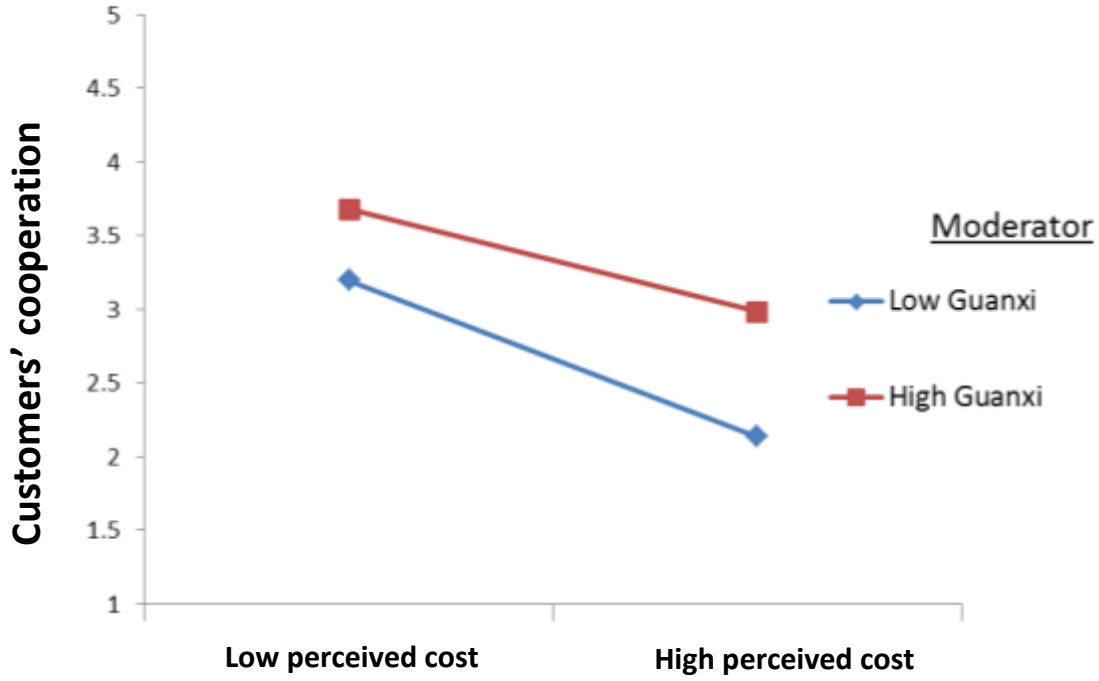

Figure 5-9. Effect of Guanxi on perceived high costs - GCC practices

In H11b, we predicted that the effect of perceived high costs on GSI will be reduced with the presence of *Guanxi*. The interaction between perceived high costs and *Guanxi* was positive and significant ($\beta = 0.103$, $p < 0.1$), thus supporting H11b. Figure 5-10 shows the conditional effects plot for *Guanxi* as a moderator of perceived high costs on GSI. The plot shows that the negative effect between perceived high costs and GSI decreased when the level of *Guanxi* was low.

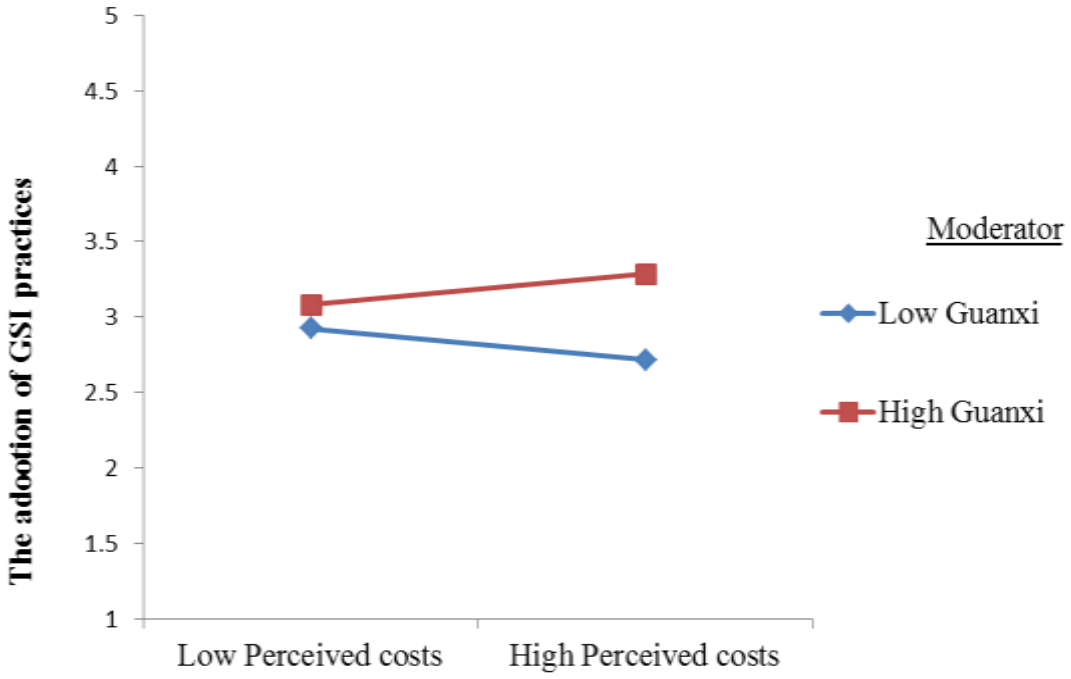

Figure 5-10. Effect of Guanxi on perceived high costs - GSI practices

Although we predicted that *Guanxi* would reduce the negative impact of complexity of regulations on GCC, the regression results for Model 16 showed an insignificant interaction between the complexity of regulations and *Guanxi* (β = -0.1, ns), which failed to support H12a. In H12b, we predicted that the negative effect of complexity of regulations on GSI would decrease with the presence of *Guanxi*. The interaction between complexity of regulations and *Guanxi* was positive and significant (β = 0.45, $p < 0.1$). As Figure 5-11 shows, when the level of *Guanxi* is low, complexity of regulations has a stronger effect on GSI. However, when *Guanxi* is high, the negative impact of complexity of regulations on GSI became weaker. Therefore, H12b was supported.

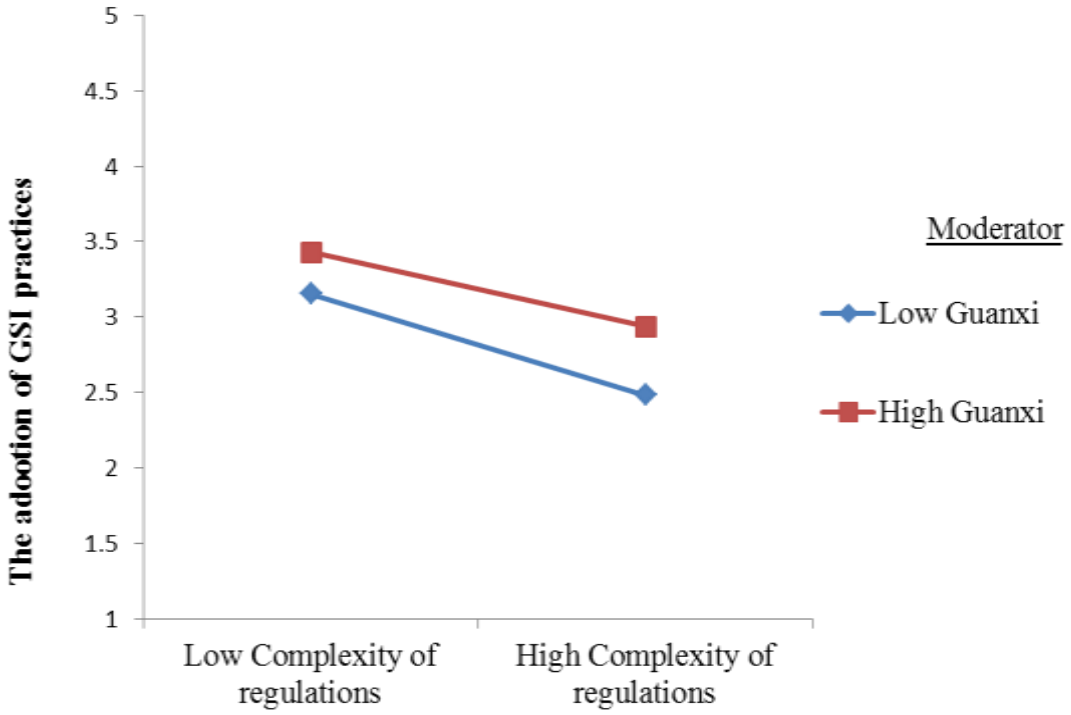

Figure 5-11. Effect of Guanxi on complexity of regulations - GSI practices

Table 5-25 summarises the results of the hypothesis testing.

Table 5-25.Results of hypothesis testing

Hypotheses	**Antecedents**	**Without Guanxi**	**GSCM practices**	**Hypotheses**	**Antecedents**	**With Guanxi**	**GSCM practices**
H1a	Supplier advices	Supported	GCC practices	H7a	Suppliers' advices	Supported	GCC practices
H1b	Suppliers' advices	Supported	GSI practices	H7b	Suppliers' advices	Rejected	GSI practices
H2a	Customers' requirements	Supported	GCC practices	H8a	Customers' requirements	Rejected	GCC practices
H2b	Customers' requirements	Rejected	GSI practices	H8b	Customers' requirements	Supported	GSI practices
H3a	Communities' pressures	Rejected	GCC practices	H9a	Communities' pressures	Rejected	GCC practices
H3b	Communities' pressures	Rejected	GSI practices	H9b	Communities' pressures	Supported	GSI practices
H4a	Competitors' actions	Supported	GCC practices	H10a	Competitors' actions	Rejected	GCC practices
H4b	Competitors' actions	Supported	GSI practices	H10b	Competitors' actions	Supported	GSI practices
H5a.	Perceived high costs	Rejected	GCC practices	H11a.	Perceived high costs	Supported	GCC practices
H5b.	Perceived high costs	Rejected	GSI practices	H11b.	Perceived high costs	Supported	GSI practices
H6a.	Complexity of regulations	Supported	GCC practices	H12a.	Complexity of regulations	Rejected	GCC practices
H6b.	Complexity of regulations	Supported	GSI practices	H12b.	Complexity of regulations	Supported	GSI practices

Chapter 6: Results discussion

6.1 Introduction

This study examined the influences of stakeholders' drivers, supply chain barriers, and Guanxi on the adoption of GSCM practices in the Chinese manufacturing sector. The present study proposes a research model for studying the effects of stakeholders' drivers and supply chain barriers on the adoption of GSCM practices and the moderating role of Guanxi on these relationships. The framework introduces the adoption of GSCM practices as being affected by both stakeholders' drivers and supply chain barriers. Moreover, it investigates the moderating role of Guanxi in helping with the adoption of GSCM practices when companies face drivers and barriers. This chapter discusses the results and reflect on the previous literature.

6.2 Direct relationships

This section presents a detailed discussion of the results for hypotheses associated with the impact of stakeholders' drivers, including customers' requirements, suppliers' advices, communities' pressures and competitors' actions, as well as supply chain barriers, including perceived high costs and complexity of regulation, on the adoption of GSCM practices.

6.2.1. Suppliers' advices

Strong evidence was found that supplier advices played a critical role in facilitating both suppliers and customers participating in the adoption of GSCM practices with focal companies. Previous literature indicated that suppliers are not the direct drivers in facilitating the adoption of GSCM practices (Miao et al., Huang, 2015). For example, Miao et al. (2012) found that supplier advice was only related to company philanthropy. Similarly, Walker et al. (2008) found that none of their study participants considered suppliers as drivers that induced the adoption of GSCM practices. Vachon and Klassen (2006) explained that suppliers are often not regarded as drivers because they did not attract enough research attention in empirical studies of GSCM. Therefore, previous literatures have concluded that suppliers are more likely to collaborate with focal companies than they are to play the role of a driver for adopting GSCM

practices (Theyel, 2001; Klassen and Vachon, 2003; Vachon and Klassen, 2006). In contrast, this study confirmed that manufacturing companies in China adopted GSCM practices based on the advices from their suppliers. This positive relationship may be because this study considered two aspects of GSCM: GSI and GCC green cooperation. Each requires an interactive process of information sharing and cooperative development (Wu et al., 2013). In this regard, supplier advice contributes to mutual understanding on implementing GSCM practices. Specifically, suppliers' advices provide professional knowledge in environmental design, which may help focal companies meet environmental standards. In other words, suppliers support Chinese manufacturing companies in adopting GSCM practices by providing advice on green material sourcing, green product specifications, and green manufacturing.

6.2.2 Customers' requirements

This study found that customers' requirements may have a contradictory effect on the adoption of GSCM practices. Consistent with previous literature, this study found that customer requirements have a positive and significant effect on GCC. ElTayeb and Zailani (2009) indicated that foreign customers' expectations for green products had a powerful impact on extending GSCM practices in AEE. In this study, 43.9% of respondents were foreign owners or joint venture companies that were part of (or partners with) multinational companies based in Japan, the USA, and Europe, and they had a high consideration for environmental impact. This analysis found no significant statistical result for the relationship between customer requirements and GSI. This result differs from those of most GSCM studies, which found that customers are the major stakeholders influencing the adoption of GSCM practices (ElTayeb and Zailani 2009; Lin and Ho, 2011; Miao et al., 2012). The non-significant result may be due to the fact that most suppliers only provide materials for focal companies and are not involved in their operations (Lin and Ho, 2011). In this regard, Lee (2013) argued that focal companies may allow their suppliers to ignore environmental issues because the costs of bringing in an

alternative environment-friendly supplier are too high. In addition, customers' environmental requirements are likely to be ignored when suppliers hold good Guanxi with focal companies. Consequently, suppliers can refuse to collaborate with focal enterprises in the implementation of GSCM practices. Lee (2013) provided an example in which Samsung asked its manufacturer to replace a parts supplier with an alternative environment-friendly supplier. However, that manufacturer had a long partnership with the parts supplier. Therefore, the manufacturer persuaded Samsung to relax the environmental limits for this parts supplier (Lee, 2013).

6.2.3 Communities' pressures

In line with previous literature, this study found that community pressure does not encourage GCC or GSI practices. However, the literature suggested that pressure from communities (industrial associations, NGOs, and media) facilitated environmental practices for manufacturing companies (Mark and Shevchenko, 2013). For example, the International Labour Organization (ILO) has a principle which addresses human rights, child and forced labour, wages, and training. Therefore, manufacturing companies in Spain apply a set of social criteria for GSCM with suppliers to meet ILO requirements. However, scholars in AEE have indicated that pressure from communities does not essentially affect the implementation of GSCM practices for two reasons. First, communities complain about illegal activities that may damage the environment more than they lobby for proactive efforts such as GSCM practices. Second, community pressures in China are oriented rather than forced (Zhu et al., 2013). Therefore, such pressures may be novel to manufacturing companies. For example, the Chinese Electrical and Electronic Association used to promote WEEE to manufacturing companies when the China WEEE regulation passed in 2008. However, Chinese manufacturers did not take action on this promotion until the China WEEE regulation was enacted in 2011 (Zhu et al., 2013).

6.2.4 Competitors' actions

This study found strong evidence that competitors' actions have a positive effect on causing both suppliers and customers to participate in the adoption of GSCM practices with focal companies. This result is in line with that reported by Zhu et al. (2013), who indicated that Chinese manufacturers often follow the actions of their successful competitors to gain competitive advantages in the global market. This may be because consumer purchasing decisions are increasingly driven by available green products globally (Hsu et al., 2013). Having the largest manufacturing base in the world, China offers companies an opportunity to adopt both GCC and GSI practices; this may enable businesses to gain advantages to beat their competitors in the global market.

6.2.5 Perceived high costs

In contrast with the hypothesis, the empirical results showed that perceived high costs do not negatively affect the adoption of GCC or GSI practices. Previous literature tended to consider perceived high costs as the most significant constraint to GSCM implementation. Scholars indicated that GSCM practices could not lead to profit or long-term financial return; thus, managers in developing countries often prioritised profitable practices (Park and Luo, 2008). However, this study found that perceived high costs cannot hinder the adoption of GSCM practices. This contrasting result may be due to the fact that China is experiencing extreme environmental problems, and the government is keen to resolve these issues. According to the Chinese Ministry of Industry and Information Technology, more than one million heavily polluting manufacturing companies were forced to close in 2015 (CMIIT, 2016). As GSCM is a set of practices that can effectively reduce environmental damage, manufacturing companies are willing to pay to implement GSCM to avoid closure by the government.

6.2.6 Complexity of regulations

In line with the literature, this study found strong evidence that complex regulation hinders the adoption of GCC and GSI practices. For example, Rauer and Kaufmann (2014) conducted

interviews and found that Chinese manufacturers often faced difficulties in meeting the requirements of Western buyers owing to less-advanced environmental regulations and enforcement in China. This study confirmed that although the Chinese government has issued ample environment laws (Zhu et al., 2013), these laws might not be backed by the legal means to force the implementation of GSCM practices. In this regard, rather than laws and regulations, Western buyers seek help from local authorities to enforce and guarantee the environmental practices of their Chinese suppliers (Rauer and Kaufmann, 2014). Moreover, manufacturing companies in China had low levels of executive power to comply with environmental regulations (Zhu et al., 2005). This study may prove that environment regulations alone cannot force the adoption of GSCM practices. In this regard, intervention by local authorities and political influence might play a decisive role in inducing GSCM practices.

6.3 Moderated relationships

We propose that Guanxi moderates the relationship between stakeholders' drivers and supply chain barriers on the adoption of GSCM practices.

6.3.1 Suppliers' advice

The empirical results showed that the effect of supplier advice on GCC practices is stronger when Guanxi is present. In the current context of the relationship between supplier advice and GCC practices, developing and maintaining effective Guanxi with major suppliers may offer focal companies a higher level of collaboration for GCC activities.

The social exchange theory (Barnes et al., 2011) provides an explanation for moderating relationships. First, good Guanxi ties lead to stable and long-term relationships which can reduce the opportunistic behaviours of all parties in a supply chain (Williamson, 1989). In the framework of social exchange theory, Guanxi is vital because it improves communication and understanding between supply chain partners (Atuahene-Gima and Li, 2002). Therefore, Guanxi helps reduce misunderstandings and mitigates uncertainty on the subject of suppliers'

advice to focal companies to adopt GSCM practices. Second, companies in China often rely on their Guanxi ties to gain valuable information (Luk et al., 2008). However, it is problematic for focal companies to verify whether the action advised by suppliers is opportunistic (Liu and Wang, 2013). Recognising the value of GCC from a strong Guanxi position may give focal companies the confidence to adopt GSCM practices with their customers. Such confidence could develop because Guanxi is considered a vital component of sustaining reputations; this enables the company/customer dyad to attract and connect with more firms (Granovetter, 1985).

When focal companies collaborate with customers in GSCM practices following suppliers' advices, the reputations of both the focal companies and the suppliers will improve (Badi et al., 2016). Guanxi functions as a means to control the relationship between supplier advice and GCC. Finally, good Guanxi ties with major suppliers help focal companies understand supply market trends, improve production methods, learn about new materials for products, and reduce total production time (Luk et al., 2008). Consequently, when they work with suppliers, focal companies are more inclined to adopt GSCM practices with customers, because they see it as a way to gain access to new technologies before their competitors do (Takeishi, 2001).

Surprisingly, our results indicated that Guanxi has a negative and significant impact on the relationship between supplier advices and the adoption of GSI practices. Previous literature indicated that when a company invests in Guanxi with a supplier, the company will be more likely to cooperate or integrate supply chain practices with this supplier (Zhao et al., 2011). With good Guanxi ties, both partners are willing to communicate and share information as a way to understand each other (Park and Luo, 2008). In contrast, Zhuang et al. (2010) indicated that when a high level of Guanxi ties exists between focal companies and their suppliers, the collaboration practices between them are often non-intimidating because the key characteristics of Guanxi are reciprocal obligation and mutual assurance (Luo, 1997; Park and Luo, 2001; Wang, 2007). Therefore, when suppliers advise focal companies to adopt GSCM practices,

they may use Guanxi ties to seek alternative practices rather than induce GSI. Similarly, Luo (2014) indicated that when companies spend too much money and effort on maintaining Guanxi ties with suppliers, their investment in GSCM may become insufficient.

6.3.2. Customers' requirements

In contrast with our hypothesis, Guanxi has a significant, adverse effect on the relationship with customers' requirements for the adoption of GSCM practices. One possible reason is that when focal companies have strong ties with their suppliers, they lack the willingness or commitment to collaborate in GSCM practices with suppliers and customers. Because having robust Guanxi ties does not imply a strategic match, this Guanxi tie in fact damages the strategic relationships between focal companies and their suppliers (Lee, 2007). As a result, focal companies often adopt a reactive or strategic approach to dealing with suppliers with good Guanxi ties. However, Guanxi has a significant and positive effect on the relationship between customer requirements and the adoption GSI practices. One possible reason is that focal companies have paid substantial attention to the anticipated reaction of their customers owing to their sensitive nature as major stakeholders in AEE (Zhao et al., 2008). Furthermore, it would be difficult for a company to ignore pressure from customers who are perceived to be significant to the company's Guanxi (Cheng, 2011), as Guanxi inevitably affects the company's willingness to maintain long and positive relationships with its customers (Gwinner et al., 1998).

6.3.3 Communities' pressures

Interestingly, Guanxi has a negative impact on the effect of community pressure on GSI. This requires the discussion of two negative aspects of Guanxi ties. First, Gu et al. (2008) argued that strong Guanxi ties between a company and its business partners often result in the company turning a blind eye in to the environmental issues. In this respect, Guanxi is viewed as a source of wrongdoings relating to cronyism and nepotism, which result in under-the-table dealings

(Millington et al., 2005). For instance, some companies would offer a contract to an unqualified supplier owing to obligations and reciprocity for Guanxi ties (Fan, 2002b). Suppliers can even carefully devise a way to systematically cheat a focal company under the veil of good Guanxi ties (Anderson and Jap, 2005). In this regard, a strong Guanxi network between focal companies and their suppliers may reduce the flow of new ideas from communities into the network and limit the number of alternative methods to get the work done. In this way, Guanxi may create a situation in which companies become complacent about implementing GSCM. Second, exchange obligations are often the most important aspect of a company and its Guanxi networks (Gu et al., 2008). A supplier may simply exchange an obligation with a key person in the focal company to avoid joining GSI practices. This exchange of obligation may lead to the focal company failing to fully integrate GSCM practices with its suppliers.

6.3.4 Competitor's actions

Previous literature indicated that consumer product firms do not rely on their Guanxi networks to promote their products (Gu et al., 2008). In contrast, this study found that Guanxi enhanced the positive relationship between competitors' actions and GSI. This may indicate that companies operating in highly competitive markets are willing to adopt GSCM practices to differentiate themselves in their customers' eyes. Guanxi fosters information sharing between focal companies and their suppliers. Therefore, when a focal company realises that one of its competitors has gained an advantage by adopting GSCM practices with suppliers, it could acquire information from a Guanxi tie to replicate the competitor's actions. Moreover, Chen et al. (2011) indicated that companies are more likely to develop a close relationship with supply chain partners when they face strong competition in the market. Tsui and Farh (1997) argued that good Guanxi ties will increase the frequency of communication between two persons. In return, this communication with suppliers could contribute to the focal company gaining a competitive advantage.

6.3.5 Perceived high costs

From previous literature, it is known that perceived high costs constitute a barrier to the adoption of GSCM practices. In our study, we found that establishing good Guanxi with supply chain partners reduces the adverse impacts from the perceived high costs of adopting GSCM.

The transaction costs theory is one way to explain this effect. Coase (1991) argued that companies attempt to minimize their transaction costs through activities with external supply chain partners. Coase (1991) also indicated that companies do not voluntarily carry out activities that they perceive to have high costs, because they often fail to identify the most cost-efficient activities. For manufacturing companies in China, it is essential to minimize transaction costs related to GSCM implementation with supply chain partners for activities that are beyond focal companies' control. Transaction costs include search, negotiation/contract, and monitoring/enforcement costs. Search costs are experienced in finding suppliers and customers necessary for all the activities in the supply chain. Negotiation/contract costs are incurred when finalizing an agreement and an appropriate contract (Fliaster and Spiess, 2008) to adopt GSCM practices. Monitoring/enforcement costs are incurred when the contracting parties are monitored for adherence to the terms of the contract, and when required actions are taken if agreements are not kept (Liang and Huang, 1998).

Rather than search for new partners, managers in China tend to collaborate with partners based on their Guanxi ties (Zhao et al., 2006; Zhao et al., 2008; Zhou et al., 2014). Researchers found that relationships from long-term Guanxi ties have significant positive impacts on reducing transaction costs by making transactions more effective and efficient. Establishing strong Guanxi ties with supply chain partners can reduce transaction costs by facilitating the flow of information by aligning firms' interests (Cai et al., 2010). Thus, good Guanxi between a focal company and its supply chain partners may play a strong role in the implementation of GSCM practices. Doing so can reduce focal companies' fear of opportunistic behaviour and reduce the

costs of adopting GSCM practices. Moreover, a high level of Guanxi creates more flexibility in communicating the adoption of GSCM practices with suppliers and customers, and it brings increased efficiency in contracting and negotiating.

Standifird and Marshall (2000) indicated that any discussion of China's economic environment must include a discussion of Guanxi. Davies (1995) found that Chinese managers believed that good Guanxi ties would bring a significant number of benefits, including smooth running of routine business operations, greater access to information about government policies, and quicker receipt of administrative approvals. In other words, a good Guanxi network allows focal companies in China to select potential partners for any transaction with a strong degree of confidence.

6.3.6 Complexity of regulations

Our study shows contradicting results for the moderating effect of Guanxi on the complex nature of regulations in the adoption of GSCM practices. Guanxi does not have a moderating effect on complex regulations impacting GCC practices. However, it positively moderates the effect of complex regulations impacting GSI practices.

To reiterate, we found that the complexity of regulations has a significant negative impact on GCC and that Guanxi does not reduce this impact. A possible reason is that strong Guanxi ties between the focal company and suppliers cannot influence customer decisions. This result indicates a negative aspect of Guanxi. Previous literature demonstrated that high levels of Guanxi may weaken the efficiency of self-enforcing mechanisms (Wicks et al., 1999). Based on the social exchange theory, good Guanxi between a focal company and its suppliers may diminish customer trust. When customers realize that focal companies spend too much money on building Guanxi ties with suppliers, they limit their purchase in their products. On the other hand, Guanxi is often described as an informal governance mechanism (Zhou et al., 2014) that

functions as a substitute for laws and regulations. However, our study showed that Guanxi could not sway regulations and customers' behaviours.

Regarding GSI, Guanxi acts as a moderator by reducing the negative impact of complicated regulations. When formal regulations fail to influence suppliers in adopting GSCM practices, Guanxi could serve as an alternative mechanism. For example, when manufacturing companies cannot fully understand complex regulations, good Guanxi ties with suppliers could provide focal companies a better understanding of environmental protection standards (Wu, 2012). As a result, suppliers can provide professional information on environment-friendly parts and components. Moreover, unlike Western countries, regulations in China usually act as tools for reinforcing conditions rather than facilitating business transactions (Cai et al., 2010). In China, regulations have high litigation costs associated with legal problems owing to inconsistent enforcement (Rao et al., 2005). Therefore, manufacturing companies in China tend to build Guanxi ties with supply chain members to reduce the potential for legal problems. Such Guanxi ties can increase suppliers' willingness to share essential knowledge regarding the adoption of GSCM practices.

Furthermore, government information is often disseminated in China. Boisot and Child (1996) argued that most information from the Chinese government is disseminated at an uncodified level, which leads to potential confusion. Thus, for foreign firms, it is critical to interpret the disseminated information correctly (Peng and Heath, 1996). In this regard, building good Guanxi ties with local suppliers can help focal companies understand information regarding government policy intents and the country's changing profile.

6.4 Guanxi

Although we did not hypothesize on the direct role of Guanxi, the analysis showed a positive and significant main effect of Guanxi on the adoption of GSCM practices; some important findings in this regard are highlighted below. First, previous studies showed contradictory

results on the effect of Guanxi on the adoption of GSCM practices. Our study confirmed the direct role of Guanxi in encouraging the adoption of GSCM practices with suppliers and customers. Second, previous research indicated that Guanxi has a lesser impact in highly economically developed regions in China (Cai et al., 2010; Park and Luo, 2001). Our empirical data collected from four of the most economically developed areas in China (Jiangsu, Shandong, Shanghai and Guangdong) showed that Guanxi is crucial in all these regions.

6.5 Summary

This chapter discussed the results of this study in light of previous literature and attempted to position the results obtained from the relevant literature; the discussion highlighted significant contributions. In brief, the results of this study suggested that Guanxi played a critical role in combination with manufacturing companies' stakeholder drivers and barriers when adopting GSCM practices. With regard to stakeholders' drivers, Guanxi enhanced the effect of suppliers' advices for GCC. With regard to barriers, we found that Guanxi reduced the negative impact of perceived high costs of GSCM practices. In addition, suppliers' advices and competitors' actions were found to have a positive effect on GSCM practices, whereas complexity of regulations negatively affected the adoption of GSCM practices.

Chapter 7: Conclusion

7.1 Introduction

This study aimed to investigate the following: (1) the relationship between the adoption of GSCM practices and firm performance; (2) stakeholders' drivers and supply chain barriers to the adoption of GSCM practices; and (3) the moderating role of Guanxi on the effects of stakeholders' drivers and supply chain barriers to the adoption of GSCM practices. To achieve these aims, this study used two theories (stakeholder theory and social exchange theory) to develop a theoretical framework and research hypotheses. This chapter concludes the study and summarises the results of the data analysis. Specifically, three research questions were revisited to provide answers regarding the findings of this study. Then, this chapter outlines theoretical and managerial implications. Finally, this chapter reports the study limitations and recommendations for future research.

7.2 Summary of research findings

This study tested the direct relationship between stakeholders' drivers and supply chain barriers to the adoption of GSCM practices. The results indicate the following:

i. Suppliers' advices played a critical role in facilitating the adoption of GCC and GSI practices.
ii. Customers' requirements have a positive and significant effect on the adoption of GCC practices but not on the adoption of GSI practices.
iii. Communities' pressures do not influence the adoption of GCC and GSI practices.
iv. Competitors' actions have a positive effect on the adoption of GCC and GSI practices.
v. Perceived high costs do not negatively affect the adoption of GCC and GSI practices.
vi. The complexity of regulations hinders the adoption of GCC and GSI practices.

With regard to the moderating impact of Guanxi on the drivers/barriers and the adoption of GSCM practices, the results indicate the following significant conclusions:

i. Empirical results showed that the relationship between suppliers' advices and the adoption of GCC practices will be strengthened when Guanxi is present. However, Guanxi has a significant negative impact on the relationship between suppliers' advice and the adoption of GSI practices.
ii. Guanxi had a significant adverse effect on customers' requirements in the adoption of GCC and GSI practices.
iii. Guanxi reduced the positive effect between Communities' pressures and the adoption of GSI practices.
iv. Guanxi enhanced the positive relationship between competitors' actions and the adoption of GSI practices.
v. Guanxi reduced adverse impacts based on perceived high costs of implementation on the adoption of GCC and GSI practices.
vi. Guanxi moderated the effect of complex regulations on the adoption of GSI practices.

As indicated above, a number of relationships proposed by the theoretical framework are tested in this study.

7.3 Revisiting the research questions

This research was designed to answer three research questions (specified in the first chapter). These three questions are:

i. What is the relationship between the adoption of GSCM practices and supply chain performance in manufacturing companies in the AEE?

ii. What factors influence the adoption of GSCM practices by manufacturing companies in China?

iii. What role does Guanxi play in the adoption of GSCM by manufacturing companies in the AEE?

7.3.1 The relationship between GSCM practices and firm performance

A meta-analysis applied in Chapter 2 examined the relationship between GSCM practices and firm performance. Through a systematic literature review, this study identified and analysed 50 articles with 130 effects (Pearson's correlation coefficients or other test statistics performance) that involved a total of 11,127 manufacturing companies in the AEE. The results of our meta-analysis indicated that GSCM practices led to better performance in three aspects: economic, environmental, and operational. More specifically, the GSCM practice–performance relationship is the strongest for economic performance, followed by operational and environmental performance. Surprisingly, GSCM practices did not have a significant impact on the firm's social performance. Moreover, the results also indicated that several GSCM practice-performance relationships were moderated. This is an important finding for several reasons. First, our meta-analysis implied that the adoption of GSCM practices contributes to firm performance, but at different levels. Second, this discovery can encourage belief in the adoption of GSCM practices as profitable environmental strategy for reducing environmental damage while increasing economic performance. In this regard, as competition in the manufacturing industry increases among supply chains and decreases among individual firms, Peng and Lin (2008) stated that adopting GSCM practices is a valuable strategy to reduce costs and satisfy stakeholders' requirements. Our meta-analysis indicated that implementing GSCM practices results in significant contributions to firm performance as supply chains become more complex. As for globalization, introducing GSCM practices will be ever more

important to manufacturing companies in AEE to reduce environmental impacts and contribute to the firm's performance.

7.3.2 Drivers and barriers to adoption of GSCM

To answer the second research question, CB-SEM analysis was used to test the hypotheses pertaining to stakeholders' drivers and supply chain barriers to implementing GSCM practices. The results suggested that suppliers' advices and competitors' actions have positive and significant impacts on enacting the adoption of GCC and GSI practices. Customer requirements positively affect adopting the adoption of GCC practices but not the adoption of GSI practices. Moreover, communities' pressures and perceived high costs do not affect the adoption of GCC and GSI practices. Furthermore, complex regulations hinder the adoption of GCC and GSI practices. In other words, supplier advice and competitor actions help facilitate the implementation of GSCM practices, whereas the complexity of regulations reduces the implementation GSCM practices.

7.3.3 The moderating role of Guanxi

The third research question addresses the role of Guanxi on the effects of stakeholders' drivers/supply chain barriers to the adoption of GSCM practices. The results suggested that Guanxi strengthened suppliers' advice on the adoption of GCC practices and competitor actions on the adoption of GSI practices. However, Guanxi reduced adverse impacts from the perceived high costs of the adoption of GCC practices. Guanxi also reduced the complexity of regulations regarding the adoption of GSI practices. In other words, Guanxi moderated the relationship between suppliers' advice and perceived high costs of adopting GSCM practices.

7.4 Meeting the study's aims and objectives

This research aimed to investigate (a) the relationship between the adoption of GSCM practices and firm performance, (b) stakeholders' drivers and supply chain barriers to the adoption of GSCM practices, and (c) the moderating role of Guanxi on the effects of stakeholders' drivers

and supply chain barriers to the adoption of GSCM practices. To achieve this aim, the following objectives were set out:

1) Conduct a meta-analysis based on the results of the systematic review to provide empirical generalizations regarding the relationship between GSCM practices and firm performance.

To meet this objective, this study identified 50 articles published between 1996 and 2015; 11,127 manufacturing companies in the AEE were surveyed. Then, a conceptual framework was developed to calculate 130 effects from 25,680 effect sizes presented in the reviewed papers' meta-analysis. The results of the meta-analysis indicated that GSCM practices led to better performance in three areas: economic, environmental, and operational. The GSCM practice-performance relationship is the strongest for economic performance, followed by operational and environmental performance.

2) Conduct a systematic review of the relevant literature to identify indicators of GSCM practices, drivers/barriers and Guanxi.
3) Develop a theoretical framework to shed light on the effects of drivers/barriers on the adoption of GSCM practices and the moderating role of Guanxi.

These two objectives were discussed in Chapters 3 with a systematic literature review and a conceptual framwork. Speficially, this atudy applied a systematic literature review to explore the relationships among GSCM practices, drivers/barriers and Guanxi. Then, a theoretical framework was developed based on the result of the systematic literature review to explain how drivers/barriers affect the adoption of GSCM practices. Additionally, the moderating role of Guanxi was introduced. This framework was developed based on two theoretical foundations: stakeholder theory and social exchange theory. Moreover, 24 hypotheses were developed from related literature.

4) Empirically assess relationships hypothesised in the theoretical framework in the manufacturing companies in China.

This objective was met in Chapters 4 and 5. Chapter 4 presented the research methodology and provided support and justification for using this methodology. Chapter 5 discussed the data analysis and the results of the tested model. Descriptive data, reliability, validity, and hypotheses testing were presented.

7.5 Research contributions

Based on the above discussion, the input of this study can be realised at different levels, especially the theoretical and empirical levels.

7.5.1 Theoretical contributions

First, based on the rapidly increasing literature on adopting GSCM practices and the limited literature on Guanxi, this study proposed and empirically tested the effects of Guanxi in enhancing positive drivers and reducing negative barriers to the adoption of GSCM practices. Surprisingly, our results indicated that Guanxi has a negative and significant impact on the relationship between suppliers' advices and the adoption of GSI practices. Previous literature has indicated that when a company invests in Guanxi ties with a partner, it is more likely to cooperate or integrate with that partner (Zhao et al., 2011). The reason is that with strong Guanxi ties, both partners show a willingness to communicate and share information to understand each other (Park and Luo, 2008). In contrast, Zhuang et al. (2010) indicated that with a high level of Guanxi ties between a focal company and its suppliers, the collaboration practices between them are often non-coercive. The reason is that the key characteristics of Guanxi are reciprocal obligation and mutual assurance (Luo, 1997; Park and Luo, 2001; Wang, 2007). As Guanxi weakens the effect of supplier advice on the adoption of GSI practice, when focal companies take suppliers' advices to adopt green practices, they may use the Guanxi tie to seek alternative practices rather than implementing GSI. Similarly, Luo (2014) indicated that

spending too much money and effort in maintaining Guanxi ties with suppliers constrains the resources of the focal company for investment in GSI practices.

Second, our findings are consistent with those of Cheng et al. (2012) and Luo et al. (2015): Guanxi played a major role in the adoption of GSCM. As the literature on Guanxi in GSCM is limited, our study provided empirical evidence that building Guanxi is essential to ensuring better chances of implementing GSCM practices. Regarding stakeholders' drivers, Guanxi will enhance the effect of suppliers' advices on the adoption of GCC practices. We explained this moderating effect by using the social exchange theory. We argued that strong Guanxi ties with major suppliers increases focal companies' confidence by reducing misunderstandings and interpreting uncertainty when they are adopting GCC practices.

Third, this study found that Guanxi can reduce the negative impacts of the perceived high costs of adopting GSCM practices. This finding confirmed that Guanxi will increase confidence in transactions between suppliers and customers. This study also found that Guanxi can reduce negative impacts from the complexity of regulations faced by suppliers in the adoption of GSI practices.. This study confirmed that Guanxi could act as an alternative mechanism when formal regulations fail to guide the adoption of GSCM practices. These findings expand supply chain literature by highlighting the importance of Guanxi in adopting GSCM practices when companies face barriers.

Then, this research extends and enriches recent literatures on Guanxi. For example, conventional wisdom suggests that formal regulations are underdeveloped and immature in developing countries. However, this study proves the need to consider the regulatory environment in China as being complex rather than being underdeveloped and immature. The concept of complex regulations offers new insights for maintaining an institutional and contingent view of business environments in all emerging economies.

Finally, the meta-analysis of this study has important implications for the research community on sustainability and GSCM in emerging economies. The relationship between collaboration-oriented practices (GCC and GSI) with the organization's performance was inconsistent. In the subgroup analysis, GCC had a stronger overall effect than GSI among economic and environmental performance measures. This result indicated that GCC may contribute more to performance in AEE. However, the sample size for GCC was smaller than that for GSI. This difference may indicate that GSI has the potential to make a strong contribution to firm performance. Owing to the smaller number of available studies on GCC, future research could extend this topic by conducting more empirical studies on this relationship to clarify this finding.

7.5.2 Empirical contributions

First, owing to widespread awareness of environmental sustainability in developed markets, companies in China are under pressure to recognize and implement GSCM practices. The outcomes of this study can help guide manufacturers in China to enhance the sustainability of their operations and to implement green standards such as ISO 14001 certification and green labels in their supply chain by recognizing the drivers of, barriers to, and moderating effect of Guanxi on GCSM practices. This could lead policymakers and key members of manufacturing supply chains in the region to revise their environmental policies and strategies based on factors that most influence GSCM implementation. For instance, our research reveals that stakeholder behaviour, such as suppliers' advice and competitors' actions, can facilitate the adoption of GSCM practices.

Second, the findings of this study have important implications for multinational enterprises operating in China. In recent decades, manufacturers of most products consumed in developed countries have relocated their manufacturing bases and production facilities to China (Lai and Wong, 2012). However, foreign firms face significant difficulties in collaborating with their

local partners. For instance, companies from Western countries prefer a legal approach to governing their relationships with local Chinese partners, rather than a personal-relationship-based approach. However, these foreign firms need to understand that Guanxi is a more effective way to achieve healthy business relationships in China. Thus, foreign firms could rely on Guanxi to reduce barriers that hinder the adoption of GSCM practices.

Third, this research established strong empirical evidence that GSCM practices can affect a firm's performance regardless of company size, industry, ISO certification, or export orientation. Our research findings suggest that when manufacturers in the AEE consider the environment in their SCM, they not only achieve better performance on sales, profit, and market share but also save energy and reduce waste, pollution, and emissions. The efficiency of a firm's operations, including scrap rate, delivery time, inventory levels, and capacity utilization, can also be improved. The positive relationships between the adoption of GSCM practices and environmental, operational, and economic performance have the potential to promote the adoption of GSCM as a strategy to improve performance.

Finally, our findings provide managers with multiple factors related to the adoption of GSCM practices, such as drivers, barriers, performance, and Guanxi, that will help them decide and adopt GSCM practices more easily. For instance, a strong Guanxi tie between a procurement manager and a sales manager in China may function as a safeguard that provides an element of assurance to the adoption of GSCM practices. Moreover, with good Guanxi ties, focal firms are more likely to persuade their supply chain partners to adopt GSCM practices by sacrificing some of their short-term benefits to achieve better long-term gains. In addition, owing to environmental issues that affect businesses globally, manufacturers in AEE have begun to change their focus to balance economic growth and environmental damage. This study encourages manufacturing companies in the AEE to seriously consider adopting GSCM practices to improve resource utilization. Companies need to share information on the benefits

they received from adopting GSCM practices with other firms. Doing so will help create interest in the concepts of GSCM. Most importantly, adoption of GSCM can bring commercial success to manufacturing companies as well as fulfil their moral obligation to protect the earth.

7.6 Limitations and directions for future research

Several research limitations provide the potential for further investigation. First, this study only collected data from the perspective of focal companies. Future research could investigate this framework from a variety of standpoints, such as those of customers and suppliers. Moreover, Sarkis et al. (2010) and Graham and McAdam (2016) both indicated the need to consider learning capabilities in the adoption of GSCM practices. Previous literature on Guanxi highlighted the positive impact on learning capability. A future study could explore how Guanxi contributes to the learning process when adopting GSCM practices.

Second, given the complexity of the theoretical framework, this study only considered Guanxi as a dyad between a focal company and its suppliers. Researchers should continue to take Guanxi into account when they examine issues related to implementing GSCM practices, particularly in the AEE such as Korea, Malaysia, and Thailand. Future studies may consider evaluating a focal firm's comparative Guanxi by measuring the degree of centrality using its network position index, This concept is drawn from the social network theory (Sparrowe et al., 2001), in which the degree of centrality denotes the level of being at the core of a network by comparing the distance of the position of an individual's linkage to others in the network at the firm level.

Third, the result of the meta-analysis of the positive relationships between GSCM practice and performance seemed linear. In the reviewed literature, only one of the reviewed papers observed that GSCM is a 'win-win' strategy (Lai et al., 2014a). The authors indicated that GSCM practices involve collaboration with firms, and their supply chain partners seek to create value for each other in adopting GSCM practices to achieve performance benefits. Therefore,

it would be interesting to examine whether the adoption of GSCM practices only contributes to the focal company's performance or whether it also affords benefits to the company's supply chain partners.

Finally, further studies can apply these results in less-explored regions in AEE and other emerging economies such as Brazil and Turkey. It would also be stimulating to implement this framework by examining companies that are not located in AEE but that conduct business with manufacturers in AEE to determine whether the propositions in this study can be generalized to this related, but nevertheless distinct, context. Given the similarities among emerging economies, comparable research with slight amendments to the framework of this study and propositions could be carried out in other parts of the world, such as South America and Africa.

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Appendix A

Variable	Item code	Items	References
Customer cooperation practices	CC1	Our company cooperate with customers for Eco-design (Eco-design is a practices that aims to reduce environmental impacts of products among its life cycle)	(Zhu et al., 2005) (Wu et al., 2012)

	CC2	Our company cooperate with customers for cleaner production (Cleaner production is a practices that aims to minimize waste and emissions and maximize product output)	
	CC3	Our company cooperates with customer for green packaging (green packaging is reduces the environmental impact and ecological footprint during the process of development and use of packaging)	
	CC4	Our company cooperate with customers for using less energy during product transportation	
	CC5	Our company cooperate with customers for using less energy during production process	
	CC6	Our company provide logistic service to encourage our customers for product returns	
Suppliers integrations practices	SI1	Our company make sure that our purchased products must not contain environmentally undesirable items such as lead or other hazardous or toxic materials	(Zhu et al., 2005) (Wu et al., 2012) (ElTayeb et al., 2010) (Hung et al., 2014) (Yen and Yen, 2012)
	SI2	Our company collect information about its suppliers' environmental aspects, activities and/or management systems	
	SI3	Our company have the environment audit programme for our first-tier suppliers' environment management	
	SI4	Our company have the environment audit programme for our second-tier suppliers' environment management	
	SI5	Our company require our suppliers to have a certified environment management standard such as ISO 14001	
	SI6	Our company have frequent face to face meetings with key suppliers for environmental issues	
Suppliers drivers	SU1	Our supplier's advances in developing environmentally friendly goods affect our adoption of GSCM practices	(Zhu et al., 2005) (Miao et al., 2012)
	SU2	Our supplier's advances in developing environmentally friendly production affect our adoption of our adoption of GSCM practices	
	SU3	Our supplier's advances in developing environmentally friendly packaging affect our adoption of our adoption of GSCM practices	
	SU4	Our company have environmental partnerships with suppliers	
Customers drivers	CU1	Our company receive requirements from consumer associations to be a more environmentally conscious firm	(Lee, 2008) (Lai and Wong, 2012) (Miao et al., 2012)
	CU2	Our company's major customers frequently encourage our firm to adopt GSCM practices	
	CU3	Our customers are one of the important reason pushing business to pursue environmental management	
Competitors drivers	CP1	Successful firms in our company's industry adopt GSCM practices	(ElTayeb et al., 2010) (Hsu et al., 2013)
	CP2	GSCM practices are generally considered in our firm's industry as having considerable marketing benefits	

	CP3	Our competitors' earlier implementations of GSCM practices provide a benchmark and guidance for our company's GSCM practices adoption.	(Ye et al., 2013)
	CP4	Competitors have a strong influence on our company's GSCM practices adoption	
Communities drivers	CM1	Neighbouring communities put pressure on our companies about the impact on the environment	(ElTayeb et al., 2010) (Liu et al., 2012)
	CM2	The media follow our industry closely about the environmental issue	
High costs of adoptions	HC1	The costs of initial capital on implementing GSCM are	(Min and Galle, 2001) (Govindan et al. , 2014)
	HC2	The costs of dealing with hazardous waste disposal are	
	HC3	The costs of recruitment of extra human resources for environment purpose are	
	HC4	Compare with the return-on-investment, the costs on the adoption of GSCM practices are	
	HC5	The costs of switching to the new system for the adoption of GSCM practices are	
Complexity of regulations	CR1	The laws, regulations, and directives on environment are	(Abdulrahman et al., 2014) (Chen et al., 2011) (Liu, 2014)
	CR2	The support from government on economic policies on solving environmental issue are	
	CR3	The support from government on Environmental friendly policies are	
	CR4	Rate the level of economic support related to resolving environmental issue through legal approach	
	CR5	Rate the level of regulatory support from government for resolving environmental issue through legal approach	
Guanxi	GX1	Rate the frequency in annual dinner or other social activities between you and the your supplier	(Cheng, 2011) (Luo et al., 2014) (Yen et al., 2011)
	GX2	Rate the level of relationship between you and your supplier	
	GX3	Rate the importance of the feeling of your supplier before making important purchasing decisions	
	GX4	Rate level of help you would provide to your supplier when he/she is in need	
	GX5	Rate frequency of you and your supplier doing favours for each other.	