An empirical study of green supplier collaboration in the Chinese manufacturing sector: The double-edged sword effect of *guanxi*

Purpose: Drawing on institutional complexity, this study explores the interaction effect of formal and informal institutional forces on the adoption of *green supplier collaboration* (GSC) practices by Chinese manufacturing firms.

Design/methodology/approach: The paper hypothesizes that the effect of the formal institutional forces on GSC in China is influenced by an informal institutional variable, *guanxi*, which is the interpersonal relationship between employees of the supplier and the manufacturer. To test the conceptual framework, hierarchical moderated regression analyses are conducted using multi-respondent data from 408 randomly sampled manufacturing companies in China.

Findings: *Guanxi* has a double-edged sword effect on the adoption of GSC practices. Specifically, *guanxi* reduces the negative impact of the perceived costs and the complexity of regulations on the adoption of GSC practices, but it also weakens the positive effect of suppliers' advice and community pressures on the adoption of GSC practices.

Research limitations/implications: Results contribute to supply chain management literature by offering novel theoretical and empirical insights on the Chinese institutional environment governed by both formal and informal institutional variables.

Practical implications: Considering *guanxi's* double-edged sword effect on the adoption of GSC, manufacturing companies are advised to carefully leverage their *guanxi* to maintain an institutional and contingent view of the environmental consequences in China.

Originality/value: This study empirically examines the effect of formal and informal institutional environments on the adoption of GSC practices in emerging economies.

Keywords: Green supplier collaboration; Institutional theory; Chinese manufacturing sector;

Guanxi; Personal relations; Moderating effect

1. Introduction

In the past decades, addressing human-induced environmental issues has been a major global challenge for organisations to gain competitiveness (York et al., 2018). Green collaboration underpins manufacturers' commitments to environmental sustainability, given that most manufacturers often purchase materials and source products from other organisations. Thus, it is essential for firms to collaborate on environmental practices with suppliers, from the design stage to the delivery of the final product, to ensure materials and production processes are green (Wang et al., 2016). In other words, supplier deficiency in green supply chain management (GSCM) can lead to a huge financial and operational impact on focal firms. Therefore, firms are encouraged to adopt green supplier collaboration (GSC) practices to reduce environmental damage while increasing their financial, operational and social performance (Lee, 2015).

The vast and growing manufacturing activities in China, deemed 'the world's factory', have inevitably damaged the country's environment. Home to 7 of the 10 most polluted cities in the world, the Chinese government now exert strict carbon dioxide reduction limits by requiring all manufacturing companies to provide information on the carbon footprint of every product listed on their packaging (MIIT, 2016). Therefore, manufacturing firms have shown increasing attention to joint efforts with suppliers by adopting GSC practices, defined as focal firms' efforts to collaboratively deploy resources and capacities with suppliers in order to jointly develop solutions that reduce the negative impact of manufacturing activities on the environment (Dubey et al., 2015).

Despite a promising outlook, the adoption of GSC practices by Chinese manufacturing firms has not been straightforward due to the country's complex institutional environment. Specifically, firms respond to a formal institutional environment to obtain legitimacy against uncoordinated demands from multiple independent groups (Greenwood et al., 2011), in an

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environment that is often conflicted, vague and in flux (D'Aunno et al., 1991). This highlights the problem of institutional complexity, which often arises when firms encounter difficulties making decisions in incompatible and sometimes conflicting institutional environments (Greenwood et al., 2011; Luo et al., 2017). Correspondingly, many management studies distinguish the coexistence of formal and informal institutional environments (Deephouse et al., 2016; Hearn, 2015; Meyer et al., 2011; Miska et al., 2018). The formal institutional environment refers to the multiplicity and diversity of institutional sources that influence firms' strategies and control mechanisms, whereas the informal institutional environment reflects cultural and behavioural characteristics (DiMaggio and Powell, 1983).

As an informal institutional force, *guanxi* is described as 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) and collaborations between buyers and suppliers (Barnes et al., 2011). Extant research shows that whilst *guanxi* proves to replace the effect of organisational trust on driving financial performance in buyer-supplier relationships and weakens the negative impact of uncertainty on long-term orientation (Yen and Abosag, 2016), ignoring *guanxi* and its various effects specific to Chinese institutional environments can lead to a failure to adopt GSC practices in China (Lee et al., 2015). In contrast, Cheng et al. (2012) indicated that good *guanxi* between a company and its suppliers positively affects the sharing of knowledge regarding GSCM practices. Considering these conflicting views, we feel it is important to further examine the role of *guanxi*, which is rooted in the informal institutional environment, in the adoption of GSC practices in the Chinese manufacturing sector.

While the research on GSCM recognizes the importance of the formal institutional environment, less attention has been paid to the co-existence of multiple and sometimes conflicting institutions. Relatively little empirical work has examined the interaction effect between formal and informal institutional environments on the development of GSCM, which fails to provide a deeper understanding of the mechanisms involved in the complex institutional environment of the firm. This paper addresses this knowledge gap by investigating the interaction effects between formal institutional environments (suppliers' advice, community pressures, competitors' actions, perceived costs and complexity of regulations) and an informal institutional environments (guanxi) on the adoption of GSC practices, using the theoretical framework of institutional complexity.

More specifically, this study examines how guanxi as an informal institutional variable interacts with formal institutional forces in the adoption of GSC practices by Chinese manufacturing firms. Building on Greenwood et al. (2011), this study paints a nuanced picture on *guanxi* deployment with suppliers, in a manner that is conducive to manifesting the formal institutional environment for the adoption of GSC practices.

On the basis of the above discussion, we aim to answer the following research question.

Does guanxi, as an informal institutional variable, interact with formal institutional • forces in the adoption of GSC practices by Chinese manufacturing firms?

By theoretically proposing and empirically showing that *guanxi* is an informal institutional variable that affects the adoption of GSC practices, this paper contributes to GSCM research through institutional theory in two ways. First, by investigating institutional complexity through the interaction between formal and informal institutional forces, the paper demonstrates how compatible institutional forces positively affect the adoption of GSC practices. Second, by explaining how *guanxi* as an informal institutional variable interacts with formal institutional forces, this paper establishes the double-edged sword effect of *guanxi* on the adoption of GSC practices in China.

2. Literature review and conceptual framework

2.1. Green supplier collaboration

Previous studies emphasised the importance of adopting GSC practices for companies to truly green their supply chains (Seuring and Müller, 2008; Cheung et al., 2009; Dubey et al., 2015) to ensure that their products meet the desired environmental standards (Lai and Wong, 2012; Wu et al., 2012). In this study, GSC refers to a firm's collaborative deployment of its resources and capacities with its suppliers to jointly develop solutions to environmental problems originating from manufacturing operations (Dubey et al., 2015; Luo et al., 2014).

From a resource-based perspective, close collaboration between focal firms and their suppliers can be an effective means of transferring essential resources from focal firms to their suppliers (Cousins, 1999). Consequently, both focal firms and their suppliers become increasingly engrossed in sustainability concerns instead of engaging in mere contract-based collaboration. Previous research showed that inadequate access to resources erects a major barrier to initiating environmental management (Bansal, 2005; Ramus and Steger, 2000). Hence, when focal firms and suppliers collaborate in the exchange of available resources, such collaborations become more effective means of improving environmental performance in GSCM (Geffen and Rothenberg, 2000; Lee and Klassen, 2008), addressing the issues caused by deficient internal resources (Large and Thomsen, 2011).

2.2. Institutional complexity

Since the seminal work of DiMaggio and Powell (1983), the research on institutional theory has focused on how institutional pressures shape an organisation's behaviour and decisions. Institutional theory is the most commonly used theory in the field of GSCM (Geng et al., 2017). Previous studies used institutional theory to classify the external antecedents that influence firms to adopt GSCM practices. These antecedents include coercive pressure from the government (Birkin et al., 2009; Lee, 2015; Liu et al., 2012), normative pressure from the market (Huang et al., 2012) and mimetic pressure from competitors (Abdulrahman et al., 2014; Govindan et al., 2014).

However, most of the studies in GSCM took an overly simplistic approach, assuming that those institutional pressures are separate, thereby ignoring institutional multiplicity and complexity. Only recently have studies started to examine the contradictory effects of complex institutional forces on a firm's decision making (Luo et al., 2017; Miska et al., 2018).

2.3. Informal institutional environments

Social norms exert legitimacy pressures on firms to adopt institutionalized practices (Meyer and Rowan, 1977). Cultural characteristics set a foundation for legitimacy through a culturally supported base embedded within a particular country or society (Miska et al., 2018). In China, guanxi, as a critical cultural institutional force, has a profound influence on firms' business decisions and actions (Luk et al., 2008). However, relatively little research discussed the interaction effect between formal institutions and guanxi in GSCM.

To address this knowledge gap, this paper focuses on the *guanxi* established as an informal institutional force between a focal company's purchasing manager and its key supplier's sales representatives, and investigates its interaction with formal institutional environments affecting GSC. The guanxi between purchasing managers and sales representatives is relevant because these two boundary-spanning personnel are the most engaged in the daily negotiations, discussions and meetings to facilitate focal firm-supplier collaborations on GSCM (Zhou et al., 2014; Yen and Abosag, 2016). Although informal, the level of guanxi between the two boundary-spanning personnel can have a significant impact on promoting trust, commitment and mutual understanding between the firms (Barnes, Yen and Zhou, 2011; Yen and Barnes, 2011). Given the importance of *guanxi* in business relationships and practice adoption, as well as its over-arching effect on GSCM in China (Geng et al., 2017), this paper argues that guanxi is a significant informal institutional force to be considered when discussing how formal institutional forces drive GSC between a focal firm and its suppliers in China.

2.4. Formal institutional environments

The formal institutional environment refers to the multiplicity and the diversity of institutional forces that influence firms' strategies and control mechanisms (DiMaggio and Powell, 1983). One of these forces, supplier's advice, reflects the fact that suppliers are constantly under pressure to take on a higher green standard to remain competitive and regulation-compliant and therefore, they are keen to request that focal firms engage in GSC practices (Zhou et al., 2016) and to provide extensive information to them on adopting greener environmental practices (Zhu et al., 2005; Zhuang et al., 2014).

The *guanxi* tie between a focal company's purchasing manager and its key supplier's sales representative is likely to have a positive effect on GSC when the supplier's advice plays a central role in the focal firms' decision making (Ramus and Steger, 2000). For example, a supply firm may encourage a focal firm to adopt higher green standards to remain competitive in the market. When the supplier's sales representative has a high level of *guanxi* with the focal firm's purchasing manager, the sales representative will have better chance to share information regularly and offer continuous support to help drive the focal firm's follows:

H1. The effect of suppliers' advice on the adoption of GSC practices is moderated by guanxi between boundary-spanning personnel, such that a positive association will become stronger when a high level of guanxi is present.

Community pressure is a normative institutional force for the adoption of GSC practices (Birkin et al., 2009). Although previous studies show that community pressures do not affect the adoption of GSCM practices in China (Liu et al., 2012), empirical evidence collected from outside of China offers contradictory conclusions by showing that community pressures increase the adoption of GSC (Mohanty and Prakash, 2013). Such contradictions could be attributed to the primary role of communities, which is to raise concerns that companies' activities are harming the environment, rather than to lobby for GSCM practices (Liu et al.,

2012). Nevertheless, considering the increasing environmental damage due to over-production in China, community pressures are a potential formal institutional force to drive GSC practices.

Strong *guanxi* between boundary-spanning personnel may negatively moderate the relationship between community pressures and GSC adoption; when purchasing managers are excessively involved in their interpersonal relationships with sales representatives (Park and Luo, 2001), they may lose their objectivity in evaluating suppliers' green standards (Opper et al., 2017). The fear of risking *guanxi* ties or damaging established long-term relationships with key suppliers' representatives may influence the focal firm's willingness to consider new GSC practices (Zhou et al., 2016). Such conflicts of interest create institutional complexity, which is particularly challenging when firms face two largely incompatible logics (Greenwood et al., 2011). When a purchasing manager gets too comfortable with a sales representative, a phenomenon called 'collective blindness' may occur (Villena et al., 2011). In this situation, the purchasing manager is unlikely to consider alternative views that drive GSC, in favour of protecting *guanxi*. Consequently, such *guanxi* reduces the focal firm's scope for creative thinking, continuous learning and willingness to contemplate new ideas on GSC practices, (Zhou et al., 2016). Therefore, the second hypothesis follows:

H2. The effect of community pressures on the adoption of GSC practices is moderated by guanxi between boundary-spanning personnel, such that a positive association will become weaker when a high level of guanxi is present.

Competitors in the same industry have the most visible commonalities with focal companies in terms of operations, and they play key roles for companies that engage in GSC practices. Normative institutions encourage organisations to learn from the actions of successful competitors in the same industry (Zhu, Sarkis and Lai, 2013), whilst mimetic institutional forces occur due to market uncertainty that encourages imitation (DiMaggio and Powell, 1983). Chinese manufacturers often exchange ideas and learn from their competitors

to gain a better competitive advantage in the global market (Birkin et al., 2009; Liu et al., 2012). Hence, many Chinese joint venture firms have adopted GSCM practices after observing their Western parent companies benefiting from such adoption (Zhu et al., 2013). When a focal firm perceives increased pressure from its competitors in the market, it will attempt to mimic their advances and strategic moves (Cao et al., 2015). This explains why a focal firm is more likely to engage in GSC practices to stay competitive and ahead of the race.

However, when a purchasing manager becomes excessively concerned about his/her *guanxi* with sales representatives, the focal firm may lose its impartiality with regard to evaluating a supplier's green performance (Luo et al., 2012). Collective blindness (Villena et al., 2011) may lead to firms' reluctance to initiate new changes and standards in fear of damaging their *guanxi* (Zhou et al., 2016). As a result, the dilemma caused by institutional complexity emerges for many Chinese managers (Zhao et al., 2008): generating optimal solutions is often difficult due to the need to avoid potential conflicts that may hinder their *guanxi* with various stakeholders. Accordingly, the third hypothesis follows:

H3. The effect of competitors' actions on the adoption of GSC practices is moderated by guanxi between boundary-spanning personnel, such that a positive association will become weaker when a high level of guanxi is present.

Perceived costs are among the key uncertainties that hinder companies from going green (Abdulrahman et al., 2014; Govindan et al., 2014). The more uncertainty a supplier perceives, the less likely it is to adopt new practices (DiMaggio and Powell, 1983). When suppliers realise that a specific GSC practice can be easily copied by fellow competitors, it is questionable whether this practice can contribute to competitive advantage and financial performance.

When a supplier perceives that the adoption of green practices is highly costly, it may become less willing to adopt them. However, this uncertainty may be reduced by strong *guanxi* ties between boundary-spanning personnel (Yen and Abosag, 2016). In other words, such *guanxi* assures suppliers of the focal firm's commitment to GSC (Dubey et al., 2015); hence, the high cost associated with the adoption of greener practices is perceived as less risky (Park and Luo, 2001). Consequently, focal firms may naturally find it easy to reduce the risk associated with the high cost of adopting GSC practices. A strong *guanxi* tie with suppliers could increase companies' confidence in such a collaboration, as *guanxi* prioritizes long-term relationships. Therefore, these formal and informal institutional forces are opposing yet harmonizing, not contradictory, in this setting. Therefore, the fourth hypothesis follows:

H4. The effect of perceived costs of adopting GSC practices is moderated by guanxi between boundary-spanning personnel, such that a negative association will become weaker when a high level of guanxi is present.

Although government regulations often impose GSC, the complexity of the regulations is usually regarded as a barrier, not an enabler to the adoption of green practices in emerging economies (Abdulrahman et al., 2014). Loose government regulations and inconsistent law enforcement contribute to the slow adoption of environmentally friendly practices in China. Whilst the fast-changing regulations hinder the adoption of GSC practices by Chinese manufacturers (Abdulrahman et al., 2014), *guanxi* is often employed as a remedy to overcome such regulatory complexity (Chen et al., 2011). Hence, *guanxi* would weaken the negative relationship between the complexity of regulations and the adoption of GSC practices for three reasons. First, companies in China often rely on their *guanxi* with suppliers to acquire valuable information about the adoption of GSC practices (Luk et al., 2008). Second, strong *guanxi* may facilitate communications, negotiations, coordination and information exchange (Zhuang et al., 2014) when focal companies adopt GSC practices. Third, inter-organisational collaboration over GSC practices requires trust and credibility between the focal company and its suppliers (Zhu et al., 2010b).

In the Chinese context, the interpersonal trust of *guanxi* between the purchasing manager and the supplier's representative is often a more powerful insurance than a formal contract (Yen and Barnes, 2011). Therefore, the fifth hypothesis follows:

H5. The effect of the complexity of regulations on the adoption of GSC practices is moderated by guanxi between boundary-spanning personnel, such that a negative association will become weaker when a high level of guanxi is present.

These five hypotheses are presented in Figure 1. The first sign in brackets next to each hypothesis suggests the direction of the relationship, and the second sign suggests the moderating effect of *guanxi* on that relationship. For example, in H1, a positive relationship from suppliers' advice to GSC practices is hypothesized, and *guanxi* will strengthen this positive relationship, whereas in H2, a positive relationship from community pressures to GSC practice is hypothesized, and *guanxi* will weaken this positive relationship.

[Insert_Figure_1_about_here]

3. Methods

3.1. Sampling

In line with previous research on GSCM (Zhu et al., 2011), we considered manufacturing companies that produce goods using labour and machines, tools and chemical and biological processing or formulations. We collected data from manufacturing firms with an environmental management certification (ISO 14000 or Green Label), located in the major coastal regions: Jiangsu, Guangdong, Shandong and Shanghai. These four regions capture the economic and geographic diversity of the manufacturing sector in China, cover China's most polluted areas and are closely scrutinized by Chinese environmental agencies (Liu, 2014). Companies in eco-industrial parks with ISO 14000 or Green Label certification were chosen because they are more likely to have embarked on adopting GSC practices (Zhu and Geng, 2013).

3.2. Measures

The adoption of GSC practices was measured as an endogenous construct assessing collaboration activities with suppliers (adapted from Zhu et al., 2005). The exogenous constructs for formal institutional forces included suppliers' advice, competitors' actions, community pressures, perceived costs and complexity of regulations. The measurement tool for the suppliers' advice was adapted from Miao et al. (2012) and Zhu et al. (2005). The construct measuring competitors' actions was adapted from El Tayeb et al. (2010). The community pressures construct was adapted from Liu et al. (2012) and measured pressures from neighbouring communities and the media. Perceived costs of adoption include costs associated with capital investment, hazardous waste disposal, human resources recruitment and switching to a new system for adopting GSC practices (Min and Galle, 2001). Complexity of regulations was measured using the level of government support, with three items from Abdulrahman et al. (2014) and two items from Chen et al. (2011) that evaluate the levels of economic and regulatory support by the government for resolving environmental issues. The level of *guanxi* was measured based on the closeness of the relationship and the frequency with which favours are exchanged between the focal firm's purchasing manager and their supplier's sales representative (Luo et al., 2014; Yen et al., 2011). The full list of measurement items is provided in Appendix A, Table A.1.

Control variables were used to account for extraneous influences of the incremental improvement in the overall 'prediction' of the regression model (Carlson and Wu, 2012). Therefore, the primary purpose of the control variable in this study is to offer a meaningful improvement in the variance accounted for by the model (Carlson and Wu, 2012). Previous studies indicated that firm size is a significant factor influencing the adoption of environmental practices (Mohanty and Prakash, 2013). Thus, firm size was controlled using the guidance provided by the Chinese Ministry of Industry and Information Technology (National Bureau

 of Statistics, 2006), which classifies companies with 1000 employees as large, 300 to 1000 employees as medium, 21 to 299 employees as small and fewer than 20 employees as micro.

3.3. Pilot study

A questionnaire survey was first developed in English and then translated into Chinese. Back-translation was used to check the proficiency of the translated version, which led to rewording several questions to improve their accuracy. Subsequently, a pilot study with 52 companies in Suzhou Industrial Park was conducted from July to August 2015 to check the clarity of the questionnaire. We selected Suzhou Industrial Park because it is in the Yangtze River Delta and represents a high degree of economic growth. According to Bryman and Bell (2014), researchers must compile a small group of participants who resemble the population from which the sample for the complete study will be drawn to maximize the benefits of pilot testing. Therefore, with regard to the participants, we approached only managers who currently hold positions in the supply chain (e.g. operations manager, purchasing manager and supply chain manager) as key informants, as they will have good knowledge about supply chain activities and be familiar with their suppliers.

Participants were briefed to focus on their GSC practices with their largest supplier and their *guanxi* with that supplier's sales representative (Barnes et al., 2011). In this pilot study, the construct of perceived costs had a low Cronbach's alpha (0.364). This was possibly because the questions pertaining to this construct were modified from previous studies (e.g. Abdulrahman et al., 2014; Govindan et al., 2014) where the measurement scale ranged from 'strongly agree' to 'strongly disagree'. In the current study, the scale for the perceived costs of adopting GSC practices were changed to 'not very costly', 'not costly', 'normal', 'costly' and 'very costly' to avoid the influence of negative statements on respondents' opinions. To address this issue, three bilingual experts who work at manufacturing companies reviewed the Chinese version of the questionnaire. Following their advice, the measurement scale was changed to

'very cheap', 'cheap', 'normal', 'expensive' and 'very expensive' to help respondents better distinguish the ratings. Finally, face-to-face discussions were held with 10 managers who completed the pilot survey to ensure the wording and the content changes were understandable and relevant to practices in China.

3.4. Data collection

Sanjintong¹ database was used to obtain the contact details of the supply chain managers and CEOs/presidents of the manufacturing companies in the target industrial park. In this way, 2143 companies were identified from 11 industrial parks in 4 locations, as follows:

- Jiangsu: Suzhou Industrial Park; Suzhou Hi-tech Industrial Zone; Wuxi New District Eco-industry Park; Yangtze River International Chemical Industrial Park
- Guangdong: Guangzhou Economic & Technical Development Zone
- Shandong: Weifang Binhai Economic-Technological Development Area; Yantai Economic & Technological Development Area
- Shanghai: Shanghai Xinzhuang Industrial Park; Caohejing Hi-Tech Park; Shanghai Chemical Industrial Zone; Minhang Economic & Technical Development Zone

The questionnaire was conducted in two parts to reduce the common method bias by targeting two informants in each firm (Guide and Ketokivi, 2015). Part I focused on the organisational characteristics, formal institutional forces and adoption of GSC practices, based on their relationship with the largest supplier. This part was sent to key informants who held senior positions in the firm's supply chain function and had a good understanding of the company's internal and external processes, including the supply chain manager, CEO/president, vice president and director of marketing and purchasing. They were targeted because senior management usually plays a vital role in the design of a firm's environmental policy (Chan et al., 2012). Part II of the questionnaire specifically focused on *guanxi* and targeted purchasing

¹ http://sanjintong.net/

managers who directly interact with the largest suppliers' representatives and are therefore most knowledgeable about the focal firm's *guanxi* ties with suppliers (Luo et al., 2014; Zhou et al., 2014).

The data was collected in two rounds: 1) from November 10, 2015, to December 31, 2015, and 2) from January 15, 2016, to February 15, 2016. Emails were sent to 1000 randomly selected individuals working in companies located in the 11 industrial parks listed above. The website randomizer² was used for random selection of participants. Part I had 230 responses and Part II had 270 responses, which were then combined by company name, leading to 217 complete pairs at the end of Round 1. In the second round, 50 companies that had filled out only Part II in the first round were approached. In addition, another 1000 randomly selected companies were emailed after excluding 98 companies that had already responded, resulting in a total of 1902 invitations. In total, 936 responses were collected for Part I and Part II, leading to 410 complete responses. This represents a response rate 21.6%. (410/1902) which compares favourably with previous surveys on GSCM (Zhu et al., 2005). Removing two univariate outliers in community pressures and competitors' actions, 408 responses were used for the analysis.

4. Analyses and results

4.1. Reliability and construct validity tests

Initially, the endogeneity of the exogenous variable was tested. The formal institutional variables are exogenous to the adoption of GSC practices. For the issue of reverse causality, a systematic literature review of 42 papers in emerging markets confirmed that formal institutional forces can shape the adoption of GSC practices both theoretically and empirically, but not the other way around (Geng et al., 2017a). The presence of endogeneity was tested statistically by conducting the Hausman test (Ketokivi and McIntosh, 2017). Formal

² <u>https://www.randomizer.org</u>

institutional forces and the adoption of GSC practices were regressed on the control variable of firm size, and whether the residual from a regression of GSC practices on the exogenous variables had a significant coefficient when added to the original model was tested (Dong et al., 2016). Secondly, augmented regressions were performed by using the residuals as additional independent variables. The results showed that the parameters estimated for the residuals in the augmented regression were not statistically significantly different from zero. Therefore, endogeneity was concluded to be absent and the results were consistent with the conceptual model. Table 1 shows the descriptive statistics of the sample.

[Insert Table 1 about here]

To evaluate measurement validity, we assessed internal consistency and convergent validity. Table 2 presents the mean, the standard deviation and the correlations between the constructs. For example, GSC practices has a mean value of 3.6, where 3 = Have a plan for the implementation and 4 = In the process of the implementation.

[Insert Table 2 about here]

Table 3 presents factor loadings, Cronbach's alpha, composite reliability scores and the average variance extracted (AVE) for each construct. The factor loading of each item ranged from 0.46 to 0.77, and all loadings were statistically significant (p < 0.001), suggesting convergent validity (Wang et al., 2016). The Cronbach's alpha coefficients (ranging from 0.580 to 0.827) and composite reliabilities (ranging from 0.645 to 0.771) suggested adequate reliability (Liu et al., 2016). In general, researchers agree that Cronbach's alpha value should be above 0.70 (Hair et al., 2010). 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. Therefore, a Cronbach's alpha value of 0.60 (Hair et al., 2014) or 0.50 (Nunnally and Bernstein, 1994) can be acceptable, especially in exploratory research or for constructs with a small number of indicators (Hair et al., 2010; Grafton et al.,

 2010; Cortina, 1993). The lowest AVE was greater than the shared variance of each construct with other constructs (Hair Jr and Lukas, 2014). Thus, these results support convergent validity.

[Insert_Table_3_about_here]

4.2. Statistical modelling

Hierarchical moderated regression analyses were used to test the hypotheses because the proposed model contains interaction terms between institutional forces and the adoption of GSC practices. This type of modelling allows comparisons across different models to determine whether the hypothesized independent and moderator variables explain the dependent variable (adoption of GSC) better than the model with only independent variables. The typical comparison criterion is the coefficient of determination (R²), which needs to be significantly better than a former model to conclude that moderation and interaction exist. 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.

The four-step variance partitioning procedure (Jaccard et al., 2003) was implemented by setting the firm size as the control variable. The variance partitioning procedure includes four steps.

Step 1: One control variable—firm size—was included in the regression.

Step 2: Five institutional forces—suppliers' advice, community pressures, competitors' actions, high perceived costs and complexity of regulations—were included in the regression.
Step 3: The moderator variable *guanxi* was included in the regression.

Step 4: Five interactions—suppliers' advice \times *guanxi*, community pressures \times *guanxi*, competitors' actions \times *guanxi*, perceived costs \times *guanxi* and complexity of regulations \times *guanxi*—were included in the regression.

To reduce multicollinearity, the 'mean-centring' technique was employed through the use of deviation scores for the independent variables and moderators (Zhu and Sarkis, 2007). In this study, the maximum variance inflation factor (VIF) value in all regression models was 1.2, which indicates that multicollinearity was not a concern because the VIF values were below the threshold of 5 (O'Brien, 2007). Therefore, the underlying assumption of multiple regression analysis was not violated. However, although the mean-centring technique is a commonly used tool for reducing multicollinearity, Echambadi and Hess (2007) indicated that this technique does not help alleviate the issue of multicollinearity. They argued that the issue of multicollinearity cannot be remedied after data collection in most cases. Therefore, two strategies were used to reduce the threat of multicollinearity by carefully designing the study before data collection. First, data regarding *guanxi* were collected separately to isolate the moderator variable and reduce the potential multicollinearity (Grewal et al., 2004). Second, the sample size was increased through a second round of data collection to address the loss of power associated with multicollinearity. Table 4 shows the results of the hierarchical moderated regression models. Model 1 includes only the control variable. Model 2 adds the independent variables and Model 3 adds the moderator. Model 4 features all interaction terms.

In Model 1, the control variable firm size accounted for 18% of the variance in the adoption of GSC practices, with a statistically significant and positive effect ($\beta = 0.136$, p < 0.005). In Model 2, inclusion of the 5 institutional forces increased the R² to 35.1%. Two of the institutional forces (suppliers' advice and community pressures) had statistically significant and positive effects on the adoption of GSC practices. However, the effects of competitors' actions and perceived costs on the adoption of GSC practices were not statistically significant. Moreover, the complexity of regulations had a statistically significant and negative effect on the adoption of GSC practices ($\beta = -0.443$, p < 0.001). In Model 3, inclusion of guanxi as the moderator increased the R² to 36.7%. *Guanxi* has a statistically significant and positive effect on the adoption of GSC practices ($\beta = 0.180$, p < 0.001). In Model 4, the R² increased to 36.8% Source with the inclusion of interaction terms.

[Insert_Table_4_about_here]

Table 4 shows that the results are consistent across the 4 models and Model 4 improves Models 1–3 by showing that moderating effects exist owing to the collective incremental F value for the regression and the statistically significant beta values of the interaction terms (O'Brien, 2007).

4.3. Hypothesis testing

To show the moderating effect of *guanxi*, this construct was split into high (one standard deviation or more above the mean) and low (one standard deviation or more below the mean) levels (Aiken et al., 1991). Formal institutional forces were discretized similarly into high and low. Then, the effects of the formal institutional forces on the adoption of GSC practices were estimated at the two levels of *guanxi* and the corresponding formal institutional force. The results are illustrated in Figure 2.

[Insert_Figure_2_about_here]

Note that the interaction effect for competitors' actions was not statistically significant, so it is not included in this stage of analysis. The moderator analysis (Table 4, Model 4) shows that *guanxi* has a negative and statistically significant impact on the effect of suppliers' advice on the adoption of GSC practices ($\beta = -0.240$, p < 0.05).

At high levels of *guanxi*, the effect of suppliers' advice on the adoption of GSC practices is weaker (Figure 2a). Therefore, H1 is rejected. *Guanxi* negatively and statistically significantly moderates the relationship between community pressures and the adoption of GSC practices ($\beta = -0.114$, p < 0.05). The effect of community pressures is higher under low *guanxi* (Figure 2.b), which means pressure from the community on the adoption of GSC practices becomes stronger with a lower level of *guanxi*. The interaction between competitors' actions and *guanxi* is not statistically significant ($\beta = -0.09$, ns). Thus, *guanxi* does not moderate the relationship between competitors' actions and the adoption of GSC. Therefore, H3 is rejected. *Guanxi* positively and statistically significantly moderates the relationship between perceived costs and GSC adoption ($\beta = 0.103$, p < 0.05). Figure 2.c shows that the negative effect between perceived costs and the adoption of GSC practices is reduced when the level of *guanxi* is high. Therefore, H4 is supported. Finally, *guanxi* positively and statistically significantly moderates the relationship between the complexity of regulations and GSC adoption ($\beta = 0.45$, p < 0.05). When the level of *guanxi* is low, the complexity of regulations has a stronger effect on the adoption of GSC practices (Figure 2d). However, when *guanxi* is high, the negative impact of the complexity of regulations on GSC becomes weaker. Therefore, H5 is supported. Below is a summary of the moderation results:

- H1: Guanxi strengthens the positive effect of suppliers' advice on GSC adoption: Rejected.
- H2: *Guanxi* reduces the positive effect of community pressures on GSC adoption: Supported.
- H3: Guanxi reduces the positive effect of competitors' actions on GSC adoption: Rejected.
- H4: Guanxi reduces the negative effect of perceived costs on GSC adoption: Supported.
- H5: *Guanxi* reduces the negative effect of complexity of regulations on GSC adoption: Supported.

5. Discussion

By testing the moderation effect of an informal institutional force—*guanxi*—on the adoption of GSC practices, this paper provides a deeper understanding of GSC adoption in China through the lens of institutional complexity. *Guanxi* significantly moderates the relations between four of the five formal institutional forces and the adoption of GSC, contributing to the debate on institutional environment in GSCM (Zhu et al., 2005).

Previous *guanxi* literature indicated that when a company invests in building *guanxi* ties with a supplier, the company is more likely to cooperate or better integrate with the supplier, given that strong *guanxi* ties promote frequent communications and information sharing between them (Ramus and Steger, 2000; Cai and Yang, 2014). However, in our study, we found

that *guanxi* between a supplier's sales representative and the focal firm's procurement manager negatively moderates the effect of the suppliers' advice on the adoption of GSC. This may be because *guanxi* could also be utilized as a defensive mechanism to diffuse supplier-initiated GSC practices that are deemed irrelevant and costly by the focal firm. Hence rather than seeing *guanxi* as a facilitator that promotes a GSC initiative, a procurement manager's *guanxi* with the supplier's sales representative may be employed by the focal firm's senior management as a way to block changes or buffer the pressure initiated by a supplier for GSC investments (Luo et al., 2014).

Guanxi significantly reduces the positive association between community pressures and GSC adoption. This observation sheds light on the dark aspects of *guanxi* ties: a strong *guanxi* tie between a company and its business partners may lead the company to turn a blind eye to non-environmentally friendly practices (Gu et al., 2008). Strong *guanxi* ties between focal companies and their suppliers may increase the entry barrier for newcomers to join the network, thus limiting the chance of discovering new alternatives and adopting new practices. *Guanxi* may produce complacency in companies, which is counterproductive to the adoption of GSC practices. Moreover, strong *guanxi* with suppliers reduces the negative impact of perceived costs on the adoption of GSC practices. This moderation effect could be explained through the lens of transaction cost economics, where companies attempt to minimize transaction costs by building relationships with supply chain partners (Zhou et al., 2016).

Guanxi reduces the negative effect of the complexity of regulations on the adoption of GSC practices. In China, regulations have high litigation costs due to inconsistent law enforcement (Zhu et al., 2005). Therefore, manufacturing companies in China tend to build *guanxi* ties to ensure compliance and reduce the risk of legal problems. Most of the information from the Chinese government is disseminated at an uncodified level, leading to potential confusion (Cai

et al., 2010). Therefore, building strong *guanxi* ties with suppliers can help focal companies better understand such complex regulations.

Surprisingly, the results do not support the negative effect of *guanxi* on the relationship between competitors' actions and the adoption of GSC practices. Zhu et al. (2013) indicated that Chinese manufacturers often follow the actions of successful competitors to gain competitive advantage in the global market. However, companies operating in highly competitive markets such as China may be willing to adopt practices that can help them differentiate themselves in their customers' eyes. In this sense, a focal company that sees a competitor gain an advantage by adopting GSC practices may want to use their *guanxi* tie with their supplier to obtain state-of-the-art marketing rather than to acquire information from their guanxi tie about replicating a competitor's actions. However, this finding could be because most of the surveyed companies (86.1%) are small and medium (in accordance with Chinese industry standards); thus, they often have limited human and financial resources for adopting GSC practices, although they may be willing to imitate their competitors' actions (Abdulrahman et al., 2014; Liu et al., 2012). In addition, firms are usually cautious about communicating their strategic moves with suppliers who also supply their competitors, in order to avoid leaking strategy and technology information (Cao et al., 2015). Therefore, Chinese manufacturers cannot implement GSC merely by imitating their competitors' actions if their suppliers are unwilling to likewise conform to GSC. In this regard, focal companies may convince their suppliers to collaborate over GSC through strategic benefits rather than good guanxi ties (Kirchoff et al., 2016).

6. Conclusions

6.1 Theoretical contribution

This research is one of the first studies to analyse institutional complexity in relation to the adoption of GSC. It shows how firms respond to the challenges posed by the coexistence of

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formal and informal institutional forces and provides insights to connect environmental sustainability and institutional complexity. The findings have three valuable theoretical implications. The first is that Chinese manufacturing firms respond to formal institutional forces by deploying an informal institutional variable: *guanxi*. Specifically, when a firm is faced with institutional multiplicity and complexity, it can respond by leveraging the informal institutional force such as *guanxi*. The second is that the importance of *guanxi* may decline even when collaborative decisions require a certain level of social approval. In this study, the negative role of *guanxi* is observed in the effects of suppliers' advice and community pressures on the adoption of GSC practices. In this way, a firm can downplay the effect of the formal institutional forces when the informal institutional force can provide a social guarantee for the adoption of GSC practices. The reduction of the influence of guanxi can be explained by the managerial cognitive mechanism rather than by changes in the macro-institutional environment. Third, unlike previous empirical studies, which considered the institutional complexity between local and central governments (Luo et al., 2017), employees and customers (Raaijmakers et al., 2015), members' and leaders' emotions (Toubiana and Zietsma, 2017) and collaboration and formalization (Ramus et al., 2017), our study provides empirical evidence showing that formal and informal institutional forces can lead to unintended consequences for GSC. Specifically, we demonstrate that institutional complexity has a double-edged sword effect with regard to how it shapes a firm's response to GSC. Therefore, we extend the knowledge on institutional complexity (Greenwood et al., 2011) by identifying the paradoxical effect of *guanxi*, which is used by firms to cope with formal institutional forces.

Previous research in the field of GSCM has focused predominantly on formal institutional forces, hence foregrounding firms' adoption of GSCM practices to comply with the need for legitimacy (Cheung et al., 2009; Dubey et al., 2015; Luo et al., 2014). However, the key feature of formal institutional forces is that firms seeking legitimacy tend to adopt sustainable practices

in a symbolic manner without substantive implementation (Luo et al., 2017). Therefore, in this study, the conflict between formal institutional forces and the adoption of GSC is further complicated by incorporating an informal institutional variable: *guanxi*. We find that the negative impacts of perceived costs and the complexity of regulations on the adoption of GSC are both reduced by utilizing *guanxi* ties. Interestingly, the informal institutional environment usually has a negative impact upon firms that received positive impacts from suppliers' advice and community pressures. These firms do not face the conflict between the need for external legitimacy and their own internal interest; therefore, they have no need for the uniting *guanxi* tie. In addition, a strong *guanxi* tie substantially reduced positive impacts, revealing that the institutional environment is conflicted and complex. Our study thus suggests that the informal institutional environment tends to produce double-edged effects on the strategic decisions about GSC that occur within the formal institutional environment.

In addition, the paper contributes to the literature on *guanxi*. Conventional thinking assumes that *guanxi* would improve business operations because formal institutional forces are underdeveloped in China (Luo et al., 2014). However, the results suggest that the institutional environment in China is complex and having stronger *guanxi* ties with suppliers may sometimes hinder the focal firm's adoption of GSC practices, thus highlighting the double-edged sword effects of *guanxi* on strategic decisions about GSC.

6.2. Managerial implications

This paper offers several guidelines for supply chain managers and policymakers in China. First, policymakers should try to reduce regulation complexity to encourage GSC adoption without *guanxi*, even though *guanxi* can serve as an alternative governance mechanism to help firms reduce these negative complexities and enforce GSC adoption. In doing so, policymakers must understand that when firms feel uncertain about regulations, they rely on informal *guanxi* rather than on formal regulations in pursuing GSC. This is not a healthy or sustainable choice

in the business market in the long run. In this regard, policymakers should try to make regulations consistent with a firm's environmental preferences to guide manufacturers' responses to formal regulations, rather than having them rely on their *guanxi* ties with suppliers. Second, these findings have important implications for focal firms who wish to collaborate on GSC with suppliers. By clarifying this double-edged sword effect, managers now understand that *guanxi* can moderate both positive and negative institutional forces in GSC adoption. This means that managers in the focal firm should focus investments in *guanxi* to facilitate GSC adoption when regulations are complex and the initial costs are very high. *Guanxi* is crucial for focal firms to communicate and coordinate with suppliers, to overcome the lack of government regulations. In this regard, a strong *guanxi* ties, then, focal firms are more likely to persuade their suppliers to adopt GSC by sacrificing some of their short-term benefits to achieve better long-term gains.

However, strong *guanxi* ties reduce the positive impact of suppliers' advice and community pressures. As such, managers should understand that investing in *guanxi* is not the ideal choice in pursuing GSC adoption when the environmental advice comes from suppliers who are experiencing community pressures. Instead, focal firms may consider specific investment in their Chinese suppliers, such as investing in specific equipment and environmental training, in promoting GSC to ensure both their first and second tier can be truly green.

6.3 Limitations and future research directions

In contrast to previous studies on the positive role of *guanxi*, this study finds that *guanxi* has a double-edged sword effect in the adoption of GSC practices: *Guanxi* both facilitates and discourages the adoption of GSC depending on the direction of the forces from formal institutional environment as a negatively moderating agency. Further studies should account for *guanxi*'s

double-edged sword effect to provide novel insights into the relationship between formal institutional forces and the adoption of GSCM. We considered *guanxi* only at the interpersonal level in this study; thus, future research is sorely needed to explore the aggregated effect of *guanxi* at the firm level (e.g. Geng et al., 2017b). Moreover, the results are valid in the context of China. Given likely differences in other emerging Asian economies, further research is needed to evaluate the role of *guanxi* in the implementation of GSC practices, particularly in countries such as Korea, Malaysia and Thailand. This study does not consider direct causal associations between <text> variables. Future studies may use longitudinal data to examine the causal relationships between institutional forces and their effect on the adoption of GSC practices. Finally, future studies may explore how guanxi contributes to the learning process in adopting GSC practices.

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Appendix A. Measurement Items

Tables and Figures of "Does Guanxi support green supplier collaboration?"

Table	1.	Sam	ble	descri	ptors
abic	т.	Sam		ueserr	piors

Firm size (emplo	yees)	Position in the (based on Part I)	company	Ownership	
Less than 20	1.40%	CEO	12.1%	Foreign owners	12.9%
21–299	46.7%	Senior Manager	22.6%	Joint ventures	31.0%
300–1000	38.8%	Middle Manager	46.9%	Private	48.1%
More than 1000	13.1%	Department	18.3%	State-owned	8.10%
	0	Manager			

 Table 2. Descriptive statistics and correlations

	Mean	Std. D	GSC	SA	СР	CA	РС	CR	GX
GSC	3.6	.77215	1.00	0	5				
SA	3.9	.59827	.481**	1.00					
СМ	3.9	.59203	.357**	.400**	1.00				
СР	4.0	.52304	.530**	.602**	.468**	1.00			
PC	2.4	.52759	178**	183**	142**	227**	1.00		
CR	2.0	.54284	448**	461**	368**	504**	.366**	1.00	
GX	3.8	.56752	.453**	.487**	.444**	.549**	160**	402**	1.00

n = 408. All correlations are statistically significant at the p < 0.01 level.

GSC= green supplier collaboration, SA=suppliers' advice, CP=community pressures, CA=competitors' actions, PC=perceived costs, CR=complexity of regulations, GX=Guanxi

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Constructs	Items	Loading	Cronbach's alpha	Composite Reliability	AVE
5	GSC1	.56	.796	0.765	0.595
	GSC2	.64			
Green Supplier	GSC3	.63			
(GSC)	GSC4	.61			
	GSC5	.60			
	GSC6	.73			
	SA1	.74	.628	0.751	0.503
Suppliers'	SA2	.62			
advice (SA)	SA3	.51			
	SA4	.77			
Community	CP1	.69	.631	0.645	0.574
pressures (CP)	CP2	.66			
	CA1	.58	.580	0.649	0.575
Competitors'	CA2	.51			
actions (CA)	CA3	.54			
	CA4	.55			
Perceived	PC1	.63	.658	0.771	0.500
costs (PC)	PC2	.64			
Complexity of	CR1	.61	.684	0.701	0.501
regulations	CR2	.63			
(CR)	CR3	.60			
	GX1	.73	.827	0.760	0.565
Course (CV)	GX2	.68			
Guanxi (GX)	GX3	.69			
	GX4	.67			
	-				

GX5 .65

Table 4. Hierarchical moderated regression analysis for formal institutional forces

Variable entered			GSC practices (N = 408)					
		Model 1	Model 2	Model 3	Model 4			
Control	Firm size	.136**	.065	.088*	.088*			
Independent	Suppliers' advice (SA)		.183***	.146**	.137*			
	Community pressures (CP		.267***	.210***	.236***			
	Competitors' actions (CA)		.033	002	.007			
	Perceived cos (PC)	ots	014	009	151*			
	Complexity Regulations (CR)	of	433***	293***	291***			
Moderator	Guanxi (GX)			.180***	.182***			
nteraction	SA*GX			X	240**			
	CP*GX				114**			
	CA*GX				.090			
	PC*GX				.103**			
	CR*GX				.045**			
F for the regre	ssion	4.994**	34.005***	32.290***	21.935***			
Adjusted R ²		.18	.351	.367	.368			
		andinad hata as	\sim	10 **n < 0.05	***n < 0.001			

Table A.1. The measurement items

Green supply chain cooperation GSC (Zhu et al., 2005)

Our company makes sure that our purchased products from key supplier must not contain environmentally undesirable items such as lead or other hazardous or toxic materials

Our company collects information about our key suppliers' environmental aspects, activities, and/or management systems

Our company has an environment audit program for our key supplier's environment management

Our company has an environment audit program for our second-tier suppliers' environment management

Our company requires our key supplier to have a certified environment management standard such as ISO 14001

Our company has frequent face-to-face meetings with our key supplier about environmental issues

Suppliers' advice (Miao et al., 2012; Zhu et al., 2005)

Our key supplier give us advice on developing environmentally friendly goods.

Our key supplier give us advice on developing environmentally friendly production.

Our key supplier gives us advice on developing environmentally friendly packaging.

Our company has environmental partnerships with our key supplier

Competitors' actions (ElTayeb et al., 2010)

Successful firms in our company's industry adopt GSC practices

GSC practices are generally considered in our firm's industry as having considerable marketing benefits

Our competitors' earlier implementations of GSC practices provide a benchmark and guidance for our company's adoption of GSC practices

Competitors have a strong influence on our company's adoption of GSC practices

Community pressures (ElTayeb et al., 2010)

Neighboring communities put pressure on our company about the impact on the environment

The media follow our industry closely about the environmental issue

Perceived costs (Govindan et al., 2014)

The costs of the initial capital for implementing GSC with this supplier are

The costs of dealing with hazardous waste disposal with this supplier are

The costs of recruiting extra human resources for environmental purposes with this supplier are

Compared with the return on investment, the costs of the adoption of GSC practices with this supplier are

The costs of switching to the new system for the adoption of GSCM practices with this supplier are

Complexity of regulations (Abdulrahman et al., 2014; Chen et al., 2011)

The laws, regulations, and directives on the environment are

Government support of economic policies for solving environmental issues are

Government support of environmentally friendly policies is

Rate the level of economic support related to resolving environmental issues through legal approaches

Rate the level of regulatory government support for resolving environmental issues through legal approaches

Guanxi (Luo et al., 2014; Yen et al., 2011)

Rate the frequency of annual dinners or other social activities between you and your key supplier's rep

Rate the level of the relationship between you and your key supplier's rep

Rate the importance of your key supplier's rep feelings before you make important purchasing decisions

Rate the level of help you would provide to your key supplier's rep when he/she is in need

Rate the frequency of you and your key supplier's rep do favors for each other





forc Fig. 2. Effects of Guanxi on the relationships between formal institutional forces and GSC

School of Management (SoM)

Staff publications (SoM)

An empirical study of green supplier collaboration in the Chinese manufacturing sector: the double-edged sword effect of Guanxi

Geng, Ruoqi

2019-12-19 Attribution-NonCommercial 4.0 International

Geng R, Mansouri A, Aktas E, Yen D. (2019) An empirical study of green supplier collaboration in the Chinese manufacturing sector: the double-edged sword effect of Guanxi. Supply Chain Management: An International Journal, Volume 25, Issue 3, April 2020, pp. 359-373 https://doi.org/10.1108/SCM-03-2019-0135 Downloaded from CERES Research Repository, Cranfield University