Cascading Sustainability in Multi-tier Supply Chains

Wilhelm, Miriam; Villena, Veronica

Published in:
Production and Operations Management

DOI:
10.1111/poms.13516

Publication date:
2021

POMS PRODUCTION AND OPERATIONS MANAGEMENT

PRODUCTION AND OPERATIONS MANAGEMENT

Vol. 30, No. 11, November 2021, pp. 4198–4218
ISSN 1059-1478 | EISSN 1937-5956 | 21 | 3011 | 4198

DOI 10.1111/poms.13516

Cascading Sustainability in Multi-tier Supply Chains: When Do Chinese Suppliers Adopt Sustainable Procurement?

Miriam Wilhelm
Department of Global Economics and Management, University of Groningen, Nettelbosje 2, 9747, AE Groningen, The Netherlands, m.m.wilhelm@rug.nl

Veronica H. Villena*
Department of Supply Chain Management, Arizona State University, WP Carey School of Business, Tempe, Arizona 85287, USA, vhvillena@asu.edu

As global brands assume more accountability for their extended supply chains, some request that their first-tier suppliers in turn adopt sustainable procurement practices, thereby "cascading" sustainability requirements to second-tier suppliers. However, such cascading has not yet become institutionalized. We partnered with a leading sustainability electronics company—here called "Tronics"—to investigate which Chinese suppliers are more likely to adopt sustainable procurement and when Tronics' power—measured by its percentage of its Chinese suppliers' business—is more/less relevant. We gathered secondary (audit and company records) and primary (survey) data on Tronics' relationship with 134 Chinese suppliers, and complemented these sources with three archival datasets from CDP's Supply Chain Program, the National Enterprise Credit Information Publicity System of China, and the World Economic Reports. The results show that Chinese suppliers that either have an integrated management system composed of economic, environmental, and social pillars or engage with key stakeholder networks are more likely to adopt sustainable procurement practices, and that these effects are boosted when Tronics' power is low to moderate. Interestingly, Chinese suppliers with sustainability violations are not necessarily less likely to adopt sustainable procurement practices. When Tronics represents a large percentage of a supplier's business, it can persuade a noncompliant supplier to adopt sustainable procurement practices, though it has limited power over suppliers that exhibit *critical* violations.

Key words: China; global brands; Multi-tier supply chain; sustainable procurement
History: Received: November 2019; Accepted: June 2021 by Robert Klassen, after 2 revisions.
*Corresponding author.

1. Introduction

Pressure is growing for global brands to ensure sustainability along their extended supply chains, beyond their first-tier suppliers. There is evidence suggesting that the risk of environmental and social breaches is particularly high among lower-tier suppliers (Kim and Davis 2016, Villena and Gioia 2018). For example, a study on Malaysian second-tier suppliers of major electronics brands (including HP) revealed low compliance with the Code of Conduct of the Electronics Industry Citizenship Coalition (EICC), dangerously compromising the global brands' reputation (Nadvi and Raj-Reichert 2015). Another study showed a lack of both environmental management systems and procedures for handling red-flag social problems among lower-tier suppliers in Mexico, China, Taiwan, and the United States (Villena and Gioia 2020). At the same time, recent legislation has created an unprecedented need for global brands to vouch for adherence to sustainability standards, including adherence by lower-tier suppliers. Such legislation includes Section 1502 of the 2010 Dodd–Frank Act, the 2012 Californian Transparency in Supply Chains Act, and the 2015 UK Modern Slavery Act. However, initial studies show that firms struggle to comply with these regulations, particularly if their supply chains are globally dispersed (Kim and Davis 2016, LeBaron and Rühmkorf 2017).

These new accountability requirements beyond a firm's boundary constitute "one of the defining grand challenges of our era" (Kim and Davis 2016: 1897). Buying firms clearly face a conundrum. Their global supply chains are increasingly complex—spanning multiple tiers and having hundreds of suppliers within each tier, all dispersed in different countries. Suppliers are often located in emerging/developing countries, where awareness of and capabilities for sustainability are less developed (Jamali and Karam 2018, Jamali and Neville 2011). Thus global brands cannot rely on regulatory institutions in the host country to ensure supplier compliance with global sustainability standards (Scherer and Palazzo 2011). Indeed, global brands have little information on most of their lower-tier suppliers (e.g., whether they comply with global brands' environmental and labor regulations) (Kim and Davis 2016, Wang et al. 2021). Some empirical evidence suggests that such suppliers are passive—that is, they cannot or will not address sustainability problems unless buyers intervene (Villena and Gioia 2018).

Despite these challenges, some leading buyers have started "cascading" their sustainability requirements throughout their extended supply chains (Villena 2019). In this study, we focus on first-tier suppliers' adoption of sustainable procurement practices. If first-tier suppliers select and monitor their own suppliers according to sustainability criteria, second-tier suppliers must meet minimum environmental and labor requirements. It is vital that such suppliers be at least on first-tier suppliers' radar because they pose the highest risks (Nadvi and Raj-Reichert 2015, Villena and Gioia 2018). However, first-tier suppliers may not always feel compelled to adopt sustainable procurement practices on their own. This is especially true for suppliers located in emerging countries where national legislation requiring suppliers to show accountability for their own supply chains is virtually absent. Likewise, although most global brands' requests that their suppliers cascade sustainability activities to second-tier suppliers is growing in practice, these requests are considered as expectations rather than enforced requirements. Thus, cascading activities depend less on the stakeholder pressures frequently discussed in the sustainable supply chain literature (Guo et al. 2016, Kraft et al. 2013) and more on the first-tier suppliers' own sustainability attributes. This leads us to our first research question: *Which attributes enable first-tier suppliers to adopt sustainable procurement, leading to cascading of global brands' sustainability requirements throughout their multi-tier supply chains?*

To capture our multi-tier context, we partnered with "Tronics," a major European company that is a sustainability leader in the electronics industry.[1] It has a Supplier Sustainability Office whose goal is to work closely with suppliers to improve their environmental, health and safety, and labor practices. With Tronics' support, we collected secondary data (audit records from a third auditing firm and Tronics' own procurement records) and primary (survey) data on the company's relationship with 134 Chinese suppliers during the 2015–2018 period. Chinese suppliers account for approximately 50% of Tronics expenditure globally. We complemented these data sources with three archival datasets. Tronics has been working with its Chinese suppliers to improve sustainability capabilities in its extended supply chain for several years, making its relationship with Chinese suppliers an ideal empirical context to study our research questions. Furthermore, cascading always begins with a buyer—in our case Tronics. The buyer's power over its suppliers (their dependence on sales to that buyer) could influence the relationship between supplier attributes and sustainable procurement, thus leading to our second research question: *When does Tronics' power contribute to or hinder first-tier suppliers' adoption of sustainable procurement practices?*

Research on cascading sustainability in multi-tier supply chains is nascent and consists primarily of conceptual (e.g., Krause et al. 2009), analytical (e.g., Huang et al. 2020), or qualitative studies (e.g., Nadvi and Raj-Reichert 2015, Villena 2019, Wilhelm et al. 2016). Extending this emerging research stream, our study makes three contributions. First, we propose three sustainability attributes that could enable Chinese suppliers to cascade Tronics' sustainability requirements to second-tier suppliers. Our research shows that Chinese suppliers with an integrated management system for quality, environment, and health and safety are better equipped to adopt sustainable procurement. Our research also finds that Chinese suppliers that actively engage with relevant stakeholder networks—such as industry associations and NGOs—are more likely to adopt sustainable procurement practices. We hypothesize but find no evidence that Chinese suppliers that themselves violate sustainability requirements are less likely to adopt sustainable procurement, challenging some earlier qualitative studies' findings (Villena 2019, Wilhelm et al. 2016).

Second, our study examines the role of buyer power in cascading sustainability requirements in multi-tier supply chains. There is evidence that such power both facilitates and constrains suppliers' own sustainability compliance (e.g., Boyd et al. 2007, Marshall et al. 2019), but we focus instead on the effect of Tronics' power on suppliers' cascading sustainability requirements upstream. When it is low to moderate, Tronics' power can act as a booster for those suppliers that either have an integrated management system or engage with relevant stakeholder networks to adopt sustainable procurement. As its power increases, Tronics can prompt noncompliant first-tier suppliers to adopt sustainable procurement. However, this corrective effect does not work on suppliers with *critical* sustainability violations (e.g., lack of controls for worker exposures to chemical, biological, and physical agents).

Third, whereas research on sustainable procurement has focused on how global brands can influence their suppliers' operations and products (e.g., Awaysheh and Klassen 2010, Ehrgott et al. 2011, Marshall et al. 2019), we focus instead on how first-tier Chinese suppliers can in turn influence their own suppliers. The idiosyncrasies under which supplier firms in emerging countries operate (e.g., stretched resources, intense cost-reduction pressure, and lax regulatory enforcement) call for sustainable procurement practices with second-tier suppliers that are less resource-intense, that first-tier suppliers are already familiar with, and that are readily tracked. Thus, our study highlights how the dynamics change when cascading moves one tier further upstream in the supply chain (i.e., from global brands to Chinese suppliers). Our research's insights is crucial because Chinese suppliers' sustainable procurement practices directly target lower-tier suppliers—those with the highest sustainability risks (Villena and Gioia 2018).

2. Literature Review

2.1. Cascading Sustainability in Multi-Tier Supply Chains

Understanding the complexity of real-life supply chains with their multiple tiers is fundamental to supply chain management. Nevertheless, most studies focus on the buyer-supplier dyad. Choi and Hong (2002) were among the first to conduct an empirical study beyond the dyad, attempting to incorporate all the chain's tiers for one product component. They emphasized that one of the challenges of managing multi-tier supply chains is the buyer's lack of direct control over suppliers with whom no direct sourcing relationship exists. To gain more control, the buyer can use a directed sourcing strategy—that is, requesting first-tier suppliers to source from an approved (lower-tier) supplier list (Choi and Linton 2011). Most attempts to exert control over lower-tier suppliers through directed sourcing have been driven by cost, quality, innovation, or financial considerations (Bellamy et al. 2014, Choi and Hong 2002, Wang et al. 2021). But when it comes to sustainability, some buyers have blindly relied on first-tier suppliers to manage their own lower-tier suppliers (Lee and Klassen 2008), perhaps ignoring the fact that lower-tier suppliers generate the most serious environmental and social risks in the supply chain (Kim and Davis 2016, Meinlschmidt et al. 2018, Villena and Gioia 2018).

The literature has suggested several ways that buyers can manage lower-tier suppliers' sustainability (Villena and Gioia, 2018). Under a direct control strategy, the buyer can work directly with its second-tier suppliers, bypassing the first-tier suppliers (Huang et al. 2020, Tachizawa and Wong 2014). This strategy can be difficult to deploy, however, because there may be hundreds of thousands of geographically dispersed second-tier suppliers and because first-tier suppliers consider information on their own suppliers to be confidential (Villena 2019). Under an indirect (or delegation) strategy, buyers make first-tier suppliers responsible for managing their second-tier suppliers' sustainability. This approach has some benefits. First-tier suppliers may know more than buyers do about second-tier suppliers' production process and therefore be better positioned to integrate sustainability metrics into their own supplier management (Huang et al. 2020). Some first-tier suppliers might also better understand lower-tier suppliers' institutional and cultural idiosyncrasies and sustainability challenges (Soundararajan et al. 2018). Buyers that are leaders in sustainability are likely to combine direct and indirect approaches, directly managing a small group of critical second-tier suppliers while giving first-tier suppliers responsibility for managing lower-tier suppliers (Villena and Gioia 2020).

Under the indirect approach—our study's focus—first-tier suppliers play a pivotal role in cascading sustainability in multi-tier supply chains. Such suppliers must meet global brands' sustainability requirements in their own operations (their primary agency role) while acting on behalf of their principals to help cascade sustainability requirements to second-tier suppliers (their secondary agency role) (Wilhelm et al. 2016). However, the primary and secondary agency roles differ greatly in nature and drivers. Pressures from governments, NGOs, and customers have influenced suppliers' primary agency role, prompting improvements in supplier sustainability (e.g., Gualandris et al. 2015, Guo et al. 2016). However, such coercive pressures might matter less for cascading—at least to emerging-country suppliers. Most emerging countries' governments, including China's, do not regulate firms' extended supply chains. A few NGOs, such as IPE—an environmental NGO located in Beijing—are working with a few global apparel brands to prompt suppliers to address water and pollution violations (Plambeck et al. 2012), but this example is the exception rather than the norm. Moreover, a growing number of global brands request suppliers to cascade; yet, they do not strictly enforce this requirement. Thus, stakeholders' pressures that are frequently discussed in the sustainable supply chain literature might not be effective for suppliers engaging in cascading activities.

2.2. Sustainable Procurement

We define sustainable procurement as the pursuit of sustainable development objectives through purchasing and supply processes (Walker et al. 2012). Villena (2019) argues that procurement can play a strategic role in cascading sustainability in extended supply networks (see also Foerstl et al. 2015, Reuter et al. 2010, Walker et al. 2012). If global brands and their first-tier suppliers adopt sustainable procurement, some second-tier suppliers will be monitored under environmental and labor requirements. They can use a sustainability scorecard to monitor supplier performance (e.g., water use), set environmental and/or labor criteria for selecting suppliers (e.g., ISO 14000 certification), audit suppliers to identify environmental and labor violations, or implement a peer learning sustainability program among suppliers (Awaysheh and Klassen 2010, Marshall et al. 2019).

Most empirical procurement studies have used samples of U.S.-based (Awaysheh and Klassen 2010, Ehrgott et al. 2011, Pagell et al. 2010) or Europe-based buyers (Blome et al. 2014, Brammer and Walker 2011, Marshall et al. 2019) and have shown how buyers' adoption of sustainable procurement practices can influence suppliers' operations and products. Only a few studies have sampled companies operating in emerging countries such as China (Zhu and Sarkis 2007). Because of stretched resources and constant cost-reduction pressure, supplier firms in these countries will probably implement more routine sustainable procurement practices that require less time for worker training and less investment (Zhu and Sarkis 2007). Also, suppliers working for the electronic industry have only modest resources they can dedicate to sustainability (Raj-Reichert 2011, Villena and Gioia 2018). Thus, they adopt practices that are less expensive and easier to track (e.g., using a supplier scorecard with a few sustainability indicators) and that are known (e.g., using an EICC audit or requiring ISO-14001 certification).

2.3. Enablers for Suppliers' Sustainable Procurement

Following Lee and Klassen (2008), we distinguish between drivers and enablers of supplier sustainability. A *driver* is a factor that motivates firms to engage in sustainability-related activities, whereas an *enabler* is a factor that helps them achieve the desired outcome. Because cascading is not institutionalized, we argue that enablers are more important to it than drivers. Various studies have shown how management systems (Bird et al. 2019, Melnyk et al. 2003), top management support (Lee and Klassen 2008), managerial incentives (Villena and Dhanorkar 2020), slack resources (Wiengarten et al. 2017), profitability (e.g., Jira and Toffel 2013), and specialized assets (e.g., Delmas and Montiel 2009) enable a firm to integrate sustainability into its operations. It remains unclear, however, whether these enablers also help a supplier firm to cascade sustainability requirements upstream, as this is a relatively new requirement for suppliers. A few global brands require cascading, but they usually do not stop buying from a supplier if it does not cascade the brand's sustainability requirements. Compared to the well-established requirement that first-tier suppliers meet sustainability requirements in their own operations, cascading is not a fully institutionalized practice.

Cascading, and sustainable procurement in particular, poses new demands in supplier management. It requires first-tier suppliers to understand their suppliers' economic, environmental, and labor situations (Ehrgott et al. 2011). In addition to the technical capabilities needed for specifying materials and components and for sharing knowledge with suppliers, firms must develop relational capabilities such as developing contractual and informal mechanisms that will align incentives and increase supplier commitment (Parmigiani et al. 2011). Sustainable procurement also requires managing relations with key external stakeholders (e.g., industry organizations and NGOs) and internal coordination between the procurement function and other sustainability-related functions (Amengual et al. 2020, Villena 2019). Thus, first-tier suppliers must have both technical and relational capabilities to develop adequate metrics for monitoring second-tier suppliers and to foster continuous improvement in the quality, cost, and sustainability of the latter's processes.

3. Hypothesis Development

3.1. Supplier Attributes for Cascading Sustainability in Multi-Tier Supply Chains

To better understand the role of first-tier suppliers in cascading buyers' sustainability requirements upstream, we propose that three supplier attributes affect a supplier's adoption of sustainable procurement: an integrated management system, engagement with stakeholder networks, and the supplier's own sustainability compliance. These attributes reflect the supplier's technical and relational capabilities. Adopting a more integrated management system (e.g., quality, environment, or health and safety) allows a supplier to develop structures, procedures, and policies for sustainability. This integrated management system allows a supplier to develop the necessary technical capabilities for cascading. Engagement with stakeholder networks, such as industry and multistakeholder associations, helps a supplier develop its relational capabilities (e.g., through interactions with NGOs and other stakeholders) and also gives it access to tools, training, and information that facilitate cascading (Gualandris et al. 2015, Johnson et al. 2018). Finally, previous studies have explored a connection between the first-tier supplier's compliance with sustainability requirements in its operations and its role of cascading such requirements upstream (Villena 2019, Wilhelm et al. 2016).

3.1.1. Suppliers' Integrated Management Systems. Global brands often ask their suppliers to adopt certified management standards, thus contributing to the diffusion of these standards throughout global supply chains (Corbett 2006, Corbett and Kirsch 2001, Qi et al. 2013). Suppliers can also strategically use certifications to signal their performance when buyers cannot adequately assess and monitor the supplier (King et al. 2005). Several studies have shown that individual management systems (e.g., ISO or OSHAS) can enhance coordination and communication among functions, increase measurement and control of internal operations, minimize backsliding, and increase workers' training and participation (e.g., Benner and Veloso 2008, Bird et al. 2019, Lo 2014, Melnyk et al. 2003). We focus on integrated management systems, which reflect a supplier's accumulated skills and expertise in addressing quality, environmental, health and safety, and labor issues. Such systems usually include specific requirements for supplier management. For instance, in addition to integrating an environmental management system into product design, manufacturing processes, and product delivery, ISO 14001 also requires that the supplier firm "give consideration to the environmental performance and practices of [its] suppliers."[2] The supplier firm can demonstrate this consideration in different ways, such as using a certified environmental management system as a supplier selection criterion or using key environmental performance indicators as supplier monitoring criteria (Zhu and Sarkis 2007). Similarly, ISO 9001 and OSHAS 18001 have supplier management requirements related to quality and health and safety, respectively.

A supplier firm with an integrated management system has not only developed processes, policies, and initiatives but also invested in its personnel, culture, and technology (Bird et al. 2019, Corbett and Kirsch 2001, Lo et al. 2014), and these investments might facilitate its adoption of sustainable procurement. For example, an integrated management system can help suppliers apply methods and technologies to improve processes, reduce pollution, or make manufacturing methods safer. This integrated system also requires suppliers to conduct periodic internal and external audits that let them monitor the quality, environmental, and safety metrics of their suppliers and use this information to foster continuous improvement. Moreover, ISO and OHSAS standards require employee training to institutionalize a culture of quality, environmental, and health and safety improvements, which also facilitate interaction with multiple stakeholders—including suppliers (Jørgensen et al. 2006).

Integrating several management systems allows supplier firms to create synergies and evaluate trade-offs when pursuing economic, environmental, and social goals (Jørgensen et al. 2006, De Oliveira Matias and Coelho 2002). A firm often has separate groups dealing with quality, environment, and occupational health and safety because each area needs different types of expertise. These different groups often deal with suppliers, but each has its own chain of command, resources, and priorities (Raj-Reichert 2011). An integrated management system requires these different groups to work together closely and understand supplier issues in a comprehensive way. Cross-functional cooperation is vital when considering trade-offs among economic, environmental, and social goals (Jørgensen et al. 2006). Thus, we propose that.

H1. *First-tier suppliers with a more integrated management system are more likely to adopt sustainable procurement practices.*

3.1.2. Suppliers' Engagement with Stakeholder Networks. Stakeholders' networks are organizational structures allowing collective action; participation is voluntary and the objectives and actions are negotiated among participants (Roloff 2008). For example, several global electronics brands have collaborated closely with their competitors and major suppliers to develop and disseminate industrywide sustainability standards—with all parties recognizing that a collective approach is required to improve labor and environmental practices in the electronics supply chain, particularly those of lower-tier suppliers (Villena and Gioia 2020). A major characteristic of these networks is a partnership approach (Roloff 2008); members have access to shared knowledge, tools and support mechanisms (Villena 2019). However, engaging with such networks may require some commitment—for example, dedicating personnel to attend regular meetings, workshops, or task force sessions. Thus, suppliers, especially in emerging countries, must carefully determine whether and with which networks to engage.

For instance, the Electronics Industry Citizenship Coalition (EICC)—consisting of more than 150 companies aiming to improve their supply chains' social, environmental, and ethical responsibility[3]—offers a range of assessment tools (e.g., a risk assessment survey and audit) and sustainability training (e.g., annual conferences and an e-learning academy) to its members (EICC Annual Report, 2018). The EICC organizes periodic outreach meetings in China, Mexico, and Taiwan, where suppliers can exchange notes on their experiences in environmental and labor management with buyers and peers. Such meetings are beneficial because suppliers tend to adopt sustainability practices that their peers are pursuing (Villena, 2019) and because suppliers' processes tend to resemble each other (Dyer and Nobeoka 2000). The EICC also hosts annual meetings and offers online courses and workshops through which supplier members learn about new requirements and updates of existing requirements (including cascading).

Another relevant stakeholder network in the electronics industry is the Carbon Disclosure Program (CDP), an NGO that uses a network approach involving intergovernmental agencies, governments, business and regional associations, financial organizations, and other NGOs (www.cdp.net). The CDP launched its Supply Chain Program (CDP-SCP) in 2008. As part of this program, firms such as Microsoft, Dell, HP, Intel, and Signify invite their suppliers to disclose their carbon emissions, risks, and initiatives on the CDP-SCP platform. Suppliers who participate in this program must collect and report not only this type of previously unsolicited information but also carbon-emission reduction initiatives they have with their own suppliers. The program makes suppliers aware of multiple buyers' expectations (including cascading), even if suppliers do not have carbon-emission reduction initiatives in place (Jira and Toffel 2013, Villena and Dhanorkar 2020). The CDP also offers webinars and regular workshops to participating suppliers, which help them improve both supplier disclosure and carbon emission performance (www.cdp.net). Thus, suppliers participating in the CDP-SCP sharpen their awareness of the environmental trends in their industries, disclose and improve their carbon emissions, and gain access to tools and resources that they could use with their own suppliers (Villena 2019, Villena and Dhanorkar 2020).

In sum, suppliers often join stakeholder networks such as EICC and CDP via customer invitation. In doing so, suppliers become aware of their customers' sustainability requirements (including cascading) and gain access these networks' standardized tools (e.g., risk assessment surveys and audits) and resources (e.g., annual and outreach meetings). Thus, participation in such networks enables suppliers to modify their procurement practices to include sustainability criteria. We thus propose that.

H2. *First-tier suppliers with higher involvement in relevant stakeholder networks are more likely to adopt sustainable procurement practices.*

3.1.3. Suppliers' Sustainability Compliance. Wilhelm et al. (2016) argue that there could be a connection between a first-tier supplier's level of compliance with its primary agency role (i.e., meeting sustainability requirements in its own operations) and its secondary agency role (i.e., helping cascade sustainability to second-tier suppliers). To explore this connection, we focus on the level of supplier compliance with the buyer's environmental and social requirements (Bird et al. 2019, Distelhorst et al. 2017, Short et al. 2016) and how it affects the supplier's adoption of sustainable procurement.

In their multiple-case study, Wilhelm et al. (2016) found that an electronics supplier that does not itself comply with sustainability requirements is not likely to cascade sustainability to its suppliers. The supplier they describe had neither a dedicated sustainability staff nor slack resources to engage in cascading activities. While line managers could temporarily take responsibility for addressing their internal environmental and labor issues, the lack of dedicated staff became particularly critical in managing the sustainability of second-tier suppliers. In her inductive study, Villena (2019) found that suppliers with several environmental, health and safety, and labor violations struggled to meet their buyers' requirements and, therefore, did not prioritize their suppliers' sustainability. In her study, one supplier who violated a 60-hour workweek limit acknowledged, "We don't comply with this requirement ourselves ... so how could we ask our own suppliers to do so?" (Villena and Gioia 2020: 88). Given these qualitative studies, we propose that.

H3. *First-tier suppliers with more sustainability violations are less likely to adopt sustainable procurement practices.*

3.2. The Moderating Role of Tronics' Power in Cascading Sustainability

First-tier suppliers' cascading sustainability requirements for second-tier suppliers does not occur in a vacuum, but in the presence of global brands that can exert their power to promote sustainability throughout their supply chains. In this section, we focus on Tronics' power. *Power* is an essentially dyadic concept and relates to the ability of one party to exert control and influence over another (Emerson 1962)—take, for example, a buyer's power over a supplier that depends on that buyer for a large portion of its sales (Krajewski et al. 2005). However, while some studies show that highly dependent suppliers are more likely to comply with their powerful buyer's environmental and labor requirements (Ehrgott et al. 2011, Touboulic et al. 2014), others show that buyer power can degrade a dependent supplier's commitment and cooperation (Handley and Benton 2012, Nyaga et al. 2013). The use of coercive mechanisms can make a powerful buyer seem like a "bully" rather than a "champion" among its suppliers (Boyd et al. 2007).

We assume that a powerful buyer can persuade its suppliers to adopt more sustainable practices across its various functions, including its procurement unit (Marshall et al. 2019, Zhu and Sarkis 2007), though only a few global electronics brands actually do this. Tronics is one of the strictest electronics brands buying from Chinese suppliers. It does not terminate a relationship with a supplier lacking cascading activities, but does if the supplier itself has recurring violations. Thus, Tronics' power might not directly affect its suppliers' adoption of sustainable procurement but could bolster or hinder the effects of the three supplier attributes we discuss above. Figure 1 shows our theoretical framework.

We argue that a low-to-moderate degree of Tronics' power over a particular supplier could catalyze its adoption of sustainable procurement if it either has an integrated management system or engages with stakeholder networks. Without perceiving much threat from Tronics, the supplier with superior technical and relational capabilities not only is better prepared to respond promptly to Tronics' sustainability demands but also can readily assimilate Tronics' sustainability training/tools, thereby facilitating sustainable procurement. Also, the supplier may consider itself proactive in dealing with sustainability challenges within its supply chain (Hanke and Stark 2009). It would initially respond favorably to external pressure to implement sustainable procurement practices, but it would not increase its commitment beyond what it had already internally established. But a similar capable supplier over which Tronics has more power might perceive that Tronics was mandating it to adopt sustainability practices and dictating how it has to implement such practices. This supplier might feel "bullied" rather than positively reinforced (Boyd et al. 2007). In such cases, Tronics' power might crowd out this supplier's intrinsic motivation to collaborate and improve (Handley et al. 2019). Thus, we hypothesize that.

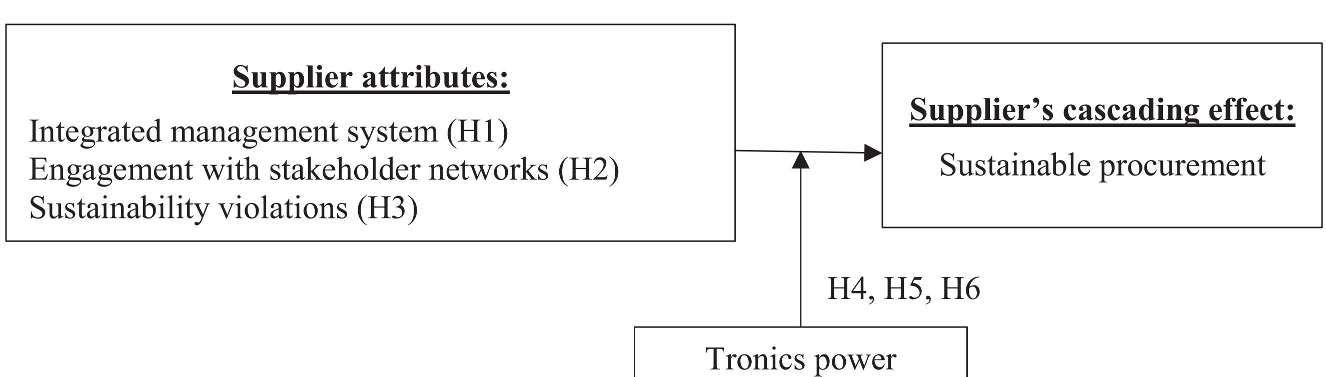
H4. *The positive relationship between integrated management systems of first-tier suppliers and their adoption of sustainable procurement weakens when Tronics' power increases.*

H5. *The positive relationship between the engagement of first-tier suppliers with stakeholder networks and their adoption of sustainable procurement weakens when Tronics' power increases.*

We also argue that suppliers with many sustainability violations are even less likely to adopt sustainable procurement practices when Tronics' power is low. Studies have shown that particularly resource-deficient suppliers may not address their internal environmental and labor issues without pressure from a powerful customer (Lee and Klassen 2008, Touboulic et al. 2014). Similarly, we argue that the lack of an external pressure aggravates the situation of non-compliant suppliers, reducing their chances of adopting sustainable procurement. However, as Tronics' power increases, dependent, non-compliant suppliers could be more receptive to comply with Tronics' demands because of their fear of losing a big portion of their business. Such suppliers not only operate under this threat but also are under greater scrutiny from Tronics because of their number of sustainability violations. Their lack of legitimacy in handling their internal sustainability issues forces them to tolerate the coercive pressure of a dominant buyer (Touboulic et al. 2014); therefore,

H6. *The negative relationship between the violations of first-tier suppliers and their adoption of sustainable procurement practices weakens when Tronics' power increases.*

Figure 1 Theoretical Framework



4. Method

4.1. Empirical Context and Sample Selection

To study a multi-tier supply chain, we partnered with a large European company we are calling "Tronics," which is ranked as one of the leaders in the electronics industry in major sustainability rankings, such as the Dow Jones Sustainability Index. Its Supplier Sustainability Office aims to work closely with suppliers to improve their environmental, health and safety, and labor practices. This office is responsible for Tronics' Supplier Development Program. Tronics selects suppliers for this program using two criteria: (a) the supplier must be located in a high-risk country, such as China, India, or Mexico; and (b) Tronics' annual purchasing from the supplier must be higher than one million euros. We targeted all 220 Chinese suppliers participating in the Supplier Development Program, which captures 98% of Tronics' purchasing expenditure in China and approximately 50% of its expenditure globally. As an EICC member, Tronics is held accountable to the EICC Code of Conduct,[4] which stipulates that suppliers should communicate EICC requirements to their own suppliers and periodically monitor compliance. And Tronics not only has the reputation of investing in developing supplier sustainability capabilities but also requires that its suppliers in turn comply with the EICC code, including its requirement for cascading.[5] Our partnership with Tronics thus provided an ideal empirical setting to test our hypotheses.

This study is part of a larger research project in which we first conducted in-depth interviews with 19 of Tronics' employees and 10 of Tronics' Chinese suppliers to learn how suppliers incorporate their buyers' requirements within their extended supply chains. Tronics allowed us to gather archival data from internal sources (audit and procurement records) and to conduct a survey with its 220 Chinese suppliers. Given the sensitivity of our topic, we carefully developed our survey to use objective questions and conducted a pilot test of the Chinese version. Three archival datasets helped us cross-validate the survey data and calculate some control variables. The following sections describe each data source.

4.1.1. Archival data. First, we collected data from the last audit for 220 Chinese suppliers during the 2015 to 2017 period. Every three years, a third-party auditing firm assesses suppliers' compliance with Tronics' environmental, health and safety, and labor requirements. When a supplier is found to have violated these requirements, third-party auditors record the number and severity of violations. A final report is submitted to Tronics' Supplier Sustainability Office, which is responsible for resolving supplier violations. Second, Tronics provided its suppliers' demographic information, such as location, compliance status (1: yes; 0: no), management systems (e.g., ISO 14001), and categories of business volume (e.g., higher than 5 million euros) in 2017. We used both datasets to capture two of our three independent variables (supplier violations and integrated management systems) and our control variables (e.g., supplier relevance). Those datasets also allowed us to assess nonresponse bias (see section 4.3). Third, we gathered information from CDP's Supply Chain Program (CDP-SCP), the National Enterprise Credit Information Publicity System of China, and World Economic Outlook Reports. The first dataset allowed us to cross-validate some survey responses; Tronics' suppliers report their climate change risks and goals, carbon emissions, and related information via CDP-SCP. The two other datasets enabled us to calculate some of our control variables (see section 4.2).

4.1.2. Survey data. Following best practices in survey-based research (Kriauciunas et al. 2011), we used several measures in developing our instrument, which was based on our interviews and literature review. The Chinese version was reviewed by two native Chinese academics who were independent of the author team and modified in accord with their feedback. We then pilot tested the survey with three sustainability researchers and four Chinese managers, who offered several suggestions for improving the survey's wording, design, and administration. In the cover letter, we offered participants anonymity and a benchmark report to increase the response rate. We used university logos and provided a link to each researcher's profile to demonstrate the study's legitimacy and noted that individual supplier responses would not be shared with Tronics under any circumstance. With the support of Tronics' Supplier Sustainability Office, we distributed the survey in January 2018. The office sent a personalized link with the survey to 220 Chinese suppliers. We did three follow-ups and gathered 134 completed responses, for a response rate of 60.9% (134/220). Table 1 shows the profile of participants.

We took several steps to ensure that respondents were knowledgeable about the topic investigated. First, Tronics' Supplier Sustainability Office has in-depth knowledge of the best contact person in the supplier firm because its representatives regularly conduct training at supplier facilities and work closely with suppliers to address environmental/labor violations found in audits. Tronics sent the survey to its list of supplier contacts. Second, we included two questions about the respondent's years of work experience in the firm (average 8 years) and in the electronics industry (average 12 years).

Table 1 Sample Profile

	Frequency	%
Firm size		
10–100	15	11.19%
101–200	31	23.13%
201–500	52	38.80%
> 500	36	26.86%
Management certificates		
ISO 9001	102	76.11%
ISO 14001	77	57.46%
OHSAS 18001	30	22.38%
Ownership type		
Foreign-owned	21	15.67%
Locally-owned	113	84.33%
Location (region)		
Guangdong	44	32.83%
Zhejiang	31	23.13%
Jiangsu	24	17.91%
Other	35	26.11%

4.2. Measurement Description

4.2.1. Independent Variables. To capture an *integrated management system,* we summed the supplier's use of management system standards for quality (ISO 9001), environment (ISO 14001), and health and safety (OSHAS 18001),[6] as recorded in supplier certification data provided by Tronics in 2017. The measure ranges from 0 (no management system standard) to 3 (ISO 9001, ISO 14001, and OSHAS 18001). A supplier with multiple management systems is better equipped to respond to its buyers' sustainability requirements. Of our sample, 16% had all three management systems, while 27% had none. To capture *sustainability violations*, we used the number of violations in the following categories: environmental (e.g., inappropriate disposal of toxic waste), health and safety (e.g., lack of emergency preparedness), and labor (e.g., excessive overtime). Like previous researchers (Distelhorst et al. 2017, Short et al. 2016), we used the aggregated number of violations found in a supplier's last audit during the 2015–2017 period. Tronics' suppliers averaged 9.5 violations. We measured *engagement with stakeholder networks* as the number of organizations with which a supplier had engaged during the last three years (2015–2017). The survey listed several relevant stakeholder networks (e.g., CDP, EICC, BSCI) but allowed suppliers to add others. Eleven firms (5.9%) had engaged with two stakeholder networks, while 57 firms (42.5%) had no engagement. To further validate this measure, we cross-validated supplier responses against CDP-SCP datasets for 2015, 2016, and 2017 and found no disparities. We could not cross-validate supplier responses against EICC reports because, unlike CDP records, EICC reports on supplier audits are not publicly available.

4.2.2. Dependent Variables. The construct of *sustainable procurement practices* was measured through three survey items that we adopted from empirical studies (Awaysheh and Klassen 2010, Marshall et al. 2019, Zhu and Sarkis 2007) and reinforced with insights from qualitative studies (Klassen and Vereecke 2012, Villena and Gioia 2018) as well as from our in-depth interviews with the 10 Chinese suppliers. This construct was measured on a 5-point Likert scale. We asked first-tier suppliers the extent to which they had implemented three practices: (a) using key performance indicators to monitor second-tier suppliers' environmental, health, and safety practices, (b) using sustainability criteria (e.g., ISO 14001 certification) in selecting suppliers, and (c) conducting supplier environmental and social audits. Collectively, these practices reflect the extent to which Chinese suppliers include some metrics and policies to assume more accountability in their own supply chains. We averaged the three items. This construct's composite reliability (CR) and average variance explained (AVE) values were 0.80 and 0.67, respectively. Table 2 presents the survey items of this measure and others used in this research.

4.2.3. Control Variables. We included three sets of control variables. First, we controlled for

Table 2 Survey Measures and Results of Confirmatory Factor Analysis

Factor and Scale Items	CR	AVE	Standard coefficient	*p*-value
Supplier sustainable procurement: Please indicate the extent to which your firm	.80	.67		
SP1: uses KPIs to monitor environmental, health and safety practices of your suppliers			0.80	.00
SP2: uses environmental and/or labor criteria (e.g., ISO 14001 certification and EICC compliance) in your supplier selection process			0.83	.00
SP3: conducts environmental and labor audit to suppliers			0.83	.00
Supplier engagement with stakeholder networks: Please select all stakeholder organizations that your company has engaged during the last 3 years: EICC (. . . .), CDP (. . . .), BSCI (. . . .), Other: (Please indicate the name)				
Tronics power: What percentage (0-100%) of your production output is bought by *Tronics*?				
Relationship duration: Please indicate the number of years *Tronics* and your company have been working together.				
Buyer training: Please indicate the number of training sessions received by your customers in 2015:. . . . ., 2016:. . . . ., 2017:.				
Buyer reward: Please indicate the extent to which your company has received rewards from customers (e.g., offering longer-term contracts, increasing order volumes, and providing sustainability awards) to comply with the EICC Code of Conduct (on a five-point Likert scale from strongly disagree to strongly agree).				

demographic factors that might affect purchasing (size, % of female employees, ownership type, public company status, the province's GDP, and geographic location). Although larger firms might have more resources to invest in environmental as well as health and safety improvements (Darnall et al. 2010, Delmas and Montiel 2009), evidence suggests that Chinese firms with more resources do not necessarily commit to investing in such improvements (Wu et al. 2014). *Firm size* was measured as the number of employees. We also controlled for the *percentage of female employees* because they tend to resist exploitative workplace conditions and exercise their rights, suggesting that suppliers with a higher percentage of female workers might have better environmental and social conditions (Bird et al. 2019). We also controlled for *ownership type* because suppliers owned by a Western conglomerate might receive support for sustainability practices and thus be more inclined to adopt them (Qi et al. 2013). This dummy variable takes a value of 1 if suppliers are owned by a foreign company and 0 otherwise. We gathered this information from the National Enterprise Credit Information Publicity System of China.[7] We also controlled for whether a supplier is a *public company* (1) or not (0). Suppliers listed in the Shanghai or Shenzhen Stock Exchange might receive more pressure from investors to deliver short-term results (and thus overlook long-term responsibilities) but also might be exposed to higher public scrutiny (and thus be forced to address their sustainability issues) (Bansal and DesJardine 2014, Lo et al. 2018). Nine percent of suppliers were listed in these two stock markets. We also controlled for the average economic development of the supplier's province in the year an audit was conducted, using the province's annual per-capita gross domestic product (labelled *Province GDP*) in 2017 dollars, calculated by the International Monetary Fund in its World Economic Outlook Reports. This control variable is important because firms located in a rich province might have access to more resources and have more experience in meeting environmental and labor requirements (Short et al. 2016).

Second, we controlled for three attributes of the relationship with Tronics: *supplier relevance*, *relationship duration*, and *product type*. We controlled for *supplier relevance* because Tronics might exert different pressure on suppliers capturing a high share of Tronics' purchasing expenditure. As a result, such suppliers could be more interested in meeting Tronics' sustainability requirements and cascading such requirements to their own suppliers. As Tronics specified three spending categories, we created two dummy variables. *Supplier_3 million* indicates that Tronics had placed orders with that supplier for more than 3 (but less than 5) million euros, whereas *Supplier 5 million* indicates that Tronics had placed orders with that supplier for more than 5 million euros. We also included *relationship duration*, measured in years, because suppliers with a long-term relationship with Tronics might be more responsive to its requests (Jiang 2009). Also, the type of product supplied to Tronics could affect how suppliers address sustainability issues and how they procure their materials. We included two product types—*electric* and *mechanical*, accounting for 56% of the sample.

Third, we controlled for global brands' supportive mechanisms—*buyer training* and *buyer rewards*—that might affect suppliers' sustainability capabilities (Lee and Klassen 2008, Villena and Gioia 2018). We asked suppliers for (a) the number of sustainability training sessions offered by their buyers in which they participated during 2015, 2016, and 2017 and (b) the extent to which they had received incentives from these buyers to comply with the EICC Code of Conduct (on a five-point Likert scale from strongly disagree to strongly agree). We measured *buyer training* by summing the number of training sessions a supplier received from its customers in the 2015–2017 period.

Finally, we measured Tronics' *power* as the percentage of the supplier's total production output purchased by Tronics (see Krajewski et al. 2005). This percentage was reported by each supplier in the survey. In our sample, this measure ranged from 1% to 90%, with an average of 22%.

4.3. Tests for Nonresponse Bias and Common Method Bias

We assessed nonresponse bias by examining the mean differences between respondents (n = 134) and nonrespondents (n = 86) (Lambert and Harrington 1990). We found no differences for supplier compliance status ($t = 1.55$, $p = 0.11$), integrated management system ($t = 1.32$, $p = 0.19$), group of suppliers for whom Tronics' spending is between 3 and 5 million euros ($t = 0.13$, $p = 0.71$), group of suppliers for whom Tronics' spending is above 5 million euros ($t = 0.01$, $p = 0.93$), or location ($\chi^2_{(1)} = 1.22$, $p = 0.27$). Tronics provided this demographic information for its 220 suppliers.

We used several remedies to control for potential common-method bias (Podsakoff et al. 2003). For instance, we guaranteed respondent anonymity in the survey, reduced item ambiguity via a pilot test, and included objective survey questions. We also used separate data sources for our independent variables (i.e., supplier violations were reported by a third-party auditing firm, and supplier certifications were gathered from a Tronics dataset) and for our dependent variable (sustainable procurement came from the survey).

5. Model and Results

Table 3 presents the constructs' descriptive statistics and correlations. We examined the data for violations of assumptions of normality and multicollinearity. All variables approximated normal distributions except for firm size and relationship duration, which were transformed by taking their logarithms. Variance inflated factor (VIF) scores were all below 3, suggesting that multicollinearity was not a serious problem in the analysis. In addition, we calculated Cook distance values for all cases to reduce the possibility that a few extreme values would overly influence results (Cohen et al. 2003); all values were below 0.08, suggesting that our analysis was not influenced by extreme values.

We tested the hypotheses using ordinary least squares regression analysis. To facilitate interpretation, we mean-centered the variables before creating interaction terms (Aiken and West 1991). Table 4 reports the increments to adjusted R^2 at each step and each regression equation's significance. First, we regressed sustainable procurement on the three supplier sustainability attributes after controlling for all control variables (see Model 1). Next, we added the interaction effects (see Model 2). The results show that integrated management system ($\beta = 0.20$, $p < 0.01$) and engagement with stakeholder networks ($\beta = 0.26$, $p < 0.05$) were significant, but supplier noncompliance was not. Thus, H1 and H2 were supported whereas H3 was not. Tronics' power negatively moderated the effect of the integrated management system ($\beta = -0.57$ $p < 0.01$) and engagement with stakeholder networks ($\beta = -0.87$, $p < 0.01$) on sustainable procurement, providing support for H4 and H5. Finally, Tronics' power positively moderated the effect of supplier violations on sustainable procurement ($\beta = 0.07$, $p < 0.01$), providing support for H6.

We also ran floodlight analyses for a more granular understanding of these significant moderation effects (see Table 5). We separately examined the simple effects of having an integrated management system, engagement in stakeholder networks, and sustainability violations on sustainable procurement, across varying levels of Tronics' power (Spiller et al. 2013). An integrated management system significantly increases sustainable procurement when Tronics' power is low; however, this effect becomes negative when Tronics' power is very high. Similarly, engagement in stakeholder networks significantly increases sustainable procurement when buyer power is low, but this effect becomes negative when Tronics' power is very high. Finally, sustainability violations have an insignificant negative relationship with sustainable procurement when buyer power is low, but this relationship becomes a significant positive one when buyer power is moderate to high. Figure 2a,b and c plot all of these effects, which provide strong support for H4, H5, and H6.

To account for violations' severity (critical versus noncritical), we reran the analysis replacing total violations with noncritical violations in Model 3 and critical violations in Model 4. A violation's criticality is determined by Tronics and identified by third-party auditors during their visits. Examples of critical violations are hiring factory workers below the minimum age, failure to use machine safeguards and emergency stop switches, no management for hazardous materials, and air emissions exceeding discharge limits for regulated constituents. Examples of noncritical violations are not implementing provisions of social insurance schemes and other benefits required by Chinese labor law, dirty canteens, and failure to obtain all legally required environmental permits, approvals, licenses, and registrations. Appendix A provides an overview of the most common violations among Tronics' Chinese suppliers. The results for noncritical violations are almost identical to the main results. In contrast, the results for "critical" violations do not support H2, H5, and H6. We briefly discuss these more nuanced results in the discussion section.

We also replaced our measure of integrated management systems, incorporating each management system separately (i.e., ISO 9001, ISO 14001, *or* OSHAS 18001) to assess whether a particular management system might have a disproportionate effect on sustainable procurement. The results do not indicate that any one management system has a stronger effect than others (see Table 6): ISO 9001, ISO 14001, and OSHAS 18001 independently have similar effects on sustainable procurement.

Three control variables were significant. Past research shows that buyers' supportive mechanisms, such as training and rewards, improve supplier sustainability compliance (Distelhorst et al. 2017, Locke et al. 2009, Porteous et al. 2015); our study shows that the same mechanisms can also play a critical role in prompting suppliers to adopt sustainable procurement practices with their own suppliers. Thus, global brands offering such support enjoy a wider reach of benefits than has been assumed: their supportive mechanisms can foster sustainability among lower-tier suppliers. Also, relationship length mattered but not in the way we had assumed; *newer* suppliers are more attentive to Tronics's cascading demands, but this attentiveness might decline with familiarity. Alternatively, if Tronics is ratcheting up its requirements over time, such demands might be grandfathered for suppliers with longer-term relationships or given minimal attention by older established suppliers.

Table 3 Descriptive Statistics and Correlations

		Correlations																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Size	1.00																			
2	% female employee	0.05																			
3	Ownership type	0.24	0.01																		
4	Public complany	0.19	–0.17	–0.01																	
5	Supplier relevance3 M	–0.27	–0.08	–0.06	–0.01																
6	Suppier relevance 5 M	0.31	0.26	0.05	–0.01	–0.50															
7	Relationship duration	0.20	0.14	–0.04	–0.07	0.11	0.15														
8	Electrical product	0.02	0.22	0.05	–0.01	–0.12	0.00	0.06													
9	Mechanical product	–0.08	–0.20	–0.03	0.00	0.21	–0.07	0.20	–0.22												
10	Province GDP	0.05	–0.14	0.04	–0.06	–0.01	–0.01	0.01	–0.12	–0.02											
11	Buyer training	0.17	0.00	–0.05	0.05	0.05	0.05	0.11	–0.09	0.04	0.06										
12	Buyer rewards	–0.04	–0.02	–0.06	0.10	–0.14	0.10	–0.06	0.07	–0.18	0.03	0.21									
13	Tronics Power	–0.17	0.16	0.01	–0.25	–0.07	0.04	0.21	0.03	–0.01	–0.06	0.12	–0.05								
14	Management system	0.45	0.00	0.26	0.07	–0.12	0.08	0.08	–0.04	–0.06	0.03	0.01	–0.04	–0.04							
15	Supplier Engagement	0.12	–0.15	–0.05	0.23	–0.17	0.00	–0.11	–0.03	–0.02	–0.03	0.17	0.07	–0.13	–0.03						
16	Supplier violations	–0.26	–0.10	–0.14	–0.13	0.01	–0.16	–0.22	–0.01	0.10	0.05	–0.14	–0.04	–0.04	–0.19	0.05					
17	Sustainable procurement (SP)	0.07	–0.04	0.05	0.06	–0.04	0.06	–0.09	0.07	–0.04	0.08	0.28	0.52	0.02	0.12	0.14	0.00				
18	SP1	–0.04	–0.08	0.06	0.09	0.02	–0.02	–0.15	0.07	–0.01	0.03	0.22*	0.49	–0.01	0.03	0.12	0.04	0.89			
19	SP2	0.13	0.02	0.14	–0.01	–0.09	0.12	–0.03	0.06	–0.08	0.06	0.30	0.47	0.06	0.15	0.12	–0.03	0.91	0.73		
20	SP3	0.11	–0.06	–0.05	0.07	–0.05	0.06	–0.06	0.06	–0.02	0.12	0.26	0.46	–0.01	0.13	0.14	–0.01	0.92	0.72	0.76	
	Minimum	1.45	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	1.00	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00
	Maximun	3.45	0.93	1.00	1.00	1.00	1.00	1.32	1.00	1.00	0.10	3.00	5.00	0.90	3.00	2.00	40.00	5.00	5.00	5.00	5.00
	Mean	2.48	0.47	0.16	0.10	0.59	0.15	0.84	0.15	0.22	0.05	0.96	3.79	0.22	1.56	0.65	9.46	4.07	4.04	4.18	3.99
	Standard deviation	0.48	0.16	0.36	0.31	0.49	0.36	0.37	0.36	0.41	0.02	1.18	0.73	0.21	1.04	0.63	6.98	0.63	0.66	0.67	0.74

All variables reported in raw data, except for supplier size and relationship length, which were log-transformed. N = 134. Coefficient above 0.18 are significant at 0.05 level.

Table 4 Regression Results

	Base Model			Model 1			Model 2 (Total violations)				Model 3 (Non-Critical violations)				Model 4 (Critical violations)			
	β	SE	Sig.	β	SE	Sig.	β	SE	Sig.	VIF	β	SE	Sig.	VIF	β	SE	Sig.	VIF
Constant	2.31	0.59	0.00	2.39	0.60	0.00	2.04	0.55	0.00		2.07	0.58	0.00		2.23	0.59	0.00	
Size	0.15	0.10	0.15	0.07	0.11	0.51	0.14	0.11	0.26	1.91	0.15	0.11	0.23	1.92	0.13	0.12	0.25	1.89
% Female employees	–0.13	0.28	0.65	–0.07	0.26	0.80	0.20	0.26	0.53	1.40	0.17	0.27	0.56	1.39	0.08	0.28	0.83	1.40
Ownership type	0.09	0.15	0.54	0.08	0.14	0.58	0.04	0.14	0.70	1.15	0.04	0.14	0.72	1.15	0.04	0.14	0.75	1.14
Public company	–0.03	0.12	0.80	–0.05	0.11	0.65	–0.10	0.11	0.32	1.22	–0.11	0.11	0.26	1.23	–0.08	0.10	0.38	1.21
Supplier 3 million	0.11	0.12	0.34	0.16	0.12	0.18	0.16	0.12	0.13	1.68	0.17	0.11	0.11	1.69	0.14	0.11	0.18	1.67
Supplier 5 million	0.07	0.14	0.62	0.12	0.14	0.38	0.12	0.13	0.32	1.66	0.11	0.13	0.36	1.65	0.06	0.13	0.63	1.63
Relationship duration	–0.26	0.16	0.09	–0.24	0.15	0.10	**–0.32**	**0.16**	**0.05**	**1.42**	**–0.33**	**0.16**	**0.04**	**1.43**	–0.30	0.15	0.06	1.36
Electrical product	0.18	0.11	0.10	**0.19**	**0.10**	**0.05**	0.15	0.10	0.14	1.20	0.15	0.11	0.16	1.20	0.14	0.11	0.16	1.20
Mechanical product	0.14	0.11	0.23	0.13	0.11	0.23	0.12	0.11	0.17	1.27	0.11	0.11	0.19	1.27	0.13	0.11	0.17	1.26
Province GDP	0.09	0.08	0.31	0.08	0.09	0.35	0.03	0.08	0.56	1.09	0.05	0.08	0.44	1.08	0.08	0.08	0.30	1.08
Buyer training	**0.09**	**0.04**	**0.02**	**0.08**	**0.04**	**0.03**	**0.07**	**0.04**	**0.04**	**1.26**	**0.07**	**0.04**	**0.05**	**1.25**	0.07	0.04	0.06	1.28
Buyer rewards	**0.44**	**0.10**	**0.00**	**0.44**	**0.09**	**0.00**	**0.44**	**0.10**	**0.00**	**1.17**	**0.45**	**0.09**	**0.00**	**1.17**	**0.44**	**0.09**	**0.00**	**1.17**
Tronics power	0.25	0.26	0.34	0.27	0.25	0.27	0.10	0.22	0.54	1.33	0.10	0.22	0.54	1.33	0.25	0.27	0.33	1.34
Direct effects:																		
Integrated management system (IMS)(H1)				**0.09**	**0.05**	**0.05**	**0.20**	**0.06**	**0.01**	**2.51**	**0.20**	**0.07**	**0.00**	**2.51**	**0.18**	**0.07**	**0.01**	**2.60**
Engagement with stakeholder networks (ESN) (H2)				0.13	0.07	0.11	**0.26**	**0.11**	**0.02**	**2.48**	**0.26**	**0.11**	**0.03**	**2.34**	0.19	0.12	0.12	2.42
Sustainability violations (SV) (H3)				0.01	0.01	0.23	–0.01	0.01	0.27	2.21	–0.01	0.01	0.22	2.15	–0.04	0.03	0.29	2.53
Moderation effects:																		
IMS*Tronics power (H4)							**–0.57**	**0.21**	**0.01**	**2.62**	**–0.64**	**0.22**	**0.01**	**2.73**	**–0.56**	**0.25**	**0.03**	**2.66**
ESN*Tronics power (H5)							**–0.85**	**0.33**	**0.01**	**2.43**	**–0.87**	**0.33**	**0.01**	**2.67**	–0.41	0.45	0.52	2.34
SV*Tronics power (H6)							**0.07**	**0.01**	**0.00**	**2.11**	**0.08**	**0.01**	**0.00**	**2.10**	0.05	0.12	0.57	2.43
R^2	0.34			0.37			0.44				0.45				0.40			
Adjusted R^2	0.27			0.29			0.35				0.35				0.30			
F Change (p value)	4.90(0.001)			1.92 (0.12)			4.62(0.001)				4.99 (0.001)				1.64 (0.18)			

We report unstandardized coefficients and robust standard error. Sample size is 134.

We also conducted several robustness checks. First, whether the supplier competes on cost or on innovation could affect how it addresses its global buyers' demands. In the survey, we asked suppliers to designate their competitive capabilities in terms of cost and innovation (from 0 to 100 points), and we created a variable for each. After we included both effects, the results remained the same. Second, whereas in the main analysis, we measured supplier relevance with two dummy variables, in an alternative analysis, we included only suppliers that sold more than 5 million euros' worth of goods to Tronics, on the assumption that those suppliers might be more amenable to Tronics' requirement. The results did not change. Third, some Chinese provinces might enforce their environmental and labor laws more strictly and thus make suppliers in these provinces more responsive to sustainability issues. We created two province dummies —*Guandong* and *Zheijan*—that accounted for almost 56% of our sample. The results remained identical.

We made several attempts to address potential endogeneity concerns. First, we included twelve control variables to account for confounding effects at the product, firm, and relationship levels. Second, to reduce concern about reverse causality, we measured two of our independent variables, integrated management system and sustainability violations, at least one year earlier (2015–2017) than our dependent variable (sustainable procurement), which was captured in our 2018 survey. However, our third independent variable (engagement with stakeholder networks) came from the survey. We asked respondents to mark all stakeholder organizations that their company had engaged with during the last 3 years (2015–2017). Thus, this variable and the sustainable procurement variable were captured from the same source. Third, we collected the data for our independent and dependent variables from different sources (integrated management system was gathered from Tronics' purchasing records, supplier violations were reported

Table 5 Impact of Supplier Attributes across Tronics Power Levels

Moderator	Simple effect of integrated management systems	Lower 95% confidence interval	Upper 95% confidence interval	*z*-value	*p*-value
Tronics power					
0.05	0.171**	0.058	0.284	2.96	0.003
0.15	0.114*	0.024	0.204	2.48	0.013
0.30	0.028	–0.062	0.118	0.62	0.537
0.45	–0.057	–0.186	0.071	–0.87	0.383
0.60	–0.143	–0.325	0.040	–1.53	0.125
0.90	–0.313*	–0.617	–0.010	–2.03	0.043
Moderator	**Simple effect of engagement with stakeholder networks**	**Lower 95% confidence interval**	**Upper 95% confidence interval**	***z*-value**	***p*-value**
Tronics power					
0.05	0.218*	0.007	0.430	2.03	0.043
0.15	0.133	–0.038	0.303	1.62	0.100
0.30	0.004	–0.145	0.153	0.05	0.959
0.45	–0.125	–0.312	0.063	–1.30	0.192
0.60	–0.253†	–0.514	0.007	–1.91	0.057
0.90	–0.511*	–0.950	–0.072	–2.28	0.022
Moderator	**Simple effect of sustainability violations**	**Lower 95% confidence interval**	**Upper 95% confidence interval**	***z*-value**	***p*-value**
Tronics power					
0.05	–0.003	–0.018	0.010	–0.55	0.585
0.15	0.003	–0.009	0.015	0.55	0.583
0.30	0.014**	0.004	0.024	2.70	0.007
0.45	0.025***	0.014	0.035	4.68	0.000
0.60	0.036***	0.023	0.048	5.64	0.000
0.90	0.057***	0.038	0.076	5.84	0.000

Two-tailed tests are reported. *N* = 134. Estimation based on robust standard errors. All reported levels are within the observed range.

from an independent auditing firm, and sustainable procurement was collected from our own survey), making the measurement error of our independent variables less likely to be correlated with the measurement errors of our dependent variable.

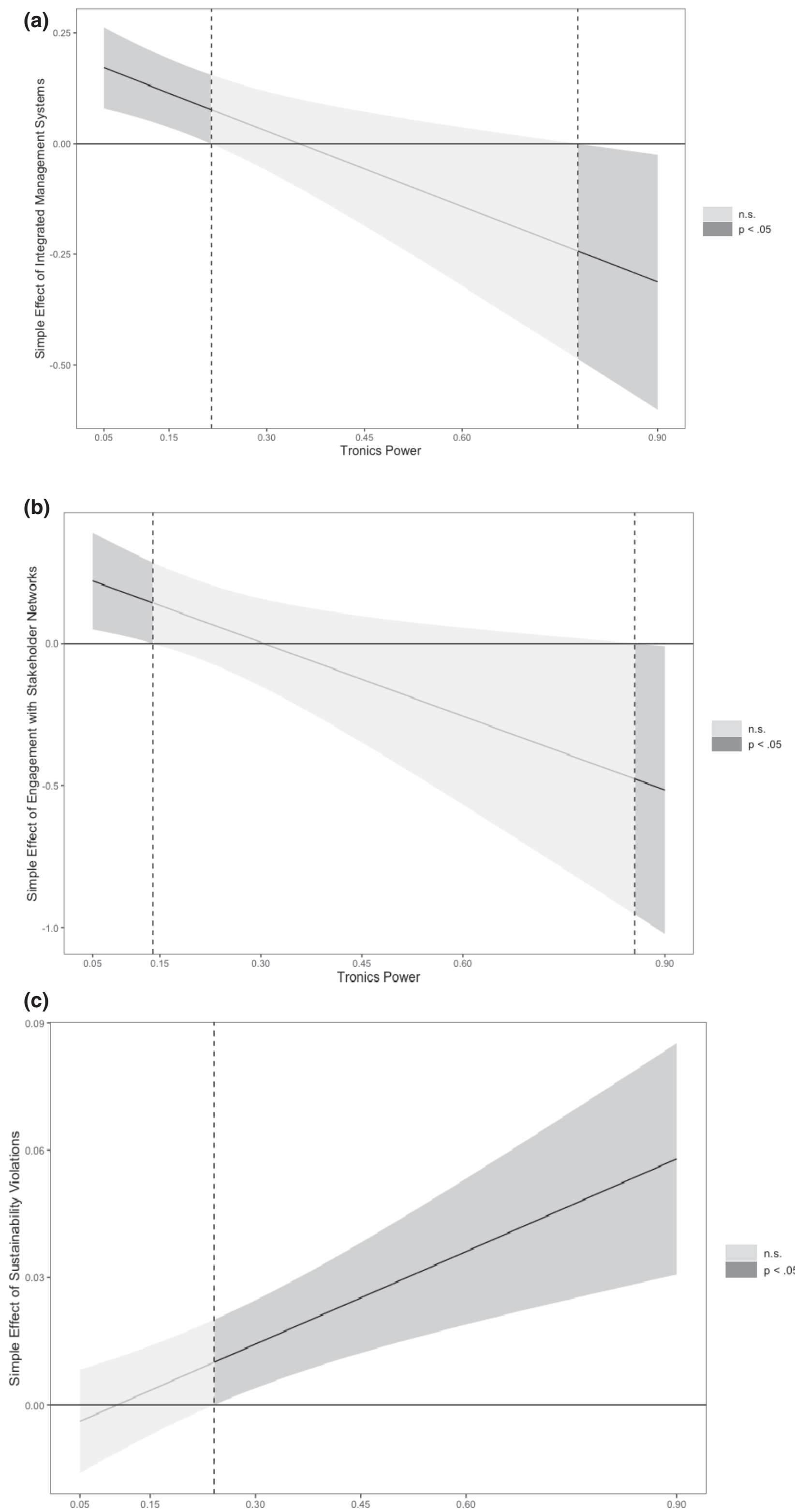
6. Discussion

New legislation and growing pressures from stakeholders have created an unprecedented need for global brands to ensure sustainability throughout their extended supply chains. A few brands with a solid sustainability agenda have relied on their first-tier suppliers to cascade their sustainability requirements to second-tier suppliers. However, such cascading activities are not yet institutionalized. We argue that the drivers and mechanisms that typically apply to global brands seeking supplier sustainability (see Amengual et al. 2020, Lee and Klassen 2008, Plambeck and Taylor 2016, Porteous et al. 2015) are not the same as those for suppliers in emerging countries seeking to cascade sustainability requirements upstream. Studies of cascading sustainability in multi-tier supply chains must consider stretched resources, persistent cost-reduction pressure, less developed sustainability capabilities, and lax regulatory enforcement that emerging-country suppliers face. We take the first step in this endeavor.

6.1. Theoretical Implications

We focus on three key sustainability attributes that can inform us about Chinese suppliers' ability to cascade global brands' sustainability requirements upstream. Integrating sustainability into procurement practices requires that Chinese suppliers enhance both their technical and relational capabilities (Ehrgott et al. 2011). They can build up these capabilities by adopting an integrated management system or engaging with relevant stakeholder networks. While previous research has studied how single management systems affect sustainable outcomes (e.g., Bird et al. 2019, Wiengarten et al. 2013), we show that integrating management systems focused on quality, environment, and health and safety particularly conduces to cascading sustainability. Also, we find that the few Chinese suppliers that engage with relevant stakeholder networks are in a better position to adopt sustainable procurement. This result supports the claim that stakeholder networks based on a partnership model can drive change towards more sustainable industrial systems (Gualandris and Klassen 2018, Johnson et al. 2018). Interestingly, our results do not support the idea that noncompliant Chinese suppliers are less likely to adopt sustainable procurement, as previous qualitative research suggested (Villena and Gioia 2018, Wilhelm et al. 2016). One potential explanation is that Chinese suppliers have been exposed to

Figure 2 (a, b, c) Simple Effects of Supplier Attributes on Sustainable Procurement Across Levels of Tronics' Power



a growing demand for cascading activities from multiple electronics brands, which we did not account for in our study. Collectively, these electronics brands have put pressure on non-compliant suppliers to adopt industry-wide supplier assessment and audit tools that are now available.

Table 6 Results with Individual Management Systems (ISO 9001, ISO 14001, or OSHAS 18001)

		Sustainable procurement (management system: ISO 9000)			Sustainable procurement (management system: ISO 14001)			Sustainable procurement (management system: OSHAS 18001)		
Variables	**H**	**B**	**SE**	**Sig.**	**B**	**SE**	**Sig.**	**B**	**SE**	**Sig.**
Constant		1.91	0.56	0.00	1.87	0.55	0.00	1.86	0.55	0.00
Size		0.12	0.10	0.21	0.16	0.10	0.14	0.15	0.11	0.17
% Female employees		0.11	0.26	0.67	0.12	0.26	0.66	0.16	0.27	0.57
Ownership type		0.07	0.15	0.62	0.04	0.15	0.81	0.09	0.14	0.54
Public company		–0.06	0.12	0.58	–0.09	0.11	0.45	–0.15	0.11	0.17
Supplier 3 million		0.15	0.12	0.18	0.16	0.11	0.15	0.14	0.11	0.19
Supplier 5 million		0.13	0.13	0.31	0.15	0.13	0.26	0.11	0.13	0.42
Relationship duration		**–0.32**	**0.16**	**0.04**	**–0.33**	**0.16**	**0.04**	–0.28	0.15	0.07
Electrical product		**0.19**	**0.10**	**0.05**	0.16	0.10	0.12	0.13	0.10	0.20
Mechanical product		0.14	0.11	0.21	0.11	0.11	0.31	0.14	0.11	0.19
Province GDP		0.04	0.08	0.65	0.05	0.08	0.56	0.02	0.08	0.85
Buyer training		**0.07**	**0.04**	**0.05**	0.07	0.04	0.07	**0.07**	**0.04**	**0.05**
Buyer rewards		**0.44**	**0.10**	**0.00**	**0.45**	**0.09**	**0.00**	**0.45**	**0.09**	**0.00**
Tronics power		0.69	0.47	0.14	**0.66**	**0.32**	**0.04**	0.36	0.25	0.16
Management system	H1	**0.30**	**0.16**	**0.06**	**0.36**	**0.13**	**0.01**	**0.46**	**0.18**	**0.01**
Engagement with stakeholder network (ESN)	H2	**0.26**	**0.12**	**0.03**	**0.25**	**0.12**	**0.03**	**0.22**	**0.12**	**0.06**
Sustainability violations	H3	–0.01	0.01	0.16	–0.01	0.01	0.14	0.00	0.01	0.76
Management system × Tronics power	H4	–0.72	0.49	0.14	**–0.98**	**0.40**	**0.02**	**–1.33**	**0.54**	**0.01**
ESN × Tronics power	H5	**–0.80**	**0.35**	**0.02**	**–0.80**	**0.34**	**0.02**	**–0.74**	**0.33**	**0.02**
Sustainability violations × Tronics power	H6	**0.08**	**0.02**	**0.00**	**0.08**	**0.02**	**0.00**	**0.05**	**0.02**	**0.00**
Adjusted R^2		0.32			0.34			0.34		

We report unstandardized coefficients and robust standard error. Sample size is 134.

By including Tronics' power as a moderator in our analysis, we acknowledge the triadic setting in which cascading occurs and reveal the complexity of its influence in multi-tier supply chains. We distinguish our research from past studies focusing exclusively on single-tier effects (e.g., between a buyer and a first-tier supplier) (e.g., Agrawal and Lee 2019, Porteous et al. 2015, Tong et al. 2018), which offer little insight into how buyer power can prompt first-tier suppliers to cascade sustainability upstream. Our results show that Tronics' power can bolster the enabling effects of integrated management systems or stakeholder networks on sustainable procurement when that power is low to moderate. However, when excessive, it might be counterproductive. A highly dependent supplier could feel bullied and respond by resisting Tronics' demands.

Also, the results support that Tronics' power can be instrumental in correcting suppliers with many sustainability violations by forcing them nevertheless to require sustainability from their own suppliers. However, this corrective action has limitations. For suppliers with *critical* violations, the degree of the global brand's power seems to be immaterial. In China, where legitimacy pressures for sustainability are often absent (and thus also any potential rewards from immediate stakeholders), sustainability is often in tension with economic aims (Xiao et al. 2019). Suppliers with *critical* violations are more likely to cut corners and will not prioritize supply chain accountability regardless of Tronics' power unless they have an integrated management system. Perhaps these suppliers believe that their cost performance will compensate for their noncompliance with critical sustainability requirements. Also, we observe that the effects of stakeholder networks on sustainable procurement become non-significant for Chinese suppliers with *critical* violations. It may be that such suppliers are using the tools and training offered by stakeholder networks to address their internal issues rather than focusing on upstream problems. Or these tools and training may simply need more time to address critical environmental and labor issues occurring in the electronics supply chain.

Our study complements research examining suppliers' sustainability beyond traditional compliance requirements. For example, recent studies have explored what drives suppliers to voluntarily disclose their carbon emissions to their buyers (Jira and Toffel 2013, Villena and Dhanorkar 2020). Jira and Toffel (2013) note that the nature of disclosure requests differs from that of the compliance requests because sharing climate change information is based on encouraging transparency rather than demanding conformity. And requests for cascading are even less institutionalized. Moreover, cascading is difficult to monitor for global brands because they are often unaware of the number and identity of second-tier suppliers. Hence, we focus on enabling factors that allow suppliers to adopt sustainable procurement and treat Tronics' power as a moderator. Our study complements research (Jira and Toffel 2013, Villena and Dhanorkar 2020) showing how supply chains can go beyond sustainability conformance, thereby moving towards becoming truly sustainable (Pagell and Shevchenko 2014).

Finally, most studies examining how procurement practices can improve sustainability have used samples of American or European buyers and involved resource-intense practices, such as providing sustainability training to suppliers or developing green products/packaging (Agrawal and Lee 2019, Amengual et al. 2020, Awaysheh and Klassen 2010, Marshall et al. 2019, Pagell et al. 2010). Chinese manufacturing firms often lack such expertise and resources and operate under tremendous cost-reduction pressure. They might adopt familiar metrics that are easily tracked (e.g., ISO 14001). They may also have limited means to influence their suppliers' behavior (Nadvi and Raj-Reichert 2015). Thus, if real progress is to be made, our efforts should focus on supporting emerging-country suppliers to adopt sustainable procurement practices, because they often deal with subtier suppliers that are even less mature regarding sustainability and that can pose substantial supply chain risks (Villena and Gioia 2018).

6.2. Managerial Implications

Our study has several implications for global brands' managers. While global brands often ask their suppliers to adopt a specific management system such as ISO 14001, and while integrating multiple systems especially fosters sustainable procurement practices, 27% of participating Chinese suppliers in our study reported not having even one management system in place. We suspect that these percentage is even higher for electronics brands that are not sustainability leaders like Tronics. Thus, global brands should use these systems as a supplier selection criterion and should provide incentives (e.g., through increased orders or long-term contracts) to current suppliers that invest in them.

Global brands should also consider actively inviting their suppliers to participate in relevant stakeholder networks. In our sample, while 52% of suppliers were engaged with at least one stakeholder network (such as EICC, CDP, or BSCI), 42.5% of suppliers did not engage with any network. Each of these networks offers useful assessment tools and training. For instance, the EICC included cascading activities in its Code of Conduct in 2018. Since then, a few electronics suppliers (e.g., Flex and Jabil) have conducted EICC-approved audits for a small group of their own suppliers. Some Chinese suppliers have participated in EICC's annual and outreach meetings, increasing their awareness of the industry's sustainability standards. Thus, global brands should not only invite their suppliers to participate in stakeholder networks but also support them so that suppliers can progress in these networks' sustainability programs over time.

Global brands should also be mindful of how they use their power. They can further motivate suppliers with an integrated management system or external networks to adopt sustainable procurement practices when their power is low to moderate. They can also prompt relatively dependent suppliers with several noncritical violations to adopt sustainable procurement; such suppliers are frequently monitored and might feel compelled to meet the global brands' sustainability demands. However, the global brands should consider terminating relationships with suppliers that have committed *critical* violations (e.g., failure to provide safe work procedures or to dispose properly of hazardous materials), because their ability to coerce such suppliers is limited. Such suppliers seem not to react even to a buyer that represents a large percentage of their business.

6.3. Limitations and Future Research Opportunities

Despite its contributions, our study has some limitations that could be seeds for future research. We focused on procurement practices but recognize that there are other ways suppliers can cascade global brands' requirements upstream. For instance, future research could explore how suppliers can provide sustainability training to their own suppliers or codevelop green products with them. However, in practice the range of observable cascading approaches may still be limited in emerging countries.

We did not examine second-tier suppliers' sustainability performance. This is regrettable because true sustainability in multi-tier supply chains depends not only on first-tier suppliers but also on lower-tier ones. However, collecting data at the second-tier (or third-tier) level is extremely challenging; and beyond case studies (e.g., Nadvi and Raj-Reichert 2015, Soundararajan and Brammer 2018, Villena 2019), we are unaware of any large-scale studies using second-tier supplier data. Suppliers in emerging countries are often reluctant to reveal their supplier list, let alone share data on those suppliers' sustainability performance (if they even collect this information) (Kim and Davis 2016). Nevertheless, future endeavors should strive to expand theorizing and data collection further upstream into the supply chain.

Furthermore, we studied a single supply chain within a single country, that of a global electronics brand leading the sustainability agenda in its industry. Tronics not only helped us gather proprietary data that otherwise would be difficult to collect but also offered an ideal empirical setting because of its working experience with Chinese suppliers to improve their sustainability capabilities. Thus, this study's results are generalizable only to other electronics buyers that are sustainability leaders and that invest resources in developing Chinese suppliers' sustainability capabilities. Our results may not compare directly with those for Chinese firms working for buyers that are sustainability laggards, or for supplier firms in other emerging countries (e.g., India or Mexico). It is equally difficult to ascertain whether our results are generalizable to other manufacturing settings. The electronics industry is dominated by a few global brands. Most are EICC members and have agreed on an industry-wide supplier code that includes environmental, health and safety, and labor requirements. They also share some supplier development activities. In contrast, the garment industry, for example, has multiple stakeholder networks (e.g., Fairwear, BetterWork), some of them with a strong regional focus (e.g., ACCORD in the Bangladesh garment and textile industry).

Furthermore, the Chinese government plays a strong role in driving both economic and sustainability agendas. In fact, state-owned firms in China are more responsive than non-state-owned firms to adopting environmental initiatives (Lo et al. 2018, Wu et al. 2014). Because our sample does not include state-owned firms, our results are generalizable only to non-state-owned firms. Relatedly, although our Chinese suppliers supply products to several global brands, we focused exclusively on the power of a single firm. Global brands can impose collective pressure by jointly auditing common suppliers (Chen et al. 2020) or by penalizing them, especially if global brands collectively represent a big percentage of suppliers' exports. Future research could include global brands' collective power and assess whether our results still hold. Finally, we acknowledge that there is a possibility of reverse causality. Although our in-depth interviews with ten Chinese suppliers suggest that directionality is as reported in the paper, the nature of our cross-section data does not allow us to test reverse causality empirically. Future research should adopt a longitudinal approach to assess how first-tier suppliers' attributes permit them to adopt sustainable practices over time.

7. Conclusion

Global brands can use several strategies to cascade sustainability throughout their extended supply chains. Our focus was on an indirect strategy wherein buyers work closely with their first-tier suppliers; if such suppliers adopt sustainable procurement practices, second-tier suppliers are being selected or monitored according to economic, environmental, and labor standards. Our research shows that global brands should not only favor Chinese suppliers that have integrated management systems or participate in relevant stakeholder networks but also use their power to further motivate these suppliers to adopt sustainable procurement practices. Our partnership with Tronics allowed us to conduct one of the first quantitative studies to investigate how a European electronics brand and its Chinese suppliers work towards engaging second-tier suppliers in its sustainability agenda. We invite other researchers to expand our study to other industry sectors or countries. If we gain more insights on how emerging-country suppliers assume more accountability for their supply chains, we move a step closer to making multi-tier supply chains more sustainable.

Notes

[1]Because we offered anonymity to our partner, we labelled it as *Tronics*.

[2]https://www.iso.org/iso-14001-environmental-management.html

[3]In October 2017 the EICC renamed itself Responsible Business Alliance (RBA). It initially focused exclusively on the electronics industry but more recently has expanded its scope to other industrial sectors.

[4]http://www.responsiblebusiness.org/media/docs/RBACodeofConduct6.0_English.pdf

[5]Tronics has direct relationships with a handful of second-tier suppliers whose sustainability is monitored directly. However, most second-tier suppliers are unknown to Tronics, so the company aims to develop the sustainability capabilities of its first-tier suppliers so that they are better equipped to assume more accountability for their supply chains.

[6]None of the participating suppliers were SAS 8000 certified.

[7]http://www.gsxt.gov.cn

References

Agrawal, V., D. Lee. 2019. The effect of sourcing policies on suppliers' sustainable practices. *Prod. Oper. Manag.* **28**(4): 767–787.

Aiken, L. S., S. G. West 1991. *Multiple Regression: Testing and Interpreting Interactions*, Sage, Thousand Oaks, CA.

Amengual, M., G. Distelhorst, D. Tobin. 2020. Global purchasing as labor regulation: The missing middle. *Ind. Labor Relat. Rev.* **73**(4): 817–840.

Awaysheh, A., R. D. Klassen. 2010. The impact of supply chain structure on the use of supplier socially responsible practices. *Intern. J. Oper. Prod. Manag.* **30**(12): 1246–1268.

Bansal, P., M. R. DesJardine. 2014. Business sustainability: It is about time. *Strategic Organ.* **12**(1): 70–78.

Bellamy, M. A., S. Ghosh, M. Hora. 2014. The influence of supply network structure on firm innovation. *J. Oper. Manag.* **32**(6): 357–373.

Benner, M. J., F. M. Veloso. 2008. ISO 9000 practices and financial performance: A technology coherence perspective. *J. Oper. Manag.* **26**(5): 611–629.

Bird, Y., J. L. Short, M. W. Toffel. 2019. Coupling labor codes of conduct and supplier labor practices: The role of internal structural conditions. *Organ. Sci.* **30**(4): 847–867.

Blome, C., D. Hollos, A. Paulraj. 2014. Green procurement and green supplier development: Antecedents and effects on supplier performance. *Int. J. Prod. Res.* **52**(1): 32–49.

Boyd, D. E., R. E. Spekman, J. W. Kamauff, P. Werhane. 2007. Corporate social responsibility in global supply chains: A procedural justice perspective. *Long Range Plan.* **40**(3): 341–356.

Brammer, S., H. Walker. 2011. Sustainable procurement in the public sector: An international comparative study. *Intern. J. Oper. Prod. Manag.* **31**(4): 452–476.

Chen, J., A. Qi, M. Dawande. 2020. Supplier centrality and auditing priority in socially responsible supply chains. *Manuf. Serv. Oper. Manag.* **22**(6): 1199–1214.

Choi, T. Y., Y. Hong. 2002. Unveiling the structure of supply networks: Case studies in Honda, Acura, and Daimler Chrysler. *J. Oper. Manag.* **20**(5): 469–493.

Choi, T. Y., T. Linton. 2011. Don't let your supply chain control your business. *Harv. Bus. Rev.* **89**(12): 112–117.

Cohen, J., P. Cohen, S. G. West, L. S. Aiken 2003. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates Inc.

Corbett, C. J. 2006. Global diffusion of ISO 9000 certification through supply chains. *Manuf. Serv. Oper. Manag.* **8**(4): 330–350.

Corbett, C. J., D. A. Kirsch. 2001. International diffusion of ISO 14000 certification. *Prod. Oper. Manag.* **10**(3): 327–342.

Darnall, N., I. Henriques, P. Sadorsky. 2010. Adopting proactive environmental strategy: The influence of stakeholders and firm size. *J. Manage. Stud.* **47**(6): 1072–1094.

Delmas, M., I. Montiel. 2009. Greening the supply chain: When is customer pressure effective? *J. Econ. Manag. Strategy* **18**(1): 171–201.

Distelhorst, G., J. Hainmueller, R. M. Locke. 2017. Does Lean improve labor standards? Management and social performance in the Nike supply chain. *Management Sci.* **63**(3): 707–728.

Dyer, J., K. Nobeoka. 2000. Creating and managing a high performance knowledge-sharing network: The Toyota case. *Strateg. Manag. J.* **21**(3): 345–367.

Ehrgott, M., F. Reimann, L. Kaufmann, C. R. Carter. 2011. Social sustainability in selecting emerging economy suppliers. *J. Bus. Ethics* **98**(1): 99–119.

Emerson, R. M. 1962. Power-dependence relations. *Am. Sociol. Rev.* 31–41.

Foerstl, K., A. Azadegan, T. Leppelt, E. Hartmann. 2015. Drivers of supplier sustainability: Moving beyond compliance to commitment. *J. Supply Chain Manag.* **51**(1): 67–92.

Gualandris, J., R. D. Klassen, S. Vachon, M. Kalchschmidt. 2015. Sustainable evaluation and verification in supply chains: Aligning and leveraging accountability to stakeholders. *J. Oper. Manag.* **38**: 1–13.

Gualandris, J., R. D. Klassen. 2018. Delivering transformational change: Aligning supply chains and stakeholders in non-governmental organizations. *J. Supply Chain Manag.* **54**(2): 34–48.

Guo, R., H. L. Lee, R. Swinney. 2016. Responsible sourcing in supply chains. *Management Sci.* **62**(9): 2722–2744.

Handley, S. M., W. Benton. 2012. The influence of exchange hazards and power on opportunism in outsourcing relationships. *J. Oper. Manag.* **30**(1): 55–68.

Handley, S. M., J. de Jong, W. Benton Jr. 2019. How service provider dependence perceptions moderate the power–opportunism relationship with professional services. *Prod. Oper. Manag.* **28**(7): 1692–1715.

Hanke, T., W. Stark. 2009. Strategy development: Conceptual framework on corporate social responsibility. *J. Bus. Ethics* **85** (3): 507–516.

Huang, L., J.-S. Song, R. Swinney 2020. *Managing social responsibility in multi-tier supply chains*, Duke University Working Paper.

Jamali, D., C. Karam. 2018. Corporate social responsibility in developing countries as an emerging field of study. *Intern. J. Manag. Rev.* **20**(1): 32–61.

Jamali, D., B. Neville. 2011. Convergence versus divergence of CSR in developing countries: An embedded multi-layered institutional lens. *J. Bus. Ethics* **102**(4): 599–621.

Jiang, B. 2009. The effects of interorganizational governance on supplier's compliance with SCC: An empirical examination of compliant and non-compliant suppliers. *J. Oper. Manag.* **27**(4): 267–280.

Jira, C., M. W. Toffel. 2013. Engaging supply chains in climate change. *Manuf. Serv. Oper. Manag.* **15**(4): 559–577.

Johnson, J. L., K. J. Dooley, D. G. Hyatt, A. M. Hutson. 2018. Cross-sector relations in global supply chains: A social capital perspective. *J. Supply Chain Manag.* **54**(2): 21–33.

Jørgensen, T. H., A. Remmen, M. D. Mellado. 2006. Integrated management systems–three different levels of integration. *J. Clean. Prod.* **14**(8): 713–722.

Kim, Y. H., G. F. Davis. 2016. Challenges for global supply chain sustainability: Evidence from conflict minerals reports. *Acad. Manag. J.* **59**(6): 1896–1916.

King, A. A., M. J. Lenox, A. Terlaak. 2005. The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Acad. Manag. J.* **48**(6): 1091–1106.

Klassen, R. D., A. Vereecke. 2012. Social issues in supply chains: Capabilities link responsibility, risk (opportunity), and performance. *Int. J. Prod. Econ.* **140**(1): 103–115.

Kraft, T., Y. Zheng, F. Erhun. 2013. The NGO's dilemma: How to influence firms to replace a potentially hazardous substance. *Manuf. Serv. Oper. Manag.* **15**(4): 649–669.

Krajewski, L., J. C. Wei, L.-L. Tang. 2005. Responding to schedule changes in build-to-order supply chains. *J. Oper. Manag.* **23**(5): 452–469.

Krause, D. R., S. Vachon, R. D. Klassen. 2009. Special topic forum on sustainable supply chain management: Introduction and reflections on the role of purchasing management. *J. Supply Chain Manag.* **45**(4): 18–25.

Kriauciunas, A., A. Parmigiani, M. Rivera-Santos. 2011. Leaving our comfort zone: Integrating established practices with unique adaptations to conduct survey-based strategy research in nontraditional contexts. *Strateg. Manag. J.* **32**(9): 994–1010.

Lambert, D. M., T. C. Harrington. 1990. Measuring nonresponse bias in customer service mail surveys. *J. Bus. Logisti.* **11**(2): 5–25.

LeBaron, G., A. Rühmkorf. 2017. Steering CSR through home state regulation: A comparison of the impact of the UK bribery act and modern slavery act on global supply chain governance. *Global Policy* **8**: 15–28.

Lee, S. Y., R. D. Klassen. 2008. Drivers and enablers that foster environmental management capabilities in small-and medium-sized suppliers in supply chains. *Prod. Oper. Manag.* **17**(6): 573–586.

Lo, C. K., M. Pagell, D. Fan, F. Wiengarten, A. C. Yeung. 2014. OHSAS 18001 certification and operating performance: The role of complexity and coupling. *J. Oper. Manag.* **32**(5): 268–280.

Lo, C. K., C. S. Tang, Y. Zhou, A. C. Yeung, D. Fan. 2018. Environmental incidents and the market value of firms: An empirical investigation in the Chinese context. *Manuf. Serv. Oper. Manag.* **20**(3): 422–439.

Lo, S. M. 2014. Effects of supply chain position on the motivation and practices of firms going green. *Intern. J. Oper. Prod. Manag.* **34**(1): 93–114.

Locke, R., M. Amengual, A. Mangla. 2009. Virtue out of necessity? Compliance, commitment, and the improvement of labor conditions in global supply chains. *Politics & Society* **37**(3): 319–351.

Marshall, D., L. McCarthy, M. Claudy, P. McGrath. 2019. Piggy in the middle: How direct customer power affects first-tier suppliers' adoption of socially responsible procurement practices and performance. *J. Bus. Ethics* **154**: 1081–1102.

Meinlschmidt, J., M. C. Schleper, K. Foerstl. 2018. Tackling the sustainability iceberg: A transaction cost economics approach to lower tier sustainability management. *Intern. J. Oper. Prod. Manag.* **38**(10): 1888–1914.

Melnyk, S. A., R. P. Sroufe, R. Calantone. 2003. Assessing the impact of environmental management systems on corporate and environmental performance. *J. Oper. Manag.* **21**(3): 329–351.

Nadvi, K., G. Raj-Reichert. 2015. Governing health and safety at lower tiers of the computer industry global value chain. *Regul. Govern.* **9**(3): 243–258.

Nyaga, G. N., D. F. Lynch, D. Marshall, E. Ambrose. 2013. Power asymmetry, adaptation and collaboration in dyadic relationships involving a powerful partner. *J. Supply Chain Manag.* **49** (3): 42–65.

De Oliveira Matias, J. C., D. A. Coelho. 2002. The integration of the standards systems of quality management, environmental management and occupational health and safety management. *Int. J. Prod. Res.* **40**(15): 3857–3866.

Pagell, M., A. Shevchenko. 2014. Why research in sustainable supply chain management should have no future. *J. Supply Chain Manag.* **50**(1): 44–55.

Pagell, M., Z. Wu, M. E. Wasserman. 2010. Thinking differently about purchasing portfolios: An assessment of sustainable sourcing. *J. Supply Chain Manag.* **46**(1): 57–73.

Parmigiani, A., R. D. Klassen, M. V. Russo. 2011. Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. *J. Oper. Manag.* **29**(3): 212–223.

Plambeck, E., H. L. Lee, P. Yatsko. 2012. Improving environmental performance in your Chinese supply chain. *MIT Sloan Manage. Rev.* **53**(2): 43–47.

Plambeck, E. L., T. A. Taylor. 2016. Supplier evasion of a buyer's audit: Implications for motivating supplier social and environmental responsibility. *Manuf. Serv. Oper. Manag.* **18**(2): 184–197.

Podsakoff, P. M., S. B. MacKenzie, J.-Y. Lee, N. P. Podsakoff. 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* **88**(5): 879–903.

Porteous, A. H., S. V. Rammohan, H. L. Lee. 2015. Carrots or sticks? Improving social and environmental compliance at suppliers through incentives and penalties. *Prod. Oper. Manag.* **24**(9): 1402–1413.

Qi, G., S. Zeng, H. Yin, H. Lin. 2013. ISO and OHSAS certifications: How stakeholders affect corporate decisions on sustainability. *Manag. Decis.* **51**(10): 1983–2005.

Raj-Reichert, G. 2011. The electronic industry code of conduct: Private governance in a competitive and contested global production network. *Competit. Change* **15**(3): 221–238.

Reuter, C., K. A. I. Foerstl, E. V. I. Hartmann, C. Blome. 2010. Sustainable global supplier managemenet: The role of dynamic capabilities in achieving competitive advantage. *J. Supply Chain Manag.* **46**(2): 45–63.

Roloff, J. 2008. Learning from multi-stakeholder networks: Issue-focussed stakeholder management. *J. Bus. Ethics* **82**(1): 233–250.

Scherer, A. G., G. Palazzo. 2011. The new political role of business in a globalized world: A review of a new perspective on CSR and its implications for the firm, governance, and democracy. *J. Manage. Stud.* **48**(4): 899–931.

Short, J. L., M. W. Toffel, A. R. Hugill. 2016. Monitoring global supply chains. *Strateg. Manag. J.* **37**(9): 1878–1897.

Soundararajan, V., S. Brammer. 2018. Developing country sub-supplier responses to social sustainability requirements of intermediaries: Exploring the influence of framing on fairness perceptions and reciprocity. *J. Oper. Manag.* **58**: 42–58.

Soundararajan, V., Z. Khan, S. Y. Tarba. 2018. Beyond brokering: Sourcing agents, boundary work and working conditions in global supply chains. *Hum. Relat.* **71**(4): 481–509.

Spiller, S. A., G. J. Fitzsimons, J. G., Jr Lynch, G. H. McClelland. 2013. Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *J. Mark. Res.* **50**(2): 277–288.

Tachizawa, E. M., Y. C. Wong. 2014. Towards a theory of multi-tier sustainable supply chains: A systematic literature review. *Supply Chain Manag.* **19**(5/6): 643–663.

Tong, X., K.-H. Lai, Q. Zhu, S. Zhao, J. Chen, T. Cheng. 2018. Multinational enterprise buyers' choices for extending corporate social responsibility practices to suppliers in emerging countries: A multi-method study. *J. Oper. Manag.* **63**: 25–43.

Touboulic, A., D. Chicksand, H. Walker. 2014. Managing imbalanced supply chain relationships for sustainability: A power perspective. *Decis. Sci.* **45**(4): 577–619.

Villena, V. H. 2019. The missing link? The strategic role of procurement in building sustainable supply networks. *Prod. Oper. Manag.* **28**(5): 1149–1172.

Villena, V. H., S. S. Dhanorkar. 2020. How institutional pressures and managerial incentives elicit carbon transparency in supply chains. *J. Oper. Manag.* **66**(6): 697–734.

Villena, V. H., D. A. Gioia. 2018. On the riskiness of lower-tier suppliers: Managing sustainability in supply networks. *J. Oper. Manag.* **45**(2): 65–87.

Villena, V. H., D. A. Gioia. 2020. A more sustainable supply chain. *Harv. Bus. Rev.* **98**(2): 84–93.

Walker, H., J. Miemczyk, T. Johnsen, R. Spencer. 2012. Sustainable procurement: Past, present and future. *J. Purchas. Supply Manag.* **18**(4): 201–206.

Wang, Y. I., J. Li, R. Anupindi. 2021. 'When ignorance is not bliss: An empirical analysis of sub-tier supply network structure on firm risk. *Management Sci.* **67**(4): 2029–2048.

Wiengarten, F., D. Fan, C. K. Lo, M. Pagell. 2017. The differing impacts of operational and financial slack on occupational safety in varying market conditions. *J. Oper. Manag.* **52**: 30–45.

Wiengarten, F., M. Pagell, B. Fynes. 2013. ISO 14000 certification and investments in environmental supply chain management practices: Identifying differences in motivation and adoption levels between Western European and North American companies. *J. Clean. Prod.* **56**: 18–28.

Wilhelm, M. M., C. Blome, V. Bhakoo, A. Paulraj. 2016. Sustainability in multi-tier supply chains: Understanding the double agency role of the first-tier supplier. *J. Oper. Manag.* **41**: 42–60.

Wu, Z., L. M. Ellram, R. Schuchard. 2014. Understanding the role of government and buyers in supplier energy efficiency initiatives. *J. Supply Chain Manag.* **50**(2): 84–105.

Xiao, C., M. Wilhelm, T. van der Vaart, D. P. Van Donk. 2019. Inside the buying firm: Exploring responses to paradoxical tensions in sustainable supply chain management. *J. Supply Chain Manag.* **55**(1): 3–20.

Zhu, Q., J. Sarkis. 2007. The moderating effects of institutional pressures on emergent green supply chain practices and performance. *Int. J. Prod. Res.* **45**(18–19): 4333–4355.

Production and Operations Management 30(11), pp. 4198–4218, © 2021 Production and Operations Management Society

Appendix

Examples of Critical and Non-Critical Violations in Our Supplier Sample

Most common critical violations	
A4.1	Legal wages for regular and overtime hours are correctly calculated and paid to all workers.
B1.2	Worker exposure to potential safety hazards (e.g., electrical and other energy sources, fire, vehicles, and fall hazards) are controlled through proper design, engineering and administrative controls and safe work procedures.
B2.2	Adequate and effective fire detection, alarm and suppression systems are in place.
B2.4	Emergency exits, aisles and stairways are adequate in number and location, readily accessible, and properly maintained.
B4.2	Appropriate controls for worker exposures to chemical, biological and physical agents are implemented.
C3.1	Hazardous materials including waste are properly categorized, labeled, handled, stored, transported and disposed using government-approved/licensed vendors as per local laws.
C4.2	Effluent discharges (industrial/process wastewater, sewage and storm water) meet the discharge limits for regulated constituents
C5.1	Air emissions meet the discharge limits for regulated constituents.
Most common non-critical violations	
A1.3	Workers are informed in writing and in their own language prior to employment (in case of migrant workers, before they leave their home country/region) of the key employment terms and conditions via employment letter/agreement/contract as required by law.
A3.1	Average hours worked in a workweek over the last 12 months does not exceed 60 hours or the legal limit (whichever is stricter).
A3.2	Workers receive at least one (1) day off per every seven (7) days.
A4.3	Social insurance scheme and other benefits as required by local law is provided to all workers.
B2.1	All required permits, licenses and testing reports for emergency preparedness are in place and a process is implemented to ensure permits and licenses are up to date at all times.
B4.1	All required permits, licenses and testing reports for Industrial hygiene are in place and a process is implemented to ensure permits and licenses are up to date at all times.
B6.1	All required permits, licenses and testing reports for machinery are in place and a process is implemented to ensure permits and licenses are up to date at all times.
B7.3	Canteens (cafeterias) are clean, well maintained, and managed in compliance with local health regulations.
C1.1	The facility has obtained all the legally required environmental permits, approvals, licenses and registrations.