Performance outcomes of supply chain practices for sustainable development: A meta-analysis of moderators

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Performance Outcomes of Supply Chain Practices for Sustainable Development: A Meta-analysis of Moderators

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Abstract

Sustainable supply chain management (SSCM) practices have received growing attention but their consequences on firm performance yielded mixed outcomes. This study aims to synthesize quantitative research and to analyze potential moderators on the link between SSCM practices and firm performance. This study draws upon resource-based view of the firm with the extensions of natural resource-based view and relational view to underpin study hypotheses. The analysis is based on data collected from 145 independent samples composed of 33,886 firms. The research hypotheses are tested using meta-analytical procedures. The results show that SSCM practices are significantly and positively correlated with firm's social, operational, economic, and environmental performance dimensions. Additional findings from moderator analysis provide nuanced views of SSCM practices-performance link. This paper contributes to the literature by underlining the relevance of SSCM, identifying and classifying SSCM practices into a coherent framework. The research findings help policy makers, practitioners and other stakeholders to better understand benefits from the adoption of SSCM practices. Additionally, to the best of authors' knowledge, this is the first study that meta-analytically combined existing empirical evidence of the social supply practices on various types of firm's sustainability performance.

Keywords: Supply Chain Management, Environmental Sustainability, SSCM Practices, Firm Performance, Sustainable development, Meta-analysis

Paper type Research paper

Introduction

Increasingly firms are held responsible for the behavior of their supply chain (SC) partners (i.e., suppliers) and are under intense scrutiny from various stakeholders to decrease or eliminate negative impacts on health, environment, and society (Esfahbodi, Zhang, Watson, & Zhang, 2017; Jawaad & Zafar, 2020). In response, firms have started to integrate sustainability principles in inter— and intra—organizational practices by adopting various initiatives including sustainable sourcing, eco-design, sustainable manufacturing, collaboration with consumers and reverse logistics (Paulraj, Chen, & Blome, 2017; Vachon & Klassen, 2006; Zhu & Sarkis, 2004). While such practices and their impact on firm performance (FP) have been extensively studied in the green and sustainable supply chain management (SSCM) literature, results are still contradictory as some studies found positive (Huang & Li, 2017; Laari, Solakivi, Töyli, & Ojala, 2016; Rao & Holt, 2005), negative (Large & Thomsen, 2011; Richey, Chen, Genchev, & Daugherty, 2005) and insignificant relationships (De Giovanni, 2012; González-Benito & González-Benito, 2005), leaving managers confused as to which practice(s) lead to desired performance. However, many scholars have suggested potential superior FP from implementation of SSCM practices (SSCMP) and call for further investigation in this regard, especially between social SC practices and firm's environmental, social, and economic performance (Huang, Huang, & Yang, 2017; Kirchoff, Tate, & Mollenkopf, 2016).

As SCs consist of and span many boundaries, policy makers, practitioners, researchers and other stakeholders need to better understand various SSCMP and their performance implications (Sarkis, 2012), but most of the prior studies only partially investigate these relationships by focusing on subsets of SSCMP and on the environmental and economic dimensions (Gorane & Kant, 2017; Muzaffar, Khurshid, Malik, & Azhar, 2019). Consequently, firm's social performance has received

limited consideration (Mani, Gunasekaran, & Delgado, 2018). Likewise, a recent review by Carter and Washispack (2018) found that there is "white space" for examining relationships among specific SSCM constructs. Hence, this finding further strengthens the rationale for our meta-analysis to examine relationships between SSCMP and FP. Meta-analysis is a necessary element of scientific inquiry and theory building that allows reconciling contradictory numerical findings and conceptually comparable (Hunter & Schmidt, 2004). Furthermore, it has been argued that because of the relatively small sample size, a single study does not have enough power to explain the magnitude of a statistical relationship (Lipsey & Wilson, 2001). Thus, a meta-analysis study is the best available tool to make empirical generalizations by synthesizing extant findings for clarifying the ongoing debate whether SSCMP positively contribute to FP.

Gap identification and problem statement

While few studies have tried to reconcile and consolidate numerical findings on the SSCMP−FP link, their scope is narrower compared with our study, and thus, their conclusions are limited in several ways. Golicic and Smith (2013) meta-analytically combined results from 31 studies and partially tested the relationship between green supply chain management (GSCM) practices and economic performance. The meta-analysis by Geng et al. (2017) is based on 50 articles from Asian emerging economies and tested the impact of some GSCM on firm's social, economic, operational and environmental performance. However, none of the above meta-analyses tested the link between social SC practices (Pullman, Maloni, & Carter, 2009; Shafiq, Johnson, Klassen, & Awaysheh, 2017; Wolf, 2014) and FP. Likewise, both previous meta-analyses use fixed-effects meta-analysis and assume that the population effect size is identical for all primary studies. Nevertheless, this is in contradiction with best-practice recommendations for conducting a meta-analysis in organizational sciences (Aguinis, Gottfredson, & Wright, 2011) since the fixed-effect

model should rather not be used given that the samples are drawn from different geographical regions, industries, and have been analyzed using different conceptual frameworks.

Previous meta-analyses focus only on environmental and economic perspective and only partially have tested the SSCMP-FP links, by omitting other important practices such as sustainable production, sustainable distribution and packaging, as well as investment recover. Similarly, they do not check for outliers when performing their meta-analyses. Furthermore, either they are focused on a single industry and geographical region or they are drawn on a limited sample. In our study, we tried to bridge these gaps from previous meta-analyses and to improve the methodological rigor, thus we believe that the present study provides a more updated and comprehensive synthesis of SSCMP-FP link. Table 1 shows a comparison between previous meta-analyses and our study and highlights its contribution on SSCM literature.

In sum, in reviewing the literature, we find broad agreement among scholars that SSCMP carry a great theoretical and practical importance (Figure 1), but their consequences in various FP dimensions remain inconclusive and partially ambiguous. Moreover, previous meta-analyses focus only on subsets of green supply practices, but a comprehensive and systematic study analyzing social supply practices along with all green supply practices on different firm's performance dimensions is missing. Hence, we seek to find more extensive evidence for such relationships by answering two questions: (i) What is the impact of SSCM practices on firm's environmental, social, operational, and economic performance? (ii) Under what conditions SSCMP-FP link is stronger?

<<INSERT TABLE 1 ABOUT HERE >>

Answering these research questions, we apply natural resource-based theory (NRBT) (Hart, 1995) and the relational view (RV) (Dyer & Singh, 1998) to argue that SSCMP adaptation impact the performance and then test our hypotheses by conducting a random-effects meta-analysis of correlation using 145 independent samples composed of 33,886 firms. Additionally, we identify and test several moderators, including firm characteristics and methodological choices on the SSCMP-FP link. Our comprehensive meta-analysis broadens current understanding about the SSCMP-FP link in several ways. First, our study contributes to accomplishing empirical generalization and richer understating of the variables, constructs, and moderators to the SSCMP–FP link. Second, the proposed conceptual framework enables an in-depth examination of SSCMP and FP by operationalizing them in nine and four subconstructs, respectively. This allowed us to provide greater clarity and nuanced views on whether different types of sustainable supply practices are positively correlated with various FP dimensions. Third, for the first time in SSCM literature, this study synthesizes the contribution of social supply practices to triple bottom line performance dimensions. Fourth, results from moderator analysis show under what conditions SSCMP yield higher sustainability payoffs. Finally, we contribute to resource-based theories in validating whether sustainable supply practices can be seen as a source of superior performance, as well as, detecting areas that require additional research.

<<INSERT FIGURE 1 ABOUT HERE >>

Following the introduction, we continue our discussion by reviewing the SSCM literature and present our research framework from which we develop hypotheses and explain potential moderators. Next, we describe the methodology employed to analyze the data and present our findings. Finally, we discuss theoretical and practical implications and note the limitations of our analysis.

Theory and Hypotheses

To underpin our research and structure the analysis, this section presents a brief literature review regarding independent variable–SSCMP and the dependent variable–FP as well as provides theoretical lenses that are used to ground the hypothesized relationships.

Sustainable supply chain management practices

The reviewed literature shows that sustainable SC practices have generated much debate within the academic literature as well as among industry practitioners (Adebanjo, Teh, & Ahmed, 2016; Qorri, Mujkić, & Kraslawski, 2018) but scholars have used different terminologies to explain such practices (Dai, Cantor, & Montabon, 2017; Kassinis & Soteriou, 2003). For instance, Tachizawa et al. (2015) classified GSCM into monitoring-based and collaboration-based practices, Rao and Holt (2005) operationalized GSCM into three broad constructs including inbound, production and outbound practices, while Eltayeb et al. (2011) and Younis et al. (2016) measured GSCM including eco-design, green purchasing, environmental cooperating with suppliers and customers, and reverse logistics. Similarly, social SC practices have primarily highlighted legislative and health and safety issues rather than cultural and ethical issues (Wang & Dai, 2018). However, as the SSCM literature started to mature, a growing number of researchers studied the link between social supply practices and FP. For example, Das (2017) classified such initiatives into practices for employees and practices for community while other researchers used only one construct that is mainly focused on internal issues such as employee welfare, participation, and training (Hollos, Blome, & Foerstl, 2012; Pullman et al., 2009).

While in the reviewed literature, authors have often GSCM and SSCM constructs interchangeably, in our study, we use only SSCM term for the following reason. By definition SSCM represents all interorganizational practices for the purpose of improving firm's social,

environmental, and economic performance (Carter & Rogers, 2008), whereas, GSCM represents practices that aim to improve firm's environmental, and economic performance (Miroshnychenko, Barontini, & Testa, 2017). Thus, SSCM is a broader construct and includes three sustainability aspects whereas GSCM focuses mainly on environmental and economic dimensions. Accordingly SSCMP are recognized as mechanisms or initiatives for achieving superior environmental, social, operational, and economic performance (Chiou et al., 2011; Kuei et al., 2015). Moreover, Lee et al. (2012) highlighted that GSCM practices should be considered from an integrated perspective because firms benefit more when such practices are managed cohesively in cross-functional and cross-company processes. In this context, two different but complementary forms of SSCMP exist within the extant literature: (i) internal practices that span within firm's direct control such as environmental management systems (Feng, Cai, Wang, & Zhang, 2015; Sroufe, 2003), sustainable product design (Khan & Qianli, 2017; Zhu & Sarkis, 2004), social and environmental certifications (González-Benito & González-Benito, 2005), and production processes (Hojnik & Ruzzier, 2016); (ii) external practices including sustainable procurement (Carter, Kale, & Grimm, 2000; Woo, Kim, Chung, & Rho, 2016), collaboration with consumers (Rao & Holt, 2005), and sustainable distribution (Vachon & Klassen, 2006).

Given that SSCM practices consist of and span many boundaries (Sarkis, 2012) and have been operationalized using different constructs, we followed one of the most used frameworks developed by Zhu et al. (2007). They structure GSCM into five managerial practices including internal environmental management, environmental procurement, environmental product design, environmental customer collaboration, and investment recovery. Additionally, in line with recent recommendations (Das, 2017; Gualandris & Kalchschmidt, 2016), we extended this framework by including other practices such as environmental manufacturing (Jayaram, Vickery, & Droge,

2008), environmental distribution and packaging (Esfahbodi et al., 2017), reverse logistics (Huang, Wu, & Rahman, 2012; Ye, Zhao, Prahinski, & Li, 2013), and social practices (Das, 2017; Hollos et al., 2012). Thus, grounded on extant literature, we conceptualize SSCMP as a holistic and multidimensional construct that is measured using following practices: Internal Sustainable Management, Sustainable Purchasing (cooperation with suppliers is included), Sustainable Product Design, Sustainable Manufacturing, Sustainable Distribution and Packaging, Customer Sustainable Cooperation, Reverse Logistics, Employee Social Practices, and Investment Recovery. Table 2 shows measurement items and several references for each construct. Next, we continue our discussion by presenting the literature of the dependent variable-FP.

<<INSERT TABLE 2 ABOUT HERE >>

Types of firm performance

SSCM literature categorizes FP into four broad types: environmental, social, operational, and economic performance (Chien & Shih, 2007; Dubey, Gunasekaran, & Ali, 2015). The SSCM research further highlights the existence of synergies and trade-offs between performance types but these have only partially been studied (Gimenez, Sierra, & Rodon, 2012). For example, Zhu and Sarkis (2004) considered environmental and economic aspects; Pullman et al. (2009) environmental, quality, and cost performance; De Giovanni (2012), Luzzini et al. (2015) and Sreekumar & Rajmohan (2019) considered environmental, social, and economic aspects; while Luthra et al. (2014) operationalized FP into economic, environmental, social, and operational performance.

Following the guidelines of past research on SSCM (e.g., Christmann, 2000; Das, 2017; Simpson, 2012), we operationalize FP as a combination of environmental, social, economic, and operational dimensions. Additionally, operational performance is considered in our study because

operations managers should monitor delivery and quality metrics, alongside specific aspects of environmental and social dimensions (Hollos et al., 2012). Environmental performance measures the reduction of environmental pollutants in air, land, water, and the decrease of harmful or hazardous or toxic materials released to the environment (Roberts & Gehrke, 1996). Social performance is measured using indicators related to improvements in overall stakeholder welfare, community health and safety of workers (Paulraj et al., 2017; Peng & Lin, 2008). Operational performance includes indicators of product quality, delivery, flexibility, and more efficient resource utilization (Sambasivan et al., 2013; Zhang and Yang 2016; Zhu et al., 2012). Economic performance represents indicators related to financial benefits, market share growth, and productivity improvement (Yang 2017; Zailani et al., 2015). Table 3 shows measurement items and references for FP dimensions. Next, we present theoretical underpinnings used in this study.

<<INSERT TABLE 3 ABOUT HERE >>

Theoretical foundations

To explain mechanisms that support SSCMP−FP links, researchers have grounded their studies in a variety of organizational theories (please refer to Sarkis et al., (2011) and Touboulic and Walker (2015) for an overview). While institutional theory, stakeholder theory, and contingency theory are utilized to provide rationale for why firms implement SSCMP, resource-based view (RBV) (Barney, 1991) with the extensions of natural resource-based view (NRBV) and relational view (RV) of the firm are commonly used to underpin SSCMP-FP links in the reviewed literature and thus we develop our hypotheses grounded on these theories.

The RBV postulates that firms can achieve sustained competitive advantage from its owned or controlled strategic resources, which are valuable, rare, inimitable, and non-substitutable (VIRN) resources (Barney, 1991). The NRBV proposes that firms, through proper environmental

management strategies such as pollution prevention and product stewardship, can develop capabilities that are valuable, rare and difficult to replicate by competitors (Hart, 1995). Whereas the theories mentioned above argue that discrepancy in FP can be attributed to heterogeneity in resources and capabilities within firm boundaries, the RV of competitive advantage (Dyer & Singh, 1998) posits that combining resources at inter-firm level to develop relationship-specific capabilities, performance gains are possible (Esfahbodi, Zhang, & Watson, 2016; Gualandris & Kalchschmidt, 2016). To sum up, despite their differences, these theoretical perspectives cohesively argue that firms can gain superior performance by leveraging firm-specific and/or relationship-specific resources and capabilities and together address the upstream and downstream as well as partnership aspects of the SSCMP.

SSCMP are considered as capabilities developed from a given set of resources (Esfahbodi et al., 2017; Gilley et al., 2000; Gimenez et al., 2012; Stefanelli, Jabbour, & Jabbour, 2014). Such capabilities can lead to a superior FP by facilitating the acquisition of strategic resources through increased cooperation and integration of specialized assets, skills and information across firms (Vachon & Klassen, 2006). For instance, environmental collaboration with suppliers and consumers, as well as sustainable design and manufacturing can bring innovations to reduce waste, material, and energy usage and, in turn, can contribute to FP. Furthermore, Carter and Rogers (2008) argued that intangible resources, such as the learning that occurs between SC partners when they are working together to improve sustainable performance, can be considered as VIRN resources. Accordingly, using these theories, the extant research has debated whether and to what extent various SSCMP have the potential to drive FP in environmental, social, operational, and economic dimensions (Albino, Dangelico, & Pontrandolfo, 2012; Choi & Hwang, 2015;

Christmann, 2000; Laari, Solakivi, et al., 2016; Mani et al., 2018; Peng & Lin, 2008; Richey et al., 2005). Subsequently, we present our conceptual model and develop hypotheses.

Research framework

Building on the arguments raised in the previous sections, and guided by Das (2017) and Zhu et al. (2007), we develop a research framework by linking SSCMP and FP, to aggregate existing numerical results using meta-analytic procedures. The conceptual model is shown in Figure 2. Dimensions and measurement scales of both independent and dependent variables have been used repeatedly in reviewed literature (Abdullah & Yaakub, 2014; Ann, Zailani, & Wahid, 2006; Chan, He, Chan, & Wang, 2012; Chien & Shih, 2007; Dubey, Gunasekaran, & Chakrabarty, 2015; Lirn et al., 2014; Simpson, 2012) and are included in our study because they capture all key practices of SSCM and FP and are in line with the SSCM definition provided by Carter and Rogers (2008). This framework allowed us to test SSCMP consequences in firm's environmental, social, operational, and economic performance. In this framework, there are also presented associated hypotheses and potential variables that moderate the focal/overall relationship.

<<INSERT FIGURE 2 ABOUT HERE >>

Hypotheses development

SSCMP as intra- and inter-organizational practices represent mechanisms that integrate environmental and social concerns along the value chain (Ateş, Bloemhof, Van Raaij, & Wynstra, 2012; Singhal, 2013). Developing and implementing SSCMP require a considerable amount of time, expertise, and investments to be allocated by firms and among SC members. As suggested by RBV, NRBV and RV theories, being valuable, intangible and socially complex, the SSCMP can be considered strategic resources that directly improve FP in various dimensions. Building on

this rationale, many empirical studies (e.g., Chang, 2011; Chen, Wu, & Wu, 2015; Kuei et al., 2015; Lee, 2016; Luzzini et al., 2015; Severo, Guimarães, Dorion, & Nodari, 2015; Wang & Dai, 2018) have found that the adoption of internal sustainable practices coupled with sustainable product and process innovation lead to reduction in air emission, solid waste, energy and water consumption, and harmful and toxic materials used. Other authors by investigating the effect of sustainable collaboration with suppliers and consumers argue that these practices can be beneficial because firms create socially complex and unique relationship-specific capabilities (Hajmohammad, Vachon, Klassen, & Gavronski, 2013; Paulraj, 2011). On the contrary, another set of studies (e.g., Abdullah & Yaakub, 2014; Mitra & Datta, 2014; Younis et al., 2016) found insignificant or negative links. Similarly, the findings related to the impact of social SC practices on environmental performance are mixed as some authors report insignificant, negative and significantly positive relationships (e.g., Das, 2017; Pullman et al., 2009; Wolf, 2014). However, based on the tenets of NRBV and RV we postulate that SSCMP (as strategic capabilities) will lead to superior environmental performance because of reductions in consumption of materials, waste and energy, environmental accidents, and excessive inventory.

H1: *Sustainable supply chain management practices are positively correlated with firm's environmental performance.*

Although most research looking at sustainable supply practices was concentrated on economic and environmental outcomes (Jawaad & Zafar, 2020), recently, the social dimension of sustainability is increasingly being studied but the results are mixed (Paulraj et al., 2017) and less convincing (Mani et al., 2018). The implementation of sustainable design and manufacturing practices can improve social performance employees and the community's quality of life (Gimenez et al., 2012), which in turn, might improve the firm's reputation (Wang & Dai, 2018).

This is consistent with the results of Sezen and Çankaya (2013) who analyze data from 53 Turkish companies and found that sustainable manufacturing has a positive effect on social and environmental performance. Likewise, the adaptation of social supply practices such as employee safety and supporting projects for the external communities are found to improve firm social reputation and social performance (Gimenez & Sierra, 2013; Wang & Dai, 2018). On the contrary, negative or insignificant relationships between sustainable product design, sustainable distribution, and reverse logistics and social performance are reported by Abdul-Rashid et al. (2017) and Eltayeb et al. (2011). Similar negative or insignificant links between sustainable supply practices and social performance are reported in other studies (e.g., De Giovanni, 2012; Luthra et al., 2014; Younis et al., 2016). Thus, among fragmented streams of literature, there is a strong need to meta-analytically synthesize the extant evidence.

The RV theory postulates that performance benefits can be gained not only by resources owned or controlled by the firm but also from inter-firm collaboration. Thus, to improve social sustainability at the SC level, firms should select and collaborate with partners (i.e. suppliers) who possess social standards such as SA 8000 or ISO 26000 or are compliant with the rules of safety and working time limits (Das, 2017). Building on the above arguments, we expect SSCMP to improve firm's social performance because by implementing a safe and healthy work environment, collaborating with SC partners on social and environmental initiatives, and promoting the return of end-of-life recyclable products, firms can reduce waste, improve working conditions and strengthen people's health.

H2: *Sustainable supply chain management practices are positively correlated with firm's social performance.*

Another dimension of performance that has often been studied in the reviewed literature is operational performance. The operational performance consists of indicators that assess firm's capabilities to optimize production process, improve product quality, flexibility, and deliver speed (Chien & Shih, 2007; Christmann, 2000). Efficiencies gained from SSCMP implementation include reduced material inputs and delivery time, less inventory and improved product quality (Carter & Rogers, 2008; Zhang & Yang, 2016). Furthermore, the adaptation of sustainable design and manufacturing practices may identify inefficiencies in production processes that were not previously recognized and can accelerate product innovation through more careful use of resources and design for recycling (Christmann, 2000; Masa'deh et al., 2017). Likewise, Hollos et al. (2012) and Carter and Rogers (2008) argued that better working conditions (i.e. balanced working hours and fair compensation) should enhance workers' motivation, which in turn may improve product quality, and reduce health and safety costs. However, similar to environmental and social performance, the findings between SSCMP and firm's operational performance are mixed. For example, Zhang and Yang (2016) and Hollos et al. (2012) report positive, negative and insignificant correlations while Sroufe (2003) reports only positive ones. Vachon and Klassen (2006) and Carter et al. (2000) found that by implementing sustainable procurement and working together with consumers can improve operational performance by increasing the flexibility of the firm. Zhu et al. (2007) suggest that speed and delivery reliability of products can be increased by implementing SSCMP. Thus, building on the above arguments, we postulate that by decreasing virgin material use, eliminating hazardous product parts as well as collaborating with their SC partners, firms develop unique, valuable, and rare capabilities that eventually will encourage

innovation and technological advancement in processes and practices, leading to superior operational performance.

H3: *Sustainable supply chain management practices are positively correlated with firm's operational performance*.

SSCMP enhance firm's capabilities to fulfill environmentally and socially expectations but are accompanied by high initial investments and direct operating costs (Schmidt et al., 2017; Zhu et al., 2007). In this direction, a stream of research argues that financial benefits from SSCMP are uncertain (Hollos et al., 2012; Kassinis & Soteriou, 2003). In contrast, another stream of literature proposes a positive influence of SSCMP on economic performance (Golicic & Smith, 2013; Longoni, Luzzini, & Guerci, 2018; Zhu et al., 2012). However, firms should strive to achieve "win-win" situation between environmental, social, operational, and economic performance to rationalize the investment in sustainable practices (Balasubramanian & Shukla, 2017). Such "win-win" situations are doable because, on the one hand, by implementing sustainable design and manufacturing practices, firms cut costs from reducing resources and improving efficiency (Chan, Yee, Dai, & Lim, 2016; Longoni et al., 2018; Rao & Holt, 2005), on the other hand, by collaborating with their SC partners firms can generate less waste in their production and distribution processes, resulting in reduced costs, greater production efficiency, and increased earnings (Gimenez et al., 2012). Furthermore, the recovery of valuable components during product reconditioning and remanufacturing activities contributes to enhanced environmental and economic performance (Huang et al., 2012; Khor, Udin, Ramayah, & Hazen, 2016; Kung, Huang, & Cheng, 2012). In contrast, Green et al. (2012) found that sustainable collaboration with consumers and investment recovery are positively associated with environmental performance but not with economic performance. Esfahbodi et al. (2017) report insignificant or negative

relationships between sustainable design, investment recovery, and sustainable distribution and economic performance. However, in accordance with NRBV theory, internal sustainable practices, can be considered as sources of competitive advantages (Laari, Solakivi, et al., 2016; Zhu et al., 2007) as firms reap benefits including an improved reputation, increased market penetration, and increased profitability (Youn, Yang, Hong, & Park, 2013). Likewise, based on RV theory, inter-firm practices such as sustainable cooperation with suppliers and consumers lead to creation of tacit knowledge and efficient management routines (Blome, Hollos, & Paulraj, 2014). Thus, we argue that the adaptation of SSCMP could improve production efficiency and reduce the use of resources, reduce production costs, increase market share and profitability, thereby lead to superior economic performance.

H4: *Sustainable supply chain management practices are positively correlated with firm's economic performance.*

While previous hypotheses test the relationships between SSCMP and firm's environmental, social, operational, and economic performance separately, in line with other meta-analyses (e.g., Geng et al., 2017; Golicic & Smith, 2013), we test the link between SSCMP and overall/aggregated firm performance. In our study, FP is defined as a combination of environmental, social, operational, and economic performance. An aggregated view for performance is important because it allows us to group relevant evidence of SSCMP-FP, which has been operationalized in different constructs by researchers in our sample. As mentioned earlier, the implementation of sustainable supply practices among firms in SC is complex and requires unique capabilities that are costly and difficult to imitate (Hart, 1995; Zhu et al., 2007) and thus eventually they will enable firms to achieve superior performance (Paulraj, 2011). Furthermore, among many other outcomes, implementing SSCMP firms can improve the corporate image in the eyes of consumers and other

stakeholders, resulting in added turnover and profitability (Bag, 2014; Kuei, Chow, Madu, & Wu, 2013; Zhu & Sarkis, 2004). Thus, building on the above arguments, we suggest the following hypothesis:

H5: *Sustainable supply chain management practices are positively correlated with overall firm's sustainability performance.*

In addition, to summarize similar results reported in other studies (e.g., Aɬan, Kuzey, Acar, & Açikgöz, 2016; Chung & Tsai, 2007; Li, 2014; Youn et al., 2013) and to provide richer information along with the focal relationship, we conducted a post-hoc analysis by testing nine other sub-propositions (H5a, H5b,…, H5j) which hypothesize one by one constructs of SSCMP presented in Table 2 with aggregated FP.

Moderating variables

In a meta-analysis the researcher can examine theoretically relevant variables that can explain the variability in effect sizes (Hunter & Schmidt, 2004). These contingency variables are coded from the primary studies but should have some theoretical justification for consideration as moderators (Aguinis et al., 2011). Thus, we first provided the rationale behind moderators and then assess the impact of such moderators on SSCMP-FP link, by dividing studies into mutually exclusive subgroups based on the underlying moderator.

In our sample of studies, firm size, industry type, geographical region, and ISO certification have been usually used as control variables, and hence we use them as moderators. Other variables including drivers and barriers, institutional and other stakeholder pressures are not considered as they are not consistently reported in the reviewed studies. This is in line with the recommendation of Lipsey and Wilson (2001) who state that a moderating variable to be considered in a meta-analysis should be reported consistently in primary studies.

Firm size can affect the implementation of sustainable supply practices since large firms have more resource availability, are under intense scrutiny from their stakeholders, and serve to many customers (González-Benito & González-Benito, 2005; Schmidt et al., 2017). Likewise, given that large firms offer more products and services and have complex SC, they can benefit from many efficiencies including a reduction in wastes, effluents, material inputs, and energy consumption as well as through recycling and remanufacturing, production costs will decrease resulting in added turnover and profitability. In contrast, it is argued that small and medium enterprises (SMEs) are in short supply of knowledge, technologies, expertise, financial and human resources to adopt SSCMP (Huang et al., 2012; Zhu & Sarkis, 2007). Furthermore, due to the scarcity of resources, it is essential for SMEs to develop strategic partnerships with their SC patterns for adopting external sustainable supply practices in order to minimize risks and to improve their performance. The literature also suggests that managers are quite aware that the adoption of SSCMP is more than a technical process (Pullman et al., 2009) and complex sustainability strategies (Baumgartner & Ebner, 2010) should be avoided when their firms lack the capabilities to manage them (Hart, 1995). Conversely, operations managers in large firms with greater capabilities adopt more easily SSCMP (González-Benito & González-Benito, 2005). Hence, large firms often find SSCMP adaptation beneficial because they reduce wastes, warehousing costs, minimize defects, and indirectly improve corporate image and profitability following recycling, reusing, refurbishing and reverse logistics programs (Lee et al., 2012). Consequently, we expect that large firms to benefit more than SMEs from SSCMP adoption.

SSCMP may not be equally beneficial to all sectors as some manufacturing sectors are higher polluters and have stricter regulations than others (Christmann, 2000; Fraj-Andrés, Martinez-Salinas, & Matute-Vallejo, 2009). For instance, while sustainable packaging is critical in retail and

transportation, in the oil industry, it is not relevant. Similarly, regulatory requirements for firms operating in high polluting industries (i.e. mining, heavy manufacturing, oil and gas, chemicals, etc.) are much more demanding than in other industries. Given that, firms operating in manufacturing sectors are highly regulated and are under intense stakeholder pressure, they should invest more in sustainable supply practices than firms in service industries (i.e. banking, hospitability, transportation and retail) (Dai et al., 2017). Hence, we expect higher SSCMP-FP correlation in manufacturing sectors than in service industries.

Firms are exposed to different laws, regulations, and public scrutiny (Schmidt et al., 2017). They should implement diverse sustainable supply practices to operate in developed vs developing economies, institutional settings, geographical regions, and cultural backgrounds. Likewise, Sarkis (2012) and Vanalle et al. (2017) argued that political and cultural factors are important boundaries that can be used for policymakers, organizations, and managers to understand the relationship between SSCMP and FP better. Therefore, we seek to examine whether country economic development and its geographical region moderates the SSCMP-FP link.

Firms certified with standards such as ISO 14001 or ISO 26000 are more prone to adopt sustainable supply practices (Choi & Hwang, 2015) than companies that are not certified. In this direction, some studies reported higher correlations for firms that possess such standards (Laosirihongthong, Adebanjo, & Choon Tan, 2013; Rao & Holt, 2005). Some researchers have further suggested that stakeholders' involvement in a firm's ISO 14001 can become a unique and valuable capability (Miroshnychenko et al., 2017). Likewise, firms reduce environmental and social risks related to their activities by requiring ISO 14001 and ISO 26000 certifications from their suppliers (Agan, Acar, & Borodin, 2013). Furthermore, the literature suggests that firms with such certifications are more prone to integrate sustainable practices with supply chain partners

(Khor et al., 2016). Thus, we expect a stronger SSCMP-FP link for companies that are ISO certified.

In addition to potential moderators that come from firm characteristics, we have identified another potential moderating variable self-report vs archival measures that comes from methodological choice employed in the primary studies. Specifically, it has been highlighted that there might be potential inherent bias when managers provide self-reported metrics (Dixon-Fowler, Slater, Johnson, Ellstrand, & Romi, 2013). In other words, the objectivity of self-reported questionnaires depends on the perception of managers who may report better sustainability performance than it actually is. Thus, we have included this moderator to investigate whether performance differences exist based on the source of the data used in primary studies. Finally, we include the publication year as a moderator in order to examine the evolution of sustainable supply practices adaptation. By including this variable, we aim to clarify the ongoing debate whether SSCMP may increase, decrease, or stabilize performance over time as there are contradictory arguments (Hollos et al., 2012). However, none of the studies in our database explore the evolution of SSCMP using longitudinal data. Thus, we use the publication year of the study as a proxy measure to explore the evolution of SSCMP-FP link.

Methodology

Search for Relevant Studies

To identify relevant empirical studies, we used several search methods based on the guidelines provided by Aguinis et al. (2011) and Geyskens et al. (2009). First, we conducted computerized keyword searches in main databases: SCOPUS, ISI Web of Knowledge, EBSCO Business Source Complete, and Google Scholar. The last time that we queried these databases was the end of February 2018. Our search string was:

((Green OR environment OR sustain OR ethic* OR soci*) AND ("supply chain" OR "value chain" OR GSCM OR SSCM OR logistics) AND (practice* OR activit* OR operation* OR initiative*) AND (performance OR outcome OR advantage OR consequence OR benefit) AND (empiric* OR statistic* OR test OR analy* OR survey OR sampl* OR quantitative))*

Second, we examined the reference sections of retrieved studies to collect more articles that are relevant. Finally, the study samples in both prior meta-analyses (Geng et al., 2017; Golicic & Smith, 2013), were searched for any unidentified article.

Study Selection Criteria

After the initial examination of abstracts and having skimmed through the content of each study, we adopted several inclusion criteria. First, studies had to empirically test the relationship between SSMCP and FP. Second, studies had to report correlation coefficients (*r*) or other statistics (i.e. $p-value, t, F, \beta, \chi^2$) that can be converted to *r*. Finally, studies had to be written in English and published in peer-reviewed academic sources. Following the above-mentioned criteria, we were able to identify 178 usable studies. The studies' search and selection processes are given in Figure 3.

<<INSERT FIGURE 3 ABOUT HERE >>

After dropping studies that do not fulfill criteria for statistical independence and outliers (explained below), the final sample consists of 143 papers. Fig. 4 presents the distribution of studies by journal where four or more articles are published, which shows the quality of the data our study is drawn. In Appendix, we provide details of articles used in the analysis.

<<INSERT FIGURE 4 ABOUT HERE >>

Statistical Independence

When more than one effect size (e.g., correlation) relevant to a given association is derived from the same sample, the statistical independence of each effect size is violated (Geyskens et al., 2009). We tried to ensure an acceptable level of independence among correlations in our database as follows. On the one hand, using detection heuristics provided by Wood (2008), we dropped 26 studies from our database because they use the same or partially overlapping sample(s) with other studies kept in the database and similar constructs were used in both remaining and dropped studies. Whenever studies used the same sample but operationalized different constructs, which are following our definition of constructs shown in Table 2 and Table 3, we recorded the sample only once and extracted relevant data from each study. On the other hand, for a few studies (Esfahbodi et al., 2016; López-Gamero, Molina-Azorín, & Claver-Cortés, 2009) that used multiple independent samples, correlations and all other relevant data were coded for each sample independently. Furthermore, whenever a study reported more than one performance dimension, we average respective correlations to obtain a single value for aggregated FP and to ensure statistical independence.

Coding Procedure

A coding form was developed in a spreadsheet based on the research framework, potential moderators and coding practices suggested by (Lipsey & Wilson, 2001). Initially, using the coding form, the authors and a research assistant coded a random sample of 15 studies to identify data that should be extracted from primary studies and validate the coding protocol. Following this step, the remaining studies were coded by the first author and a research assistant independently from one other. Besides, the coders compared their codes after a batch of 20 studies to ensure consistency throughout the process. Discrepancies in coded studies and complicated cases were marked and

later resolved in a discussion between coders and authors. To ensure that the items of each construct in primary studies belong to respective constructs in our study presented in Table 2 and Table 3, 75% of the items should closely match our definition (Hunter & Schmidt, 2004). Using this rule and the coding protocol, we recorded data from each study for the variables of our interest, including the sample size, reliability estimates, correlations or other statists that can be converted to *r*, and moderators. Specifically, to create mutually exclusive subgroups, the moderating variables are coded as follows. The firm size in each sample is coded as either large enterprises (more than 500 employees) or SMEs. We excluded studies that draw their samples from mixed or unknown firm size. For industry type, each study is coded in one industry (i.e. automotive, electronics, etc.) based on the sample used in the article. Studies that draw their samples from more than one industry settings are excluded from moderator analysis. We also coded the samples as either ISO certified or the ISO not specified, whenever the information about certification is not explicitly stated in the study. Likewise, we coded samples based on the country they were drawn and the source of data (self-reported in surveys vs. obtain archival data from a database) employed by primary studies. Finally, we recorded the publication year to test whether there is a tendency in SSCMP-FP link. This process of coding and discussion between coders yielded inter-coder reliability of 93%. Formulas developed by Hunter and Schmidt (2004, pp. 435–437) for calculating inter-construct correlation are used when item level correlations were reported. Otherwise, we calculated the mean of inter-construct correlations reported (Geyskens et al., 2009). Likewise, reliabilities for these composite correlations were estimated with the Mosier formula (Hunter & Schmidt, 2004). Similar to other meta-analyses, mean reliability reported across all studies was substituted whenever reliability was not reported, or ranges were not provided. If only reliability ranges were given, we recorded the lowest value (usually 0.70).

Meta-analytic Approach

In this study, we used the meta-analytic procedures by Hedges and Olkin (1985) and recommendations by Aguinis et al. (2011) and Geyskens et al. (2009). For our analysis, we relied on Pearson product-moment correlation coefficient (*r*) as a bivariate linear measure between constructs. Because of variation in population parameters in our research (e.g., firm size, country, industry etc.) and based on suggestions from previous studies (e.g., Aguinis et al., 2011) for organizational research, we used the random-effects meta-analysis. The sequence of calculations conducted in this meta-analysis is outlined in the following steps.

Step 1: We corrected recorded effect sizes for measurement error by dividing the correlation coefficient by the product of the square root of the reliabilities (attenuation factor) of the dependent and independent constructs. This step aims to correct for imperfections of research methods used in the primary studies (Hunter & Schmidt, 2004) and is appropriate in our case because the goal is to understand construct-level relationships (Aguinis et al., 2011).

Step 2: The reliability adjusted correlations were transformed into Fisher's z-coefficients in an effort to make them approximately normally distributed (Geyskens et al., 2009). After the calculations are completed, we back-transformed Fisher's z-coefficients to *r*.

Step 3: Based on the guidelines provided by Aguinis et al. (2013) and on the method for the detection of outliers developed by Viechtbauer and Cheung (2010), we identified, analyzed and finally dropped 9 studies from our database. After dropping the outliers, the final number of studies included in our database is 143 articles (145 independent samples).

Step 4: We computed corrected mean correlation (*r*) by averaging and weighting z-coefficients by their inverse variance.

Step 5: We calculated standard error (*sd*) and 95% confidence interval (*C.I*) for *r*.

Step 6: To examine the existence of moderators, we calculated the *Q* statistic (Lipsey & Wilson, 2001). A significant *Q* is a sign of potential presence of moderators.

Step 7: We performed moderator analysis using analog to analysis of variance (ANOVA) technique (Lipsey & Wilson, 2001). This approach is suitable for categorical moderating variables (Aguinis et al., 2011). For each variable, we split the total sample into subgroups and then separate meta-analyses were conducted. The analysis involved partitioning the *Q* statistic into a within-subgroups homogeneity statistic (Q_w) and a between-subgroup statistic (Q_b) - an index of the variability that tests whether the difference between mean Q_w correlations is zero. A statistically significant Q_b, which has an approximate χ^2 distribution with $p - 1$ degrees (p is the number of subgroups), suggests that mean correlation across subgroups differs by more than the sampling error or, in other words, the subgrouping variable is indeed a moderator.

Step 8: Finally, we used the following methods to check potential publication bias (Rosenthal, 1979). We estimated the Orwin's (1983) fail-safe number (N_{fs}) of missing studies averaging null results that would be required to reduce the mean effect size to a specified level. As a trivial value for mean correlation in our study, we set the criterion value to 0.05 and calculated N_{fs} for all relationships.

More advanced methods for detecting publication bias including Trim and fill, Rank correlation tests, Regression-based models (e.g., Egger's regression test) were not used because they can produce misleading results in the presence of between study heterogeneity (Peters et al., 2010).

However, following in footsteps of Ioannidis and Trikalinos (2007), we also observed the issue of continuing inappropriate use of publication bias tests. As an additional investigation of publication bias, we visually inspected funnel plots for symmetry and examined the forest plot for evidence of drifts of correlations in the cumulative meta-analysis (Borenstein, Hedges, Higgins, & Rothstein, 2009). This process included performing a cumulative meta-analysis with one study, then with two studies, and so on, until all studies have been added. We did not notice any significant shift of the correlation in the forest plot where effect sizes were sorted by precision (i.e. sample size). Thus, in sum, we can claim that publication bias is not a major concern in our study.

Results

The results for all hypotheses from H1 to H4 are presented in Table 4. First, we tested the associations between SSCMP and firm's environmental, social, operational, and economic performance, and then we tested the relationship between SSCMP and FP. In our database, there are 87 studies that test the link between SSCMP and firm's environmental performance. The results show a positive and significant effect, with a mean correlation of 0.54 ($p<0.01$), and thus, we conclude there is support for H1. Likewise, the correlations between SSCMP and firm's social, operational, and economic performance are significant and positive, thereby providing support for H2, H3, and H4. While all the correlations are positive, findings further indicate that firms from adopting SSCMP can expect more significant improvements in terms of environmental and operational performance.

<<INSERT TABLE 4 ABOUT HERE >>

Additionally, the results of individual sustainable supply practices and overall FP are shown in Table 5. The correlations are significant and positive, and thus we conclude that there is support

for H5 and for all other sub-hypotheses. While the findings indicate that it pays off to invest in greening and behaving socially responsible in SC, firms would expect higher payoffs in terms of overall FP from implementing internal sustainable management programs coupled with sustainable product design and social practices. These results show that initially firms can implement sustainable practices that fit with their existing capabilities and knowledge. Next, they should leverage their resources and capabilities to identify and develop strategic partnerships with their supply partners. In this way even firms that lack capabilities or knowledge for developing sustainable strategies can learn and benefit from complementary assets resulting from collaborative practices with suppliers, distributors and consumers, leading to improvements in performance. Following the results of the main associations, this section continues with evaluating whether the mean correlation between SSCMP and FP is affected by potential moderators including firm size, industry type, and country.

<<INSERT TABLE 5 ABOUT HERE >>

Moderator analysis

Given that primary studies in our sample examined a diverse range of firms in terms of industry, economic development, geography, data measurement source, ISO-certification, and company size, we will test whether such contingencies affect the strength of SSCMP-FP link. The *Q* statistic (*3,274.78; p<0.01*) for the overall relationship is quite large and significant, indicating the existence of moderators. To create mutually exclusive groups for moderator analysis, we had to exclude many samples that are drawn on various firm sizes (*n=97*), industries (*n=96*), and countries (*n=16*). Following this criterion, we then run subgroup analysis and results are presented in Table 6. Although, in contrast to our expectation, the findings indicate nonsignificant differences regarding firm size, industry type, country economic development, and ISO

certification, there are several important implications which will be highlighted in the discussion section. Next, we examined whether there is a difference between surveying managers (self-reporting) and using secondary (archival) data (i.e. COMPUSTAT, Sustainalytics) for measuring FP. The findings reveal a statistically significant difference ($Q_b = 9.54$, $p<0.01$), suggesting that managers tend to be biased when reporting performance measures of the firm they work for. The results also show a significant difference regarding the study publication year, and thus we conclude that there is evidence for a positive evolution of SSCMP influence on FP. We further categorized samples based on the specific country and continent because we have argued earlier that, the political, social, cultural, and economic factors play an important role in SSCMP adaptation. The results show that such factors moderate the relationship between SSCMP and FP among various countries and continents significantly. For instance, samples from US show weaker correlations ($r = 0.29$) than samples from Taiwan ($r = 0.51$), China ($r = 0.46$), and India ($r = 0.47$).

<<INSERT TABLE 6 ABOUT HERE >>

It is important to note that we could not perform meta-analytic regression analysis (MARA), as an alternative technique to complement the subgroup analysis, since we did not have enough studies covering all moderating variables. For example, we grouped studies by firm size in SMEs and large firms. However, most samples (97 out of 145) are drawn on mixed firm sizes and hence cannot be assigned a binary value. Consequently, after we excluded these studies, our database consists of 48 samples covering all variables. Likewise, after dropping samples drawn from more than one industry and country from the above database, we are left with a small sample size (n=17). According to Borenstein et al. (2009, p. 188), the use of MARA with multiple covariates, is not a recommended option when the number of studies is small. They further suggest a ratio of ten studies for each covariate (moderator). Hence, due to the restrictions on sample size, we were not

able to construct a MARA with at least two moderators. Thus, the only option left to test moderators was by performing subgroup analysis explained above.

Discussion

The aims of this study were two-fold: (1) to examine empirical research on the association between SSCMP and firm performance; (2) to explore which factors moderate SSCMP-FP relationship. By synthesizing empirical findings, we have provided a more accurate estimation of SSCMP-FP link and have identified important moderators regarding this link. While a few meta-analyses are conducted in the SSCM literature, our study provides clarity and extends further their findings by investigating the relationship between sustainable supply practices and various types of FP, which are not studied in earlier meta-analyses (see Table 1). Specifically, our results show strong and significantly positive relationship between individual SSCMP and FP. In addition to the focal relationship, we tested the impact of SSCMP on firm's environmental, social, operational, and economic dimensions separately. Again, the results show that all associations are strong and significantly positive and thus supporting our hypotheses which are consistent with a stream previous research (e.g., Choi and Hwang 2015; Sancha et al., 2016; Wu et al., 2014; Yang et al., 2011). Such results provide further evidence that by adopting sustainable supply practices, firms and their SC partners, enhance their reputation in front of consumers and other stakeholders regarding social concerns, as well as they acquire access to new resources/capabilities, knowledge, experiences, and have more control of and lower risks in their SCs. Accordingly, knowledge and capabilities of SC partners can be leveraged to create unique value in sustainable strategies, which would allow firms to not only differentiate their services/products but also increase their sustainable performance from triple bottom line perspective, thereby generating positive spillover effects (Christmann, 2000; Pullman et al., 2009). In sum, our study provides strong evidence that

SSCMP are positively correlated with FP sustainability dimensions and contradicts the view of trade-offs between environmental and social, and economic performance (Adebanjo et al., 2016; Esfahbodi et al., 2016).

Theoretical implications

By combining empirical findings that are conceptually comparable (Lipsey & Wilson, 2001), this meta-analysis study makes significant contributions to the SSCM literature. First, leveraging insights from NRBV and RV theories, we were able to determine whether SSCMP should be viewed as a source of competitive advantage. Carter and Rogers (2008) argue that combining existing frameworks into one comprehensive framework helps define the boundaries of the field more rigorously. Our comprehensive research framework grounded on NRBV and RV theories operationalizes SSCMP and FP in nine and four constructs respectively and can serve as a foundation for future research to investigate such associations more consistently. Then yielding results can be grouped and accumulated easier in a future meta-analysis. However, given that social SC practices – as opposed to GSCM practices are relatively newly deployed in many firms and have been less researched (Wichaisri & Sopadang, 2018), we were restricted to synthesize extant research in a single construct. Thus, we believe that our framework can help authors in scoping new research and enable them to focus more on other contingencies that affect SSCMP-FP link.

Second, although prior research on SSCMP-FP dimensions shows mixed evidence (Esfahbodi et al., 2017; Green et al., 2012; Zhu & Sarkis, 2007), the results from our study provide an empirical generalization of positive and significant relationships between SSCMP and FP dimensions. The findings from hypotheses provide strong evidence that SSCMP are important strategic capabilities and are linked with firm's environmental (H1; $r=0.54$), social (H2; $r=0.43$), operational (H3; $r=0.46$), economic (H4; $r=0.42$), and aggregated (H5; $r=0.46$) performance.

These findings support the complementarity of the NRBV and RV theories and show that both intra– and inter–firm practices such as eco-design, sustainable purchasing and reverse logistics can be considered as bundles of strategic resources that lead to superior performance. On the one hand, firms directly improve their performance, for example, through reduced energy and material usage, waste reduction, and enhanced health and safety of employees. On the other hand, SSCMP improve FP by combining resources and knowledge in collaborative practices across SC (Schmidt et al., 2017).

Third, the positive links between individual SSCMP and FP (*H5a-H5j*) suggest that firms should implement diverse social and environmental supply practices to enhance their performance. Our results are in line with Tachizawa et al. (2015) who stressed that a firm benefits more from SSCMP adoption than the mere reconciliation of environmental practices with stakeholder expectations. Moreover, such findings imply that additional FP is gained when there is joint implementation and collaboration between SC partners. This highlight further the relevance of resource-based theories (NRBV and RV) used in our study by indicating that competitive advantages may emerge also from exploiting resources/capabilities beyond firm boundaries.

Fourth, for the first time in SSCM literature, we meta-analytically synthesized quantitative research on the relationship between social SC practices and FP dimensions. Results suggest that these links are significantly positive for both overall firm performance (*H5h: r=0.49*) and for individual performance dimensions. This helps to clarify mixed evidence reported in extant research (e.g., Das, 2017; Esfahbodi et al., 2017; Gimenez et al., 2012; Rao & Holt, 2005), and, thus our findings extend and complement recent research related to the SSCMP-FP link and advance the understanding of the importance of social and environmental supply practices. Furthermore, while previous studies focused on subsets of SSCMP and single types of

performance such as environmental and economic dimensions, our study simultaneously considers SSCMP from end-to-end perspective and all four types of performance studied in the reviewed literature.

Fifth, a comparison of our results with Golicic and Smith (2013) and Geng et al. (2017) yields mostly similar outcomes but there are some significant differences that need to be highlighted. The correlations between SSCMP and firm's environmental, operational, and financial dimensions are usually stronger than the respective correlations from previous meta-analyses. Perhaps this is because we aggregated results from 145 independent samples, which is 3 to 5 times higher than the total samples of prior meta-analyses. Another element that may contribute to these discrepancies is that we have used random-effect meta-analysis model while they used the fixed-effect meta-analysis.

Sixth, in moderator analysis, we examined potential variables that might affect the focal relationship between SSCMP and FP. Surprisingly, and contrary to our argumentation that large firms and ISO certified companies are expected to gain more benefits, we found nonsignificant differences regarding firm size and ISO certification. Due to the flexible nature and structure of SMEs, it seems that implementation of practices such as sustainable design and manufacturing coupled with improved working conditions for employees pays off more for SMEs than large firms. However, given that the majority of the primary studies utilized various firm sizes operating in more than one industry, such findings should be taken with more caution. The results also show that firms benefit from SSCMP adaptation regardless if they are ISO certified or not. This finding is consistent with Geng et al. (2017). Moreover, because of certifications such as ISO 14001 are costly (Vanalle et al., 2017), firms try to adopt their environmental practices consistent with such certifications without formally acquiring them (Zhu et al., 2012). This might explain the reason

behind stronger correlations for firms that are not ISO certified (*r=0.46*) versus those that are ISO certified (*r=0.44*). Again, given the small number of samples in ISO certified category, this finding should be taken with caution. Next, the results also indicate that the firms in manufacturing industries (i.e. automotive, electronics; *r=0.47*) with high rates of scrapping and dumping waste, earn more than firms in service industries (i.e. transportation, retail; *r=0.46*) from implementing SSCMP. Although the difference between manufacturing and service industries, is not statistically significant (*p=0.91*), it shows that firms improve significantly their sustainability performance regardless of their industry and is in line with previous studies (Yang et al., 2010; Zailani et al., 2015).

Interestingly, in contrast to our expectation, the findings show that SSCMP lead to better performance in developing (*r=0.49*) than in developed countries (*r=0.45*). Such results can be explained from the resource-based view perspective. While in industrialized and developed countries, SSCMP are fairly developed and implemented to some degree, they may not be considered (anymore) as a valuable, rare, inimitable, and non-sustainable (VRIN) resources because many firms in the industry likely have adopted such practices, leading to weak competitive advantage (Schoenherr, 2012). In contrast, in emerging and developing economies SSCMP can be viewed as VIRN resources, leading to competitive advantage, because firms may earn benefits of 'low hanging fruits' associated with the reduction in materials, energy, emissions and waste as well as market performance gains from intra— and inter—process inefficiencies (Li et al., 2016; Schmidt et al., 2017). Likewise, firms benefit from social supply practices by enhancing skills, compensation and quality of life of workers, leading to increased employee retention and productivity (Pullman et al., 2009). Moreover, our results indicate that firm's geographic location, source of performance data used in primary studies, and publication year make a difference in the

SSCMP-FP link. Our findings indicate that sustainable supply practices yield greater performance benefits in collectivist Asian cultures (*r=0.49*) than in the individualistic Western cultures such as in Europe (*r=0.46*) or in America (*r=0.32*). One explanation includes differences in cultures and regulatory requirements in individual countries among these regions. In Asian countries, environmental and social regulatory requirements have been implemented later than in European and North American countries. Thus, there is more room for improvement because of adopting SSCMP, which has led to higher performance. We also find that using archival data yields a lower correlation (*r=0.22*) than using self-report measures (*r=0.48*). As a result, this finding diverges from Dixon-Fowler et al. (2013) and implies that studies drawn on self-reported performance data can be biased compared to studies that use archival data. However, both correlations are significant and positive and thus providing strong empirical evidence that SSCMP are valuable and important sources for improving FP. Our results also help to clarify the debate on whether SSCMP improve performance over time as there is a significant difference in the publication year of the studies. In other words, this indicates that studies published after 2010 show a stronger correlation (*r=0.48*) than the correlation (*r=0.35*) stemming from the studies published before 2010. Thus, we can conclude that sustainable supply practices strengthen performance over time.

Finally, as we have emphasized earlier, samples used in the meta-analysis must be statistically independent. Wood (2008) developed an algorithm based on detection heuristics (study characteristics) that should be checked to ensure an acceptable level of statistical independence. However, previous meta-analyses (Geng et al., 2017; Golicic & Smith, 2013) violated this criterion and coded duplicate samples as unique by which they artificially increased the sample size. Likewise, when testing the effect of moderators, both prior meta-analyses fail to build mutually exclusive subgroups and did not test at all for statistical differences between such groups. In

contrast, we provide a detailed discussion of the methodology applied in conducting this study and we believe that might be helpful to other researchers who may follow it when preparing similar studies.

Managerial and policy implications

This meta-analysis can help practitioners and policy makers to understand the importance of sustainable supply practices to improve environmental, social, operational and economic performance by providing relatively large empirical evidence. First, the positive and significant SSCMP-FP correlations with overall firm performance and with each sub-dimension of sustainability performance, indicate that sustainable supply practices not only improve firm's environmental and social reputation but also increase firm's operational and economic benefits. That includes gains in financial performance, more efficient processes and quality improvement of products/services, and reduced pollution, water and energy consumption, as well as enhanced company image and job satisfaction. Thus, a firm can realize many sustainable development objectives through SSCMP implementation, leading to enhanced value for all stakeholders involved.

Second, individual outcomes of SSCMP-FP links (*H5a-H5j*) can help managers in choosing sustainable practices that fit with their firm's capabilities and knowledge and which would lead to the desired performance. Moreover, such results also suggest that to gain the highest performance from SSCMP adoption, firms should work at least at two levels. Internally, as a strategic imperative to develop companywide sustainable practices and to modify information systems to monitor and process performance outcomes of such practices. Externally, to enhance collaboration and cooperation with supply and demand sides for providing and encouraging consumption of more sustainable products/services. This implies that SC managers must develop various managerial

skills, structures and sustainability practices in intra— and inter—firm levels, to work together with suppliers and consumers for taking advantage of complementarity effects resulting from distributing costs and benefits and the combination of resources and knowledge.

Third, the positive and significant link between social supply practices and performance provides further evidence for practitioners that social practices along with environmental initiatives are important and should be integrated for realizing competitive advantages over their competitors. Accordingly, by offering healthy and safe working environment for employees and more career development opportunities, along with increased good social welfare, firms can not only reduce risks, but they may enhance their sustainable performance and competitiveness.

Finally, regarding SSCMP-FP links under different conditions, our results show that such links are significant and positive regardless of firm characteristics and market condition. Managers should also be informed that firms gain additional benefits from SSCMP adoption when they operate in manufacturing industries vs. service industries, in developing countries vs. developed countries, SMEs vs. large firms, and ISO not certified vs. ISO certified firms. However, such findings should be taken with caution resulting from analyzing small number of studies in several respective categories.

From a policy perspective, this study provides important implications. Our results can help policy makers to identify and prioritize factors for devising and adjusting policies for adopting environmental and social supply practices. On the one hand, governments and regulators should develop mechanisms that control and regulate issues relating to environmental and social sustainability dimensions. On the other hand, governmental bodies should provide financial and technical assistance and invest in appropriate infrastructures that promote and develop social and environmental capabilities and expertise among firms. Thus, governments and local municipalities

should have a complimentary approach by requiring firms to be in line with green and social standards and policies and to provide measures such as subsidies or other public grants and tax exemptions for firms that adopt sustainable business practices. Our meta-analytic results show that environmental and social supply practices improve sustainable performance and in turn may lead to economic growth, as well as findings from moderators analysis may help policymakers and managers to deploy resources more appropriately.

Limitations and Future Research

A meta-analysis study has some inherit limitations. First, the quality of the meta-analytic findings depends on data obtained from available studies. To ensure the quality of the data our study is drawn, we decided to restrict our search to peer-reviewed published documents. We believe that this limitation does not weaken the validity of our results as we employed several searching techniques to identify suitable studies (145 independent samples) and found very high fail-safe numbers shown in Tables 4 and 5. Thus, we are confident that the inclusion of additional (existing) studies in the meta-analysis would be unlikely to significantly change our results. Furthermore, our database of samples is significantly larger (3 to 5 times) than the number of studies in previous meta-analyses (Geng et al., 2017; Golicic & Smith, 2013). Second, due to the small sample size for the correlation between SSCMP and firm's social performance, it is evident that additional studies are needed. Third, in several studies reported information is not enough to estimate the Pearson correlation coefficient, which forced us to dismiss the records for a few constructs. Hence, in future empirical SSCMP-FP studies, we encourage authors, at least, to report correlations between latent variables and the reliabilities between constructs. Fourth, given that we aggregated samples from different contexts (i.e. countries, time) with cross-sectional design, this study does not allow inferring causality from results of meta-analysis. Similarly, Pullman et al.

(2009) and Wong et al. (2012) highlighted that defining causality and relationships between sustainable SC practices and performance outcomes is difficult. Thus, a longitudinal study is worth pursuing as it can advance understanding of the causal relationships amongst sustainable supply practices and performance over time. Fifth, findings from moderator analysis on the SSCMP-FP link indicate that additional research is needed to examine other contextual factors. This will help researchers and managers to better understand contingencies that lead to the best performance when adopting SSCMP. Likewise, future studies should address areas that are not sufficiently researched by drawing their samples from specific countries, single industry settings, and archival data. Finally, in a meta-analysis study, the researcher sometimes is required to mix and compare results that look like apples and oranges. Thus, the aggregation across different types of sustainable supply practices and types of performance may be a potential limitation, despite rigorous methodology followed.

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Table 1. Comparison of previous meta-analyses with the present study.

						Theory		Methodology			SSCM Practices					Firm performance				Moderators						
Study	Period	No of papers	Sample size	Region	Sector	NRBV	RV	Model	Duplicates Check	Outlier Check	Other practices	Social supply practices	Sus. Manufact.	Sus. Distribu.	Inv Recovery	Environmental	Social	Operational	Economic	Firm size	Geogra. region	Industry type	ISO Certified	Eco conditions	Self-report	Evolution
Golicic and Smith (2013)	2000-2011	31	15160	World	All	✓		Fixed	✓		✓							✓	✓	✓	✓	✓		✓		
Geng et al. (2017)	1996 - 2017	50	25680	Asia	Manufa -cturing	Not Specified		Fixed			✓					✓	✓	✓	✓	✓		✓	✓			
Present study	1996 - 2019	143	33886	World	All	✓	✓	Random	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: SSCMP = Sustainable supply chain management practices; NRBV = Natural Resource-based view; RV = Relational view.

Table 2. Constructs and measurement items for Sustainable supply chain management practices (SSCMP).

Practice	*Definition*	*Items*	*References*
Internal Sustainable Management	Refers to strategies, processes and procedures supporting intra-organizational environmental and social objectives.	• Written sustainability policy statement. • Environmental management system and regulatory compliance • Top and middle management support and commitment to environmental and social programs. • ISO 9000, ISO 14001, SA8000 and/or ISO 26000 standards. • Cross-functional cooperation for sustainable improvements.	Green et al., 2015; Kim and Rhee, 2012; Koo et al., 2014; Wu et al., 2008; Yang et al., 2013
Sustainable Purchasing	Reflects the importance of cooperating with suppliers for the purpose of developing products that are environmentally and socially sustainable.	• Select suppliers who control hazardous substances and have or are obtaining standards such as ISO 14001, OHSAS 18000, ISO 9000, SA8000, and/or ISO 26000. • Environmental and social audit of suppliers' internal management practices. • Cooperation with suppliers for improving environmental and social practices to achieve sustainability goals.	Gimenez and Sierra, 2013; Graham and Potter, 2015; Khaksar et al., 2016; Lee et al., 2013; Vijayvargy and Agarwal, 2014
Sustainable Product Design	The design of products with environmental and social objectives and impacts in mind during their entire life-cycle and focus more on recycling and reusing products.	• Design products for reuse, recycle, recovery of material and component parts. • Design products to reduce or eliminate the use of harmful/hazardous/toxic materials. • Design products to store at room temperature and to reduce storage area needed in transportation. • R&D for sustainable product innovation. • Provide design specifications to partners that include environmental and social requirements for purchased items.	Ar, 2012; Grekova et al., 2013; Huang and Wu, 2010; Khan et al., 2017; Küçükoğlu and Pınar, 2015; Li, 2014; Van den Berg et al., 2013; Wong et al., 2012
Sustainable Productio	All activities implemented to minimize environmental impacts in manufacturing processes.	• Use of pollution prevention and energy-efficient technologies • Remanufacturing, raw material consumption, and waste reduction in equipment and processes	Aboelmaged, 2018; Sezen and Çankaya, 2013; Zeng et al.,

		• R&D for sustainable production process innovation.	2010; Grekova et al., 2016
Sustainable Distribution and Packaging	Any means of transportation of from suppliers to manufacturers to final customers with the purpose of having the minimal harmful impacts and packaging usage.	• Cooperate with vendors to standardize and downsize packaging and to use renewable energy in transportation. • Promote and adopt reusable and recycled packaging. • Use of alternative fuel vehicles and collaborative warehouses. • Combine modes of transportation and upgrade freight logistics to minimize negative environmental impacts. • Customer feedback regarding the use of green transportation.	Chung and Tsai, 2007; Kung et al., 2012; Petljak et al., 2018; Tang et al., 2016; Zailani et al., 2012
Customer Sustainable Cooperation	Working with customers to better understand sustainability related problems and issues from a downstream point-of-view.	• Cooperation with customers for sustainable purchasing. • Customer cooperation for sustainable design. • Cooperation with customers for cleaner production. • Customer cooperation for green distribution and packaging.	Chandra Shukla et al., 2009; Jabbour et al., 2014; Kirchoff et al., 2016; Laari et al., 2016
Reverse Logistics	Include activities that aim at taking products back or materials from consumers to manufacturers for the purposes of reuse or recycling.	• Retrieve products and materials from the point of consumption for recycling, reusing, and safe disposal. • Waste collectors and remanufacturing policies • Reprocessing of the used products by the company.	Abdul-Rashid et al., 2017; Agan et al., 2013; Khor et al., 2016
Employee Social Practices	Firm's efforts to induce socially responsible behavior in its own operations and the operations of its suppliers.	• Safe working conditions for employees • Skills development and fair compensation to all employees • Healthy and positive working environment for employees. • Supporting projects and social commitment to the external community.	Mani et al., 2018; Masa'deh et al., 2017; Pullman et al., 2009; Wolf, 2014
Investment Recovery	Reflects the importance of capturing value through resell and reuse of used materials.	• Sale of excessive capital equipment. • Sales of scrap and used materials • Sale of excess inventories or materials	Gorane and Kant, 2017; Ketikidis et al., 2013

Table 3. Constructs and measurement items for types of firm performance (FP).

Dimensions	*Description*	*Items*	*References*
Environmental performance	Environmental outcomes represent consequences of SSCM practices on the natural environment inside and outside organizations.	• Reduction of air emission and wastewater • Reduction of solid waste and energy consumption • Reduction of used harmful and toxic materials • Firm's environmental accidents decline and biodiversity protection in the surrounding area.	Dong et al., 2014; Hung et al., 2014; Laosirihongthong et al., 2013; Rodríguez, 2009; Sancha et al., 2016; Yang et al., 2011
Social performance	Social performance represents indicators covering improvements in overall stakeholder welfare, community health and safety of workers.	• Improvement of corporate image • Enhanced employee job satisfaction • Enhanced health and safety of employees • Improvement of awareness and protection of the claims and rights of people in community served	Abdul-Rashid et al., 2017; Amjad et al., 2017; Chen et al., 2006; Gopal and Thakkar, 2016; Lai and Wong, 2012; Lim and Biswas, 2019
Operational performance	Operational outcomes measure the improvements in operational activities to more efficiently produce and deliver products to customers.	• Reduction in delivery time and improvements in capacity utilization • Reduction in inventory levels and scrap rate • Improvement in the efficiency of inbound and outbound logistics. • Quality improvement of products and services.	Ali et al., 2017; Fraj-Andrés et al., 2009; Kuei et al., 2013; Mitra and Datta, 2014; Perramon et al., 2014; Schoenherr, 2012; Yu et al., 2014
Economic performance	Economic outcomes are expected financial benefits resulting from SSCM practices.	• Cost reduction for purchased materials, energy consumption, waste treatment and discharge. • Growth in market share and profitability • Increase on return on investment and sale growth	Cheng et al., 2014; Jiang et al., 2018; Li et al., 2016; Longoni et al., 2018; Wang and Sarkis, 2013; Wu et al., 2014

Table 4 Results between sustainable supply chain management practices (SSCMP) and firm's performance types.

Hypotheses				*k*	*N*	*r*	*sd*	95% CI		*Q*	N_{fs}
H1:	SSCMP	→	EnP	87	16752	0.5393	0.033	0.49	0.58	1505.93	963
H2:	SSCMP	→	ScP	28	6900	0.4279	0.059	0.33	0.52	597.08	229
H3:	SSCMP	→	OpP	59	13104	0.4574	0.047	0.38	0.53	1557.92	524
H4:	SSCMP	→	EcP	96	22257	0.4230	0.034	0.37	0.48	2327.25	771

Notes: k – number of independent samples, *N* – total number of firms, *r* –corrected mean correlation, *sd* – standard error, *CI* – confidence interval, *Q* – chi square statistic, N_{fs} – Orwin's fail safe number, *EnP*-Environmental Performance, *ScP*-Social Performance, *OpP*-Operational Performance, *EcP*-Economic Performance. p-value < 0.01

Table 5 Bivariate meta-analytical results between sustainable supply chain management practices (SSCMP) and firm performance.

Hypotheses				*k*	*N*	*r*	*sd*	95% CI		*Q*	N_{fs}
H5:	**SSCMP**	**→**	**FP**	**145**	**33886**	**0.4571**	**0.027**	**0.42**	**0.50**	**3274.78**	**1287**
H5a:	ISM	→	FP	61	14496	0.4844	0.041	0.42	0.54	1379.24	585
H5b:	SP	→	FP	76	18609	0.4587	0.039	0.40	0.52	1941.21	678
H5c:	SD	→	FP	63	11361	0.5015	0.041	0.44	0.56	1094.61	632
H5d:	SM	→	FP	47	14680	0.4231	0.045	0.35	0.49	1206.20	378
H5e:	SDP	→	FP	17	2737	0.5096	0.118	0.32	0.66	581.58	175
H5f:	CSC	→	FP	32	5305	0.4372	0.050	0.35	0.51	395.16	269
H5g:	RL	→	FP	15	3545	0.2986	0.051	0.20	0.39	109.09	78
H5h:	ESP	→	FP	13	4282	0.4928	0.106	0.32	0.63	494.40	128
H5j:	IR	→	FP	15	2384	0.5035	0.078	0.38	0.61	185.64	152

Notes: k – number of independent samples, *N* – total number of firms, *r* –corrected mean correlation, *sd* – standard error, *CI* – confidence interval, *Q* – chi square statistic, N_{fs} – Orwin's fail safe number. *ISM*-Internal Sustainable Management, *SP*- Sustainable Purchasing, *SD*-Sustainable Product Design, *SM*-Sustainable Manufacturing, *SDP*-Sustainable Distribution and Packaging, *CSC*-Customer Sustainable Cooperation, *RL*-Reverse Logistics, *ESP*-Employee Social Practices, *IR*- Investment Recovery, *FP*-Firm Performance. *p*-value < 0.01

Table 6 Results of moderators' effect on the sustainable supply chain management practices (SSCMP) and firm performance (FP).

	k	*r*	*95% CI*		Q_b	*Z*	*p*
Company size							
Large	35	0,420	0,34	0,50		8,88	0,000
SMEs	13	0,537	0,41	0,64		7,04	0,000
					2,37		0,124
Single industry							
Automotive	9	0,455	0,31	0,58		5,70	0,000
Construction	4	0,521	0,23	0,72		3,33	0,001
Electronics	16	0,513	0,40	0,61		7,57	0,000
Food	7	0,426	0,27	0,56		5,12	0,000
Shipping and logistics	4	0,371	0,12	0,58		4,93	0,000
Other	9	0,436	0,29	0,56		5,49	0,000
					1,90		0,863
Industry							
Manufacturing	41	0,474	0,40	0,54		11,49	0,000
Services	8	0,463	0,25	0,63		4,07	0,000
					0,01		0,913
ISO Certification							
ISO_No	123	0,463	0,42	0,51		16,88	0,000
ISO_Yes	22	0,443	0,35	0,52		8,70	0,000
					0,18		0,674
Measurement							
Archival data	12	0,221	0,04	0,39		2,41	0,016
Self-report	133	0,481	0,44	0,52		19,80	0,000
					9,54		0,002
Evolution							
1996-2009	26	0,348	0,27	0,42		8,37	0,000
2010-2018	119	0,481	0,43	0,53		17,31	0,000
					9,36		0,002
Economic conditions							
Developed countries	78	0,455	0,40	0,51		14,12	0,000
Developing countries	54	0,493	0,43	0,55		12,69	0,000
					0,80		0,371
Country							
China	20	0,464	0,37	0,55		8,29	0,000
India	12	0,470	0,31	0,60		5,29	0,000
Malaysia	9	0,402	0,30	0,49		7,47	0,000
South Korea	6	0,661	0,49	0,78		6,09	0,000
Spain	7	0,411	0,25	0,55		4,66	0,000

Taiwan	19	0,513	0,42	0,60		9,01	0,000
Turkey	6	0,553	0,41	0,67		6,40	0,000
US	17	0,287	0,18	0,39		5,24	0,000
Other	33	0,512	0,42	0,59		9,35	0,000
					23,85		0,002
Continent							
Africa	2	0,754	0,32	0,93		2,95	0,003
America	23	0,324	0,24	0,41		6,93	0,000
Asia	86	0,494	0,45	0,54		17,25	0,000
Europe	27	0,463	0,38	0,54		9,91	0,000
					14,95		0,002

Notes: k – number of samples, *r* – mean corrected correlation, *CI* – confidence interval, Q_b – between group statistic. indicates samples that are drawn from a single industry or country and are not shown in the respective category but are grouped as *other*.

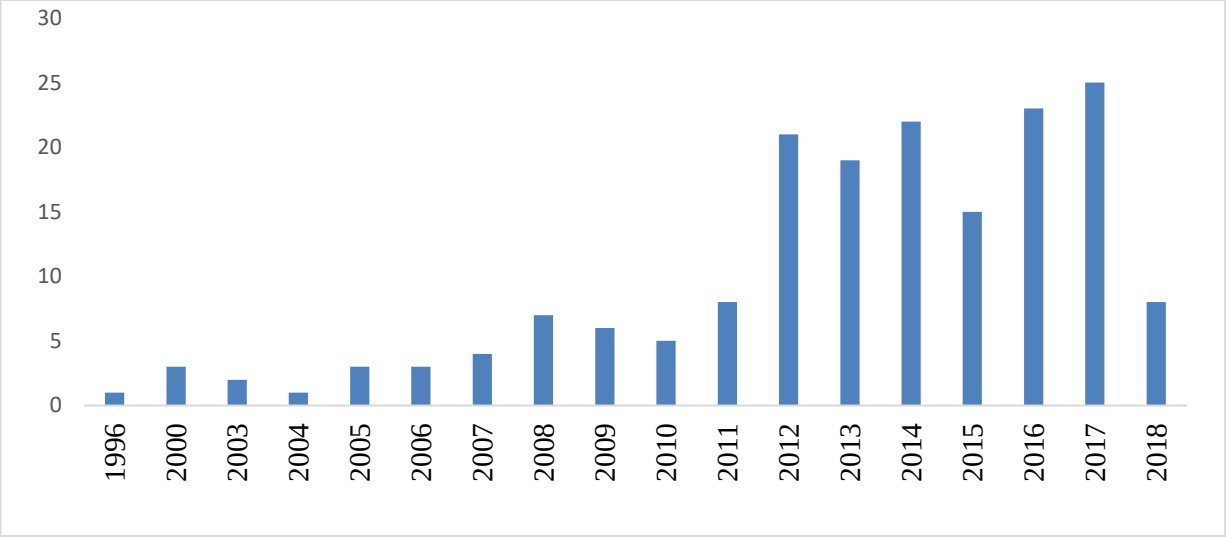

Figure 1. Number of empirical studies that test the relationship between sustainable supply chain management practices and firm performance.

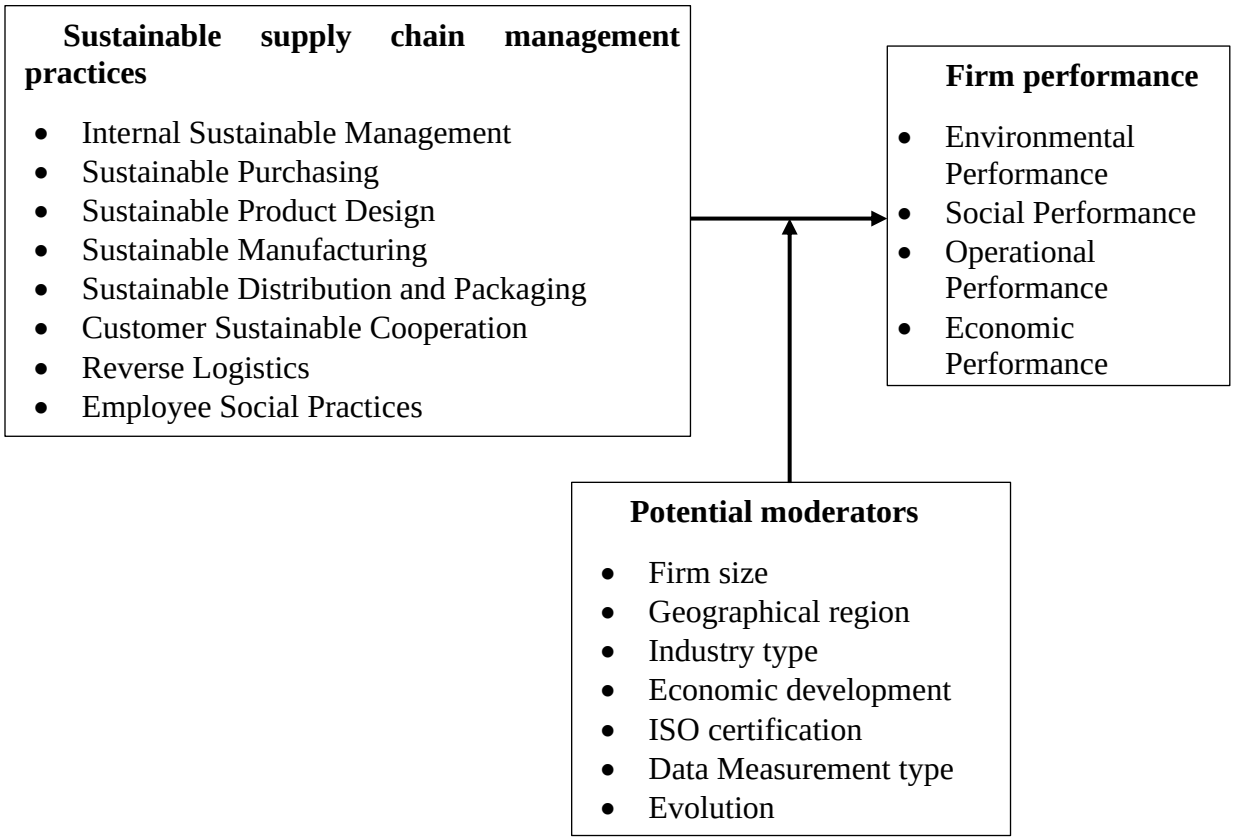

Figure 2. Research framework.

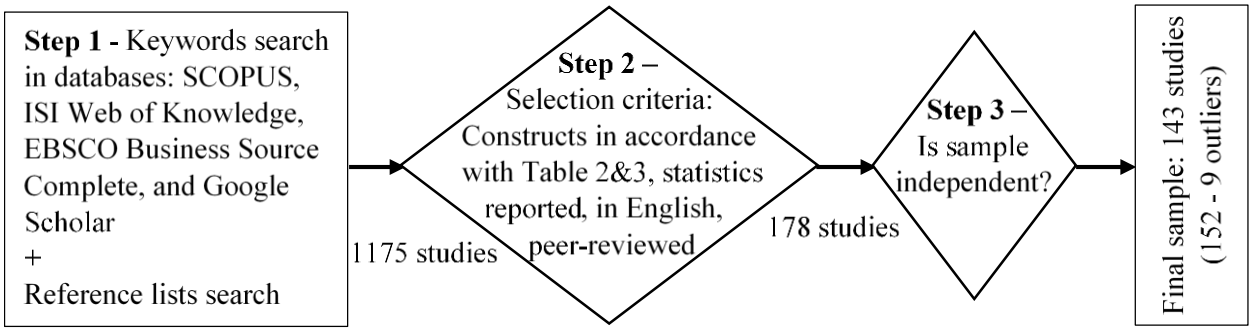

Figure 3. Literature search and selection process for studies included in the meta-analysis.

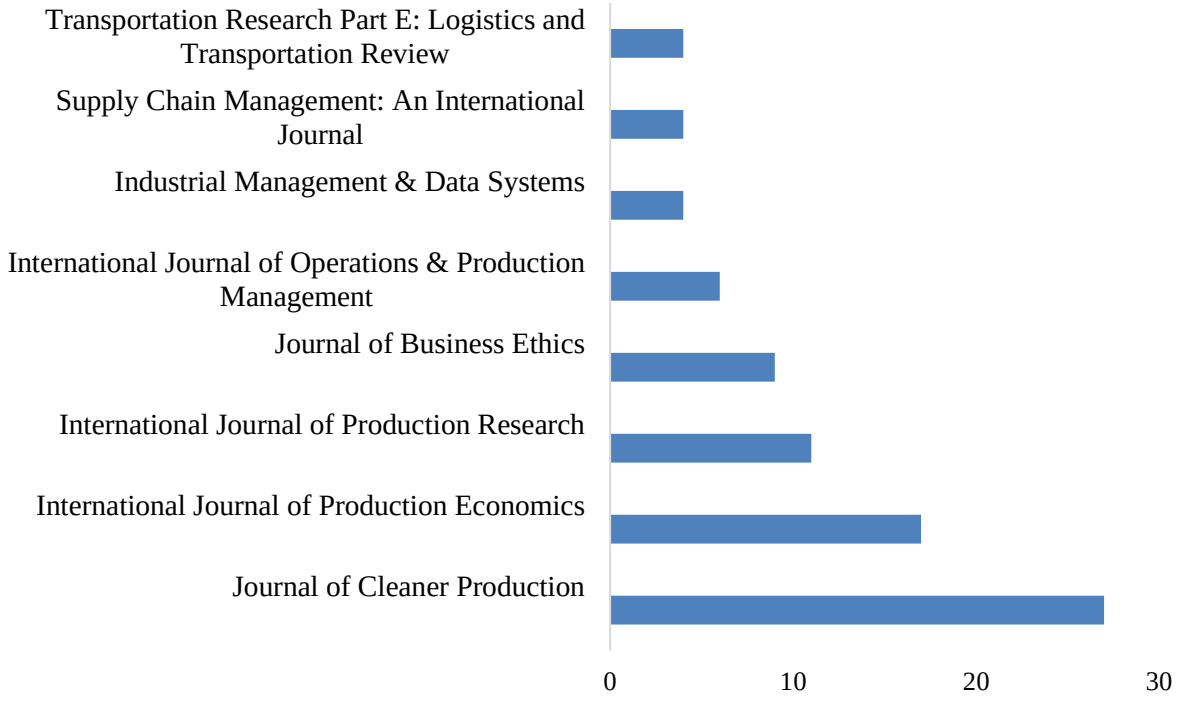

Figure 4. Distribution of reviewed studies by journal where four or more articles are published.

Appendix. Summary of data coded from primary studies used in the meta-analysis.

Appendix. Summary of data coded from primary studies used in the meta-analysis.

No.	Study	Sample size	Analysis Method	Theoretical lenses	Firm size	Region	Industry	ISO Certified	Data
1	Roberts and Gehrke (1996)	5	Regression analysis	N/A	Large	New Zealand	Metallurgy	Yes	Self-report
2	Carter et al. (2000)	437	Regression analysis	N/A	Large	USA	Various	No	Self-report
3	Christmann (2000)	88	Regression analysis	RBV	Large	USA	Chemical	No	Archival
4	Gilley et al. (2000)	71	Regression analysis	RBV	Large	USA	Various	No	Archival
5	Kassinis and Soteriou (2003)	104	PLS-SEM	N/A	SMEs	Many countries	Hospitality	No	Self-report
6	Sroufe (2003)	1118	CB-SEM	NRBV	Large	USA	Various	Yes	Archival
7	Zhu and Sarkis (2004)	186	Hierarchical moderated regression	N/A	Mixed	China	Various	No	Self-report
8	González-Benito and González-Benito (2005)	185	Multiple regression	N/A	Mixed	Spain	Various	No	Self-report
9	Rao and Holt (2005)	52	CB-SEM	N/A	Mixed	Many countries	Various	Yes	Self-report
10	Richey et al. (2005)	118	Regression analysis	N/A	Mixed	USA	Automotive	No	Self-report
11	Ann et al. (2006)	45	Regression analysis	N/A	Large	Malaysia	Various	Yes	Self-report
12	Chen et al. (2006)	203	Regression analysis	N/A	Large	Taiwan	Electronics	No	Self-report
13	Vachon and Klassen (2006)	84	Hierarchical regression	NRBV	Large	USA and Canada	Printing	No	Self-report
14	Chien and Shih (2007)	151	CB-SEM	ST	Mixed	Taiwan	Electronics	Yes	Self-report
15	Chung and Tsai (2007)	107	Multiple regression	N/A	Large	Taiwan	Electronics	No	Self-report
16	Zhu and Sarkis (2007)	341	Hierarchical moderated regression	IT	Mixed	China	Various	No	Self-report
17	Zhu et al. (2007)	89	Regression analysis	N/A	Large	China	Automotive	No	Self-report
18	Jayaram et al. (2008)	57	CB-SEM	N/A	Large	USA	Automotive	No	Self-report
19	Peng and Lin (2008)	101	CB-SEM	IT	Large	Taiwan	Electronics	No	Self-report
20	Wu et al. (2008)	1165	CB-SEM	RBV	Mixed	USA	Various	No	Self-report
21	Fraj-Andrés et al. (2009)	361	CB-SEM	NRBV	Mixed	Spain	Various	No	Self-report

22	López-Gamero et al. (2009)	208	CB-SEM	RBV	Mixed	Spain	Various	No	Self-report
	López-Gamero et al. (2009)	240	CB-SEM	RBV	Mixed	Spain	Hospitality	No	Self-report
23	Pullman et al. (2009)	117	Path analysis	NRBV	SMEs	USA	Food	No	Self-report
24	Rodríguez (2009)	195	PLS-SEM	N/A	Mixed	Spain	Various	Yes	Self-report
25	Shukla et al. (2009)	30	Regression analysis	N/A	SMEs	India	Automotive	No	Self-report
26	Huang and Wu (2010)	181	Multiple regression	N/A	Mixed	Taiwan	Electronics	No	Self-report
27	Yang et al. (2010)	107	Multiple regression	N/A	Large	Taiwan and China	Electronics	No	Self-report
28	Zeng et al. (2010)	125	PLS-SEM	NRBV	Large	China	Various	Yes	Self-report
29	Chang (2011)	106	PLS-SEM	NRBV	Mixed	Taiwan	Various	No	Self-report
30	Chiou et al. (2011)	124	CB-SEM	N/A	Mixed	Taiwan	Various	Yes	Self-report
31	Eltayeb et al. (2011)	132	Multiple regression	N/A	Mixed	Malaysia	Various	Yes	Self-report
32	Large and Thomsen (2011)	109	PLS-SEM	N/A	Mixed	Germany	Various	No	Self-report
33	Paulraj (2011)	145	CB-SEM	NRBV and RV	Mixed	USA	Various	No	Self-report
34	Yang et al. (2011)	309	CB-SEM	N/A	Mixed	Many countries	Various	No	Archival
35	Albino et al. (2012)	347	Regression analysis	RBV and RV	Large	USA	Various	Yes	Archival
36	Ar (2012)	140	CB-SEM	N/A	SMEs	Turkey	Various	No	Self-report
37	Ateş et al. (2012)	96	PLS-SEM	CT	Mixed	Turkey	Various	Yes	Self-report
38	Chan et al. (2012)	194	Path analysis	NRBV	Large	China	Various	No	Self-report
39	De Giovanni (2012)	240	CB-SEM aN/A PLS-SEM	N/A	Large	Italy	Various	No	Self-report
40	Gimenez et al. (2012)	519	Regression analysis	NRBV	SMEs	Many countries	Various	No	Archival
41	Green et al. (2012)	159	CB-SEM	N/A	Large	USA	Food	No	Self-report
42	Hollos et al. (2012)	70	PLS-SEM	RBV and RDT	Large	Many countries	Various	No	Self-report
43	Huang et al. (2012)	349	CB-SEM	N/A	Mixed	Taiwan	Electronics	No	Self-report
44	Kim and Rhee (2012)	249	CB-SEM	N/A	Mixed	S. Korea	Various	No	Self-report
45	Kung et al. (2012)	118	Multiple regression	N/A	Mixed	Taiwan	Various	No	Self-report
46	Lai and Wong (2012)	128	CB-SEM	Structuration theory	Mixed	China	Various	No	Self-report
47	Lee et al. (2012)	223	CB-SEM	RDT	SMEs	S. Korea	Various	No	Self-report

48	Schoenherr (2012)	1211	Ordinary-least squares regression	RBV and production frontiers theory	Large	Many countries	Various	No	Archival
49	Simpson (2012)	220	CB-SEM	RBV	Mixed	USA	Various	No	Self-report
50	Wong et al. (2012)	122	CB-SEM	NRBV	Mixed	Taiwan	Electronics	No	Self-report
51	Zailani et al. (2012)	105	Multiple regression	TCT	Mixed	Malaysia	Various	No	Self-report
52	Zhu et al. (2012)	396	Hierarchical regression	Coordination theory	Mixed	China	Various	No	Self-report
53	Agan et al. (2013)	500	PLS-SEM	N/A	SMEs	Turkey	Various	No	Self-report
54	Gimenez and Sierra (2013)	158	PLS-SEM and Cluster analysis	RBV and TCT	Mixed	Spain and Germany	Various	No	Self-report
55	Grekova et al. (2013)	90	PLS-SEM	RBV	Mixed	Holland	Food	No	Self-report
56	Hajmohammad et al. (2013)	94	PLS-SEM	NRBV	Mixed	Canada	Various	No	Self-report
57	Ketikidis et al. (2013)	58	Regression analysis	N/A	Mixed	Kosovo	Construction	No	Self-report
58	Kuei et al. (2013)	113	CB-SEM	N/A	Mixed	China	Various	No	Self-report
59	Laosirihongthong et al. (2013)	190	Multivariate regression	IT	Large	Thailand	Various	Yes	Self-report
60	Lee et al. (2013)	119	PLS-SEM	N/A	Mixed	Malaysia	Various	Yes	Self-report
61	Sambasivan et al. (2013)	291	CB-SEM	RBV and ST	Mixed	Malaysia	Various	No	Self-report
62	Sezen and Çankaya (2013)	53	Regression analysis	N/A	Large	Turkey	Various	No	Self-report
63	Singhal (2013)	91	Multiple regression	N/A	Mixed	India	Electronics	No	Self-report
64	Van den Berg et al. (2013)	75	Kendall's tau b correlation coefficient	N/A	Mixed	S. Africa	Various	No	Self-report
65	Wang and Sarkis (2013)	333	Regression analysis	N/A	Large	USA	Various	Yes	Archival
66	Yang et al. (2013)	132	CB-SEM	N/A	Mixed	Taiwan	Shipping and logistics	No	Self-report
67	Ye et al. (2013)	209	CB-SEM	IT	Large	China	Electronics	No	Self-report
68	Youn et al. (2013)	141	CB-SEM	N/A	Mixed	S. Korea	Various	No	Self-report
69	Abdullah and Yaakub (2014)	101	PLS-SEM	N/A	Mixed	Malaysia	Various	No	Self-report
70	Bag (2014)	103	Regression analysis	N/A	Mixed	India	Various	No	Self-report

71	Blome et al. (2014)	114	PLS-SEM	NRBV and IT	Mixed	Many countries	Various	No	Self-report
72	Cheng et al. (2014)	121	CB-SEM	NRBV	Large	Taiwan	Electronics	No	Self-report
73	Dong et al. (2014)	245	Regression analysis	N/A	Mixed	China	Various	No	Self-report
74	Hung et al. (2014)	160	PLS-SEM	Social capital theory	Mixed	Taiwan	Electronics	Yes	Self-report
75	Jabbour et al. (2014)	95	PLS-SEM	N/A	Mixed	Brazil	Various	Yes	Self-report
76	Koo et al. (2014)	121	PLS-SEM	N/A	Mixed	S. Korea	Various	No	Self-report
77	Li (2014)	148	CB-SEM	RBV and IT	Mixed	China	Various	No	Self-report
78	Lirn et al. (2014)	80	CB-SEM	NRBV	Mixed	Taiwan	Shipping and logistics	No	Self-report
79	Luthra et al. (2014)	123	Multiple regression	N/A	Mixed	India	Automotive	No	Self-report
80	Mitra and Datta (2014)	81	CB-SEM	N/A	Mixed	India	Various	Yes	Self-report
81	Perramon et al. (2014)	374	CB-SEM	N/A	SMEs	Spain	Food	No	Self-report
82	Stefanelli et al. (2014)	80	PLS-SEM	N/A	SMEs	Brazil	Bioenergy	No	Self-report
83	Vijayvargy and Agarwal (201	161	CB-SEM	N/A	Mixed	India	Various	No	Self-report
84	Wolf (2014)	1621	Regression analysis	RDT	Mixed	Many countries	Various	No	Archival
85	Wu et al. (2014)	172	Hierarchical regression	N/A	Mixed	Taiwan	Various	No	Self-report
86	Yu et al. (2014)	126	CB-SEM	N/A	Mixed	China	Automotive	No	Self-report
87	Chen et al. (2015)	205	Hierarchical moderated regression	NRBV and ST	Mixed	Taiwan	Electronics	No	Self-report
88	Choi and Hwang (2015)	230	Hierarchical regression	NRBV and RV	Mixed	S. Korea	Various	Yes	Self-report
89	Dubey et al. (2015)	174	Multiple regression	IT, behavioral and human agency theory	Mixed	India	Rubber	No	Self-report
90	Dubey et al. (2015)	167	Hierarchical regression	IT	Mixed	India	Various	No	Self-report
91	Feng et al. (2015)	214	Hierarchical moderated regression	RBV and CT	Large	China	Various	No	Self-report

92	Graham and Potter (2015)	149	Hierarchical regression	NRBV	Mixed	UK	Food	No	Self-report
93	Green et al. (2015)	225	PLS-SEM	Resource-advantage theory	Mixed	USA	Various	No	Self-report
94	Küçükoğlu and Pınar (2015)	162	Regression analysis	N/A	Large	Turkey	Various	Yes	Self-report
95	Kuei et al. (2015)	167	PLS-SEM	N/A	Mixed	China	Various	No	Self-report
96	Luzzini et al. (2015)	383	CB-SEM	RBV	Mixed	Many countries	Various	No	Archival
97	Severo et al. (2015)	298	CB-SEM	N/A	Mixed	Brazil	Various	No	Self-report
98	Tachizawa et al. (2015)	71	PLS-SEM	RV and IT	Mixed	Spain	Various	No	Self-report
99	Zailani et al. (2015)	153	PLS-SEM	IT	Large	Malaysia	Automotive	Yes	Self-report
100	Adebanjo et al. (2016)	159	CB-SEM	RBV and IT	Mixed	Many countries	Various	No	Self-report
101	Aɬan et al. (2016)	314	PLS-SEM	N/A	Large	Turkey	Various	No	Self-report
102	Chan et al. (2016)	250	CB-SEM	CT	Mixed	China	Various	No	Self-report
103	Esfahbodi et al. (2016)	56	Multiple regression	RDT	Large	Iran	Various	No	Self-report
	Esfahbodi et al. (2016)	72	Multiple regression	RDT	Large	China	Various	No	Self-report
104	Gopal and Thakkar (2016)	98	PLS-SEM	N/A	Mixed	India	Automotive	No	Self-report
105	Grekova et al. (2016)	139	CB-SEM	RBV and RV	Mixed	Holland	Food	No	Self-report
106	Gualandris and Kalchschmidt (2016)	77	PLS-SEM	RBV and RV	Mixed	Italy	Various	No	Self-report
107	Hojnik and Ruzzier (2016)	223	CB-SEM	IT	Mixed	Slovenia	Various	No	Self-report
108	Khaksar et al. (2016)	139	PLS-SEM	N/A	Mixed	Iran	Construction	No	Self-report
109	Khor et al. (2016)	89	Hierarchical regression	RBV	Mixed	Malaysia	Electronics	Yes	Self-report
110	Kirchoff et al. (2016)	367	CB-SEM	RBV and Strategic choice theory	Large	USA	Various	No	Self-report
111	Laari et al. (2016)	119	PLS-SEM	NRBV	Mixed	Finland	Various	No	Self-report
112	Laari Solakivi et al. (2016)	311	Hierarchical regression	NRBV and RV	Mixed	Finland	Shipping and logistics	No	Self-report
113	Lee (2016)	366	Hierarchical regression	N/A	SMEs	S. Korea and Vietnam	Various	No	Self-report
114	Li et al. (2016)	256	CB-SEM	NRBV and ST	Mixed	China	Various	No	Self-report

115	Longoni et al. (2018)	74	PLS-SEM	RBV	Mixed	Italy	Various	No	Self-report
116	Sancha et al. (2016)	170	CB-SEM	TCT and Social exchange theory	Mixed	Hong Kong	Textile	No	Self-report
117	Tang et al. (2016)	141	Regression analysis	N/A	Mixed	Hong Kong	Various	No	Self-report
118	Woo et al. (2016)	103	PLS-SEM	NRBV and Social capital theory	Mixed	S. Korea	Construction	No	Self-report
119	Younis et al. (2016)	117	Multiple regression	N/A	Mixed	UAE	Various	No	Self-report
120	Zhang and Yang (2016)	124	PLS-SEM	ST	Mixed	China	Various	No	Self-report
121	Abdul-Rashid et al. (2017)	115	PLS-SEM	N/A	Mixed	Malaysia	Various	Yes	Self-report
122	Ali et al. (2017)	84	PLS-SEM	IT and RDT	SMEs	UK	Various	No	Self-report
123	Amjad et al. (2017)	360	CB-SEM	ST	Mixed	Pakistan	Various	No	Self-report
124	Balasubramanian and Shukla (2017)	455	Path analysis	N/A	Mixed	UAE	Construction	No	Self-report
125	Dai et al. (2017)	229	CB-SEM	RBV	Mixed	USA	Various	No	Self-report
126	Das (2017)	255	Confirmatory factor analysis	N/A	Mixed	India	Various	No	Self-report
127	Esfahbodi et al. (2017)	146	CB-SEM	IT	Large	UK	Various	No	Self-report
128	Gorane and Kant (2017)	292	CB-SEM	N/A	Mixed	India	Various	No	Self-report
129	Huang and Li (2017)	418	CB-SEM	Social network theory	Mixed	Taiwan	Electronics	No	Self-report
130	Huang et al. (2017)	380	CB-SEM	IT and Stewardship theory	Mixed	Taiwan	Electronics	No	Self-report
131	Khan and Qianli (2017)	218	Multiple regression	N/A	Mixed	Pakistan	Various	No	Self-report
132	Khan et al. (2017)	415	Hierarchical regression	N/A	Mixed	China	Various	No	Self-report
133	Masa'deh et al. (2017)	150	CB-SEM	N/A	SMEs	Jordan	Hospitality	No	Self-report
134	Miroshnychenko et al. (2017)	3490	Regression analysis	N/A	Mixed	Many countries	Various	No	Archival
135	Paulraj et al. (2017)	259	CB-SEM	RBV, ST, IT, and utilitarianism theory	Mixed	Germany	Various	No	Self-report
136	Schmidt et al. (2017)	284	CB-SEM	NRBV and ST	Mixed	Germany, Austria & Switzerland	Various	No	Self-report

137	Shafiq et al. (2017)	149	Path analysis	Agency theory	Large	USA	Various	No	Archival
138	Vanalle et al. (2017)	41	PLS-SEM	IT	Large	Brazil	Automotive	No	Self-report
139	Yang (2017)	129	PLS-SEM	IT	Mixed	Taiwan	Shipping and logistics	No	Self-report
140	Aboelmaged (2018)	238	PLS-SEM	NRBV	SMEs	Egypt	Various	No	Self-report
141	Mani et al. (2018)	300	CB-SEM	RBV, ST, and RDT	Mixed	India	Various	No	Self-report
142	Petljak et al. (2018)	190	PLS-SEM	N/A	Mixed	Croatia	Food	No	Self-report
143	Wang and Dai (2018)	172	PLS-SEM	RBV and TCT	Mixed	China	Various	No	Self-report
	Summary	33886	CB-SEM: 35% PLS-SEM: 24% Regres analysis:14% Multipl regres: 10% Hierarch regres: 7% Others: 10%	Including RBV:17% Includ NRBV:16% Instituti theory: 7% Stakehol theory: 2% N/A: 46% Others: 12%	Large:24% SMEs: 9% Mixed:67%	China: 14% Taiwan: 13% USA: 12% India: 8% Many countri:8% Others: 45%	Electronics:11% Automotive:6% Food: 5% Shipping: 3% Various: 66% Others: 9%	No: 85% Yes: 15%	Archival: 8% Self-report: 92%

Notes: PLS-SEM= Partial Least Squares Structural Equation Modelling; CB-SEM = Covariance based Structural Equation Modelling;
(N)RBV = (Natural) Resource-based view; IT = Institutional theory; ST = Stakeholder theory; RV = Relational view; RDT = Resource dependence theory; TCT = Transaction cost theory; CT = Contingency theory;
N/A = Not Available.