

Why and how do suppliers develop environmental management capabilities in response to buyer-led development initiatives?

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Abstract

Purpose – Although buying firms increasingly adopt supplier development to help suppliers enhance their ability to deal with environmental issues, little is known about the mechanisms by which buyer-led environmental supplier development (ESD) affects the environmental management capabilities (EMC) of suppliers. Focusing on the supplier perspective and specifically on the role of psychological mechanisms at the supplier level, the authors adopt the stimulus–organism–response framework from functionalist psychology to investigate the mediating role of environment-related supplier perceived relationship value in the association between ESD, in the form of environmental requirements and audits (indirect development – ID) vs. direct development projects (direct development – DD), and supplier EMC.

Design/methodology/approach – The authors used structural equation modeling and regression analysis to test the hypotheses using survey data from 221 supplying organizations in China.

Findings – Results reveal that each of the three considered dimensions of the environment-related supplier perceived relationship value (i.e. economic, strategic and co-creation) helps enhance EMC. However, while DD influences positively all three dimensions, ID has a positive effect on only the economic and strategic dimensions. Moreover, the mediation analysis suggests that, while DD affects EMC both directly and via the three dimensions of environment-related supplier perceived relationship value (partial mediation), ID affects EMC only through its impact on environment-related supplier perceived relationship economic and strategic value (full mediation).

Originality/value – The study sheds light on the psychological mechanisms that drive suppliers' involvement in green supplier development activities. By doing so, it contributes to the understanding of ESD practices and processes and their effectiveness.

Keywords Supply-chain management, Competencies, Green supply chains, SCM practices, Supplier – manufacturer relationships, Relationship value

Paper type Research paper

1. Introduction

As external environments become continuously more complex and dynamic, and the pace of competition accelerates, firms increasingly resort to interorganizational collaboration to gain and sustain competitive advantages (Brito and Miguel, 2017; Daghar *et al.*, 2021). Buying firms, in particular, leverage supplier networks from which they draw both tangible and intangible assets that complement or add to their own resource base (Capaldo, 2007; Skipworth *et al.*, 2023). Although buyers are used to draw on a variety of organizational competencies of their supplying partners—concerning, among others, design, manufacturing, communication, transportation and logistics (Adebanjo *et al.*, 2018; Paulraj *et al.*, 2017; Woo *et al.*, 2016)—the environmental management capabilities of suppliers have become of the utmost strategic importance for their customers in several industries (Lee and Klassen, 2008; Wang *et al.*,

2021). Indeed, as a growing number of stakeholder categories prioritize sustainability issues in their agendas, buyers need to “green” their supply chains (Lee *et al.*, 2013; Vidal *et al.*, 2022; Liu *et al.*, 2023a, 2023b).

Extant research has shown that support and cooperation of suppliers to corporate green initiatives is urgently needed for buying firms to transfer sustainability practices across the

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supply chain and that the greening of the buying firms' supply chains largely depends on the suppliers' environmental awareness and environmental management capabilities (Saghiri and Mirzabeiki, 2021; Simpson *et al.*, 2007). Suppliers with strong environmental management capabilities can mitigate environmental risks in their operations and develop green products and processes, which is essential to the effective implementation of environmentally friendly supply chains (Wang *et al.*, 2021; Hajmohammad *et al.*, 2024). For instance, Kaiping Benda Textile Co. Ltd. actively implemented multiple water-saving projects by modifying and upgrading its existing equipment and technology. Through these initiatives, the company successfully aided the customer Kontoor Brands in reaching its water conservation goals [1]. Analogously, the energy-saving and emission reduction measures implemented, both internally and across its supply chain, by the Taiwanese company Foxconn, the world's largest contract manufacturer of electronics, have laid a solid groundwork for establishing a sustainable supply chain for Apple [2]. Thus, buying firms are increasingly asking their suppliers to develop or upgrade their capabilities to deal with environmental issues (Rao and Holt, 2005; Shumon *et al.*, 2019).

Nevertheless, suppliers often strive to meet their customers' environmental requirements due to limited financial resources, lack of human resource expertise and difficulties in identifying and acting on relevant information (Shumon *et al.*, 2019; Ingenbleek and Krampe, 2023). A useful tool for buying firms to promote and expand the environmental competence of their supplying counterparts is environmental supplier development (Jia *et al.*, 2023), which typically includes key activities such as supplier evaluation and motivation and management participation (Gimenez *et al.*, 2012; Danese *et al.*, 2018). A number of scholars have shown how buyers rely on environmental supplier development to encourage and drive suppliers to implement green practices by enhancing their environmental management capabilities through, among others, environmental assessment, knowledge transfer and information sharing activities (Busse *et al.*, 2016; Jia *et al.*, 2023; Saghiri and Mirzabeiki, 2021).

Environmental supplier development raises nontrivial challenges, however. Practitioners observe that supplying firms involved into the same supplier development programs often react differently to their customers' actions and experience different environmental performance (EP) (Busse *et al.*, 2016). For example, despite Schaeffler Group requires suppliers to comply with strict environmental guidelines and collaborates with them to enhance their environmental management capabilities, one of its suppliers repeatedly violated environmental regulations, which caused the company to suspend production of a critical component (Qiao *et al.*, 2022). A lack of understanding about why some participating suppliers have successfully adopted environmental practices and improved their environmental capabilities, while others have not, increases uncertainty, on the customers' side, about whether to invest in environmental supplier development programs and how they should be organized. Scholars who have tried to dispel these doubts have typically focused on the characteristics of the buying firms' initiatives (Yu *et al.*, 2017), but no unified conclusion has been reached.

Some scholars have found that setting strict environmental constraints on suppliers, conducting rigorous assessment and

giving timely feedback and careful assistance to them to act on nonconformities (i.e. indirect development [ID]) are effective ways to improve suppliers' EP and capabilities (Chen and Chen, 2019; Lee and Klassen, 2008; Yadlapalli *et al.*, 2018). Other scholars argue instead that buyers' activities aimed at auditing and monitoring suppliers may impede the development of trust and increase the likelihood of conflict in buyer-supplier relationships, making suppliers resistant to adhere to the customers' environmental standards, or even driving them to exhibit opportunistic behavior (Tachizawa *et al.*, 2015). Therefore, a considerable literature cautions buying firms to adopt direct development (DD) initiatives, which require relationally intensive collaborative approaches, based on social mechanisms such as interpersonal relations, trust and reciprocity, that facilitate the interorganizational transfer of environmental knowledge along the supply chain and the joint development of green products and processes (Wang *et al.*, 2021; Capaldo, 2014; Qiao *et al.*, 2022).

The inconsistent results of the existing studies suggest two possible research strategies, aimed at exploring, respectively, the conditions that may facilitate or hamper the (indirect vs direct) environmental supplier development programs implemented by buying firms (i.e. "when" research questions, which require moderation analysis) (e.g. Alghababsheh *et al.*, 2020; Sancha *et al.*, 2019; Shafiq *et al.*, 2022; Qiao *et al.*, 2022), and on the motivations and mechanisms underlying the effectiveness of those programs (i.e. "why and how" research questions, which require mediation analysis) (e.g. Allenbacher and Berg, 2023; Benton *et al.*, 2020; Saghiri and Mirzabeiki, 2021). Regardless of whether they employed research strategies based on moderation or mediation analysis, however, previous studies exhibit two major limitations.

First, they have typically adopted the buyer's perspective, while the willingness and commitment of suppliers to the buyers' development initiatives (Jia *et al.*, 2023; Qiao *et al.*, 2022) and the suppliers' perspective more broadly (Tate *et al.*, 2012; Saghiri and Mirzabeiki, 2021) have received scant attention. Second, only recently the crucial role of the psychological dimension in the suppliers' reactions to their customers' environmental development programs has been explicitly acknowledged and included into the picture for the purposes of empirical research. Along this vein, Qiao *et al.* (2022) examined the moderating role of the suppliers' perceptions of the attractiveness and justice of their supply chain relationships in the association between green supply chain management initiatives implemented by buying firms and the environmental commitment of suppliers.

While the study by Qiao *et al.* (2022) adopts a research strategy based on moderation analysis to shed some light on "when" (i.e. the supplier-side psychological conditions under which) buyer-led environmental supplier development practices lead suppliers to increase their environmental commitment and performance, we argue that suppliers' perceptions can also help explain "why and how" those practices can be effective, or in other words, the supplier-side motivations and psychological mechanisms behind suppliers' responses to the buyers' practices. This, however, requires mediation analysis. Accordingly, the present study adopts a mediation research strategy to answer, from the supplier's perspective, the following research question:

RQ1. Why and how do suppliers develop environmental management capabilities in response to buyer-led environmental supplier development initiatives?

By addressing this question, we expect to gain a more thorough understanding of the role of the psychological dimension in the effectiveness of buyer-led supplier development practices. Doing so will also enrich our knowledge of how buying firms can proactively influence the effectiveness of those practices by creating the conditions that may facilitate a positive response by suppliers, with major implications for practitioners seeking to design and implement more effective supplier development initiatives.

We tackle the research question of this study by drawing on Stimulus–Organism–Response (SOR) theory from functionalist psychology (Jacoby, 2002). SOR theory purports that environmental stimuli can influence an individual's internal state, which in turn affects his/her behavior (Jacoby, 2002). This makes the SOR framework particularly well-suited to the purposes of this study, whose primary objective is to explore the underlying psychological mechanisms that drive supplier responses to buyer-led environmental development initiatives.

Specifically, we conceive of buyer-led environmental supplier development programs as external stimuli that trigger a psychological reaction on the supplier side, which in turn influence the supplier's decision to commit resources to the development of environmental management capabilities. We argue that the suppliers' perceptions about the financial, strategic and co-creation value they can obtain by engaging in environmental activities within buyer–supplier relationships play a mediating role in the association between buyer-led environmental supplier development and suppliers' environmental management capabilities. Our findings suggest that such a mediating role is different in the case of indirect vs direct supplier development initiatives. While DD affects supplier environmental management capabilities both directly and indirectly via its impact on the three dimensions of suppliers' perceptions of the value creation potential of their customer relationships (partial mediation), ID does not exert a direct effect on supplier capabilities but affects them only through its impact on environment-related supplier perceived relationship economic and strategic value (full mediation).

By corroborating the salience of the psychological dimension in supply chain relationships and by showing how it exerts its effect, our study sheds light on the “why and how” of the effectiveness of environmental supplier development, thereby generating significant theoretical and practical implications for those interested in the development of the environmental management capabilities of suppliers and in green supply chain management more generally.

The remainder of the article is organized as follows. In Section 2 we outline the theoretical background of the study and review the relevant literature. In Section 3 we sketch out the conceptual framework of our research and articulate a number of testable research hypotheses. Methods and findings are illustrated in Sections 4 and 5, respectively. In Section 6, after discussing the main findings of our research and its most relevant theoretical and practical implications, we illustrate the

study's limitations and some avenues for further research that arise from our work.

2. Theoretical background and literature review

2.1 The effectiveness of buyer-led environmental supplier development

Previous literature has offered significant evidence of supplier development practices implemented by buying firms to enhance suppliers' capabilities and their business performance (Wagner, 2010; Saghiri and Wilding, 2021; Patrucco *et al.*, 2024). Nevertheless, studies are discordant on the effectiveness of such practices. Some scholars suggest that buyer-led supplier development reduce suppliers' environmental violations, improve suppliers' environmental compliance and offer to suppliers critical environmental resources and support (Jia *et al.*, 2023; Bai and Satir, 2022; Liu *et al.*, 2018). Other scholars observe that environmental supplier development essentially consists of substantial relation-specific investments on the buyers' side, which strengthen the suppliers' bargaining power and increase the risk that suppliers behave opportunistically (Alghababsheh *et al.*, 2023; Villena *et al.*, 2011).

Recent studies have focused on the reasons for the inconsistent conclusions of previous research by adopting moderation or mediation research strategies. Studies which have pursued the former strategy have usefully informed our understanding of the boundary conditions for the effectiveness of environmental supplier development practices (i.e. “when”, or under which conditions, they are effective) by focusing on contextual, relational and firm-specific factors that may affect the outcomes of buyer-led environmental supplier development, such as: relationship stability, relationship adaptability and product complexity (Sancha *et al.*, 2016); supplier dependence (Sancha *et al.*, 2019); social capital (Alghababsheh *et al.*, 2020); buyer firm's cultural sensitivity and operations cognizance (Shafiq *et al.*, 2022); and suppliers' perceived relationship attractiveness and justice (Qiao *et al.*, 2022) (Table 1).

These studies, however, have left unanswered questions concerning the “why and how” of the effectiveness of buyer-led supplier development initiatives (i.e. the reasons behind their effectiveness and related mechanisms), to which the latter research strategy is most suitable. Thus, other scholars have looked at the processes and mechanisms by which environmental supplier development accomplishes the strategic goal of “greening” suppliers, thereby identifying a number of mediating variables. Table 2 summarizes studies adopting a mediation approach to delve into the effectiveness of buyer-led supplier development and their main findings.

Starting from the assumption that supplier development practices are primarily aimed at fostering the ability of suppliers to meet the current and future needs of their customers, these studies have typically adopted supplier performance as the dependent variable. Drawing on the resource dependence theory, Benton *et al.* (2020) have showed that tight buyer–supplier relationships characterized by bilateral communication, commitment and cooperation exert a positive mediation effect on the relationship between buyer-led supplier development and supplier performance in terms of product quality, delivery

Table 1 Moderating variables of the effectiveness of buyer-led supplier development

Moderating variables	Outcome	Main findings	Reference
Relationship stability; relationship adaptability; product complexity	Supplier environmental commitment	Relationship stability/adaptability and product complexity positively moderate the effect of buyer-led supplier development initiatives on suppliers' environmental commitment	Sancha et al. (2016)
Supplier dependence	Supplier performance	Supplier dependence enhances the positive effect of buyers' environmental development practices on supplier performance	Sancha et al. (2019)
Social capital	Supplier social performance	When relational and structural social capital are manifested in buyer–supplier relationships, buyers' assessment practices become significant in driving suppliers' social performance	Alghababsheh et al. (2020)
Buyer's cultural sensitivity; buyer's operations cognizance	Supply chain performance	A buying firm's cultural sensitivity and operational cognizance toward its suppliers strengthens the positive relationship between buyer-led supplier development initiatives and supply chain performance	Shafiq et al. (2022)
Supplier perceived relationship attractiveness and justice	Supplier environmental commitment	Suppliers' perceptions of the relationship attractiveness and fairness enhance the positive effect that buying firms' green supply chain management initiatives exerts on suppliers' environmental commitment	Qiao et al. (2022)

Source: Authors' own work

performance, price, responsiveness to changes and service support. [Maestrini et al. \(2018\)](#) have employed a theoretical framework based on the agency theory to examine the intervening role of goal congruence and supplier opportunism in the relationships between two key supplier performance measurement and management practices (i.e. monitoring and incentives) and suppliers' operational performance. Results do not support the mediating role of goal congruence and show that supplier opportunism is a positive mediator of the monitoring–performance link (i.e. monitoring reduces opportunism, which in turn positively affects performance) but a negative mediator of the incentives–performance link (i.e. incentives increase opportunism, which in turn reduces performance). Drawing on the resource-based view, [Saghiri and Mirzabeiki \(2021\)](#) have found that buyer-led environmental supplier development affects the ability of suppliers to implement environment-related activities through its positive effect on the propensity of suppliers to both allocate resources to the environmental development programs of their buying counterparts and collaborate with them.

Interestingly for our purposes, some scholars have emphasized the role of the environmental management capabilities of suppliers for the effectiveness of buyers' environmental supplier development programs, thus focusing on such capabilities as a crucial intervening variable in the relationship between buyer-led environmental supplier development and its outcomes. Accordingly, [Shumon et al.](#)

(2019) have suggested that the environmental supplier development initiatives implemented by buying firms improve suppliers' financial and EP through their influence on the environmental capability of suppliers. Recently, [Allenbacher and Berg \(2023\)](#) have hypothesized a mediating role for suppliers' sustainable supply chain management capabilities in the relationship between different types of buyers' sustainable supply chain management practices (assessment vs cooperation) and suppliers' sustainable supply chain management practices, but found confirmation only for the mediating role of cooperation.

In sum, extant research on the effectiveness of buyer-led supplier development has focused on the intervening processes and mechanisms by which buyer-led supplier development improves supplier performance. This research has showed the role of supplier environmental management capabilities as a basic antecedent of supplier performance and a mediator in the relationship between buyer-led supplier development and its outcomes. This research has also showed that different types of supplier development initiatives may have different effects on supplier capabilities and performance. However, the missing link is explaining why and how (different types of) supplier development initiatives affect supplier environmental management capabilities. Taking on this question, we focus on the psychological mechanisms behind suppliers' responses to buyers' initiatives, and in particular on the mediating role of the

Table 2 Mediating mechanisms in the effectiveness of buyer-led supplier development

Mediating variables	Outcome	Main findings	Reference
Bilateral communication, cooperation and commitment	Supplier performance	Buyer-led supplier development programs improve suppliers' performance by enhancing bilateral communication, cooperation and commitment	Benton <i>et al.</i> (2020)
Goal congruence and supplier opportunism	Supplier performance	Buyer-led supplier development activities influence suppliers' performance by affecting supplier opportunism	Maestrini <i>et al.</i> (2018)
Supplier resource allocation and collaboration with the buyer	Supplier environmental activities	Supplier resource allocation mediates the relationship between buyer-led environmental supplier development and the supplier energy efficiency and logistics and transport activities, while the mediating role of buyer–supplier collaboration is effective only on the supplier logistics and transport activities	Saghiri and Mirzabeiki (2021)
Suppliers' environmental capability	Supplier environmental and financial performance	The stringency of buyers' environmental requirements improves suppliers' environmental capability, which in turn enhances their environmental performance	Shumon <i>et al.</i> (2019)
Suppliers' sustainable supply chain management capabilities	Suppliers' sustainable supply chain management practices	Buyers' cooperation (vs. assessment) practices help improve suppliers' adoption of sustainable supply chain management practices by enhancing the suppliers' sustainable supply chain management capabilities	Allenbacher and Berg (2023)

Source: Authors' own work

value suppliers perceive they can draw from the relationships with their purchasing counterparts by engaging in buyer-led environmental management activities.

2.2 Supplier environmental management capability

Environmental management capability (EMC) is usually understood as a firm's ability to respond to the environmental requirements of its stakeholders and improve performance on environmental issues (Bowen *et al.*, 2001; Lee and Klassen, 2008). Specifically, supplier environmental management capability encompasses the assets, technologies, organizational knowledge and skills that enable suppliers to respond in a timely and effective manner to environmental issues in their business systems and processes and to the environmental requirements of their buying counterparts (Wang *et al.*, 2021).

Supplier environmental management capability includes a number of activities to be performed by suppliers within and across their organizational boundaries, such as providing environmentally friendly products to their customers (Wong *et al.*, 2012), establishing an environmental management system that clearly allocates environmental responsibilities and provides effective training to employees on environmental issues (Tong *et al.*, 2023), prioritizing environmental issues in

their manufacturing and operations processes (Schoenherr *et al.*, 2014), assessing and improving the EP of upper-tier suppliers (Wilhelm and Villena, 2021) and managing environmentally sound relationships with several external stakeholders through various communication methods (Lee and Klassen, 2008).

2.3 Indirect vs. direct environmental supplier development

A variety of buyer-led supplier development practices have been identified and different classifications of those practices have been adopted (Allenbacher and Berg, 2023; Bai and Satir, 2022; Jia *et al.*, 2023). Some scholars have distinguished between reactive and proactive (or strategic) supplier development, based on the degree of involvement of the buying firm (Cox *et al.*, 2003). On the one hand, buying firms adopting reactive practices typically pass on the basic requirements to suppliers and expect suppliers to fulfill them without the significant participation of the customer. Proactive practices, on the other hand, include long-term partnership mechanisms wherein buying firms proactively make relation-specific investments. The distinction between reactive and proactive supplier development also reflects the resources committed by

the buying firm to the supplier. Buying firms adopting proactive practices place more emphasis on continuous and significant resource investment in their supplying counterparts, when compared to buying firms adopting reactive practices, who do not invest or invest only limited resources (Wagner, 2010).

Other scholars have focused on the motivation of the buying firm to implement supplier development, delineating two other types of supplier development practices. The first type is aimed at constraining supplier opportunistic behaviors and enhancing their compliance to standards by, among others, setting evaluation criteria, implementing routine evaluation and feedback and enhancing supplier improvement incentives (León Bravo *et al.*, 2022). The second type is aimed at actively seizing strategic opportunities and reaching competitive advantages by leveraging strategic activities such as supplier training and education, employee exchanges, management participation and financial investment (Glock *et al.*, 2017; Krause *et al.*, 2007; León Bravo *et al.*, 2022).

Based on the above literature, and focusing specifically on *environmental* supplier development, we believe that both the purpose of buying firms and the degree of environmental resources devoted by buyers to suppliers should be accounted for when considering buyer-led environmental supplier development. Accordingly, drawing on Saghiri and Mirzabeiki (2021), we distinguish between indirect and direct environmental supplier development. ID, i.e. buyer-led environmental supplier development in the form of environmental requirements and audits, is based on tightly inspecting suppliers' compliance to environmental norms and standards to control suppliers' environmental risks. It usually includes formulating environmental guidelines and evaluation standards, conducting daily monitoring activities, implementing green assessment and providing suppliers with feedback on assessment results (Belhadi *et al.*, 2021; Tachizawa *et al.*, 2015).

DD, i.e. buyer-led environmental supplier development in the form of DD projects, is based on close collaborative relationships between the supplying organizations and their customers, who devote significant resources to improve the suppliers' EP (Kitsis and Chen, 2023). It usually includes providing suppliers with technical, personnel and financial support to deal with environmental problems, helping suppliers to establish their own environmental systems and transferring environment-related knowledge to them (Gimenez *et al.*, 2012; Sanja *et al.*, 2019).

2.4 Environment-related supplier perceived relationship value

Perceived relationship value is the value that parties in a business relationship perceive to gain from the relationship, after weighing the benefits and costs (Aarikka-Stenroos and Jaakkola, 2012; Smals and Smits, 2012). In the context of buyer-supplier dyadic relationships, supplier perceived relationship value is the net value between the benefits and costs that the supplier perceives to be gained/incurred through interacting with the customer (Songailiene *et al.*, 2011; Jääskeläinen, 2021). Extant research on supplier perceived value has considered the time factor and argued that supplier perceived relationship value is based on the organizational transactive memory and on future-oriented value evaluations, thus including both realized value and expected value. Realized

value arises from the supplier's evaluation of the resources obtained, and the costs incurred, in the relationship, based on previous interactions with the customer. Expected value arises from the supplier's judgment of the resource returns, and the costs incurred, from future interactions with the customer.

Strategy literature has looked more carefully at the nature of the value generated by interorganizational relationships and its origins (Capaldo, 2014). While early scholars focused on the economic benefits of interorganizational collaboration, typically (but not necessarily) framed in terms of transaction costs reduction, those adopting a resource-based and knowledge-based perspective to strategy and value creation emphasize two other value dimensions (Capaldo and Messeni Petruzzelli, 2014). First, the value that originates from the partners' resources that the participating firms access (i.e. use) within the relationship (Grant and Baden-Fuller, 2004), or from the knowledge they acquire (i.e. learn and internalize) from their partners (Mowery *et al.*, 1996; McEvily and Marcus, 2005). Second, the value resulting from the new knowledge and capabilities jointly developed by the participating organizations through repeated interactions (Capaldo, 2007; Zaheer and Bell, 2005).

Accordingly, supplier perceived relationship value has been conceptualized as a multidimensional construct composed of a financial, a strategic and a co-creation dimension (Songailiene *et al.*, 2011). Supplier perceived relationship financial value consists of the economic net benefits suppliers believe they draw from their participation in a relationship, that they assess by balancing realized and expected economic benefits of the relationship with the costs and risks of obtaining them (Songailiene *et al.*, 2011). Supplier perceived relationship strategic value arises from the strategic resources of their buying counterparts that suppliers believe they can access or acquire, including tangible and intangible resources (e.g. technological knowledge, productive know-how, increased status and enhanced visibility on customers' needs) which can contribute to their competitive advantage (Songailiene *et al.*, 2011; Jääskeläinen, 2021). Finally, supplier perceived relationship co-creation value is the value suppliers perceive to be generated by the joint action of the parties, in terms of, among others, operational improvements and development of new products and processes and of new (inter)organizational capabilities (Capaldo, 2007).

Although research to date has discussed the value that buyer-supplier relationships bring to the participating organizations (Capaldo, 2014; Dyer and Singh, 1998) and specifically to suppliers (Baxter and Kleinaltenkamp, 2015; Hänninen and Karjaluoto, 2017; Songailiene *et al.*, 2011), scant attention has been paid to the environmental side of such value. Whereas it is not clear whether suppliers can be "better-off" overall by being environmentally proactive when collaborating with their buying counterparts, suppliers can gain significant environmental benefits from their customer relationships (Hanim Mohamad Zailani *et al.*, 2012). To deepen this point, we need to consider the financial, strategic and co-creation value suppliers can obtain by engaging in environmental activities within buyer-supplier relationships.

Environment-related supplier perceived relationship financial value consists of the perceived economic net benefits of engaging in environmental activities within the relationships,

such as higher profits, lower costs and additional sales and business opportunities (Patrucco *et al.*, 2019). Environment-related supplier perceived strategic value results from the tangible and intangible resources suppliers perceive as resulting from their engagement in environmental activities within the relationships (Baxter and Kleinaltenkamp, 2015), e.g. knowledge related to the customer's environmental initiatives and culture or to environmental issues, know-how concerning the establishment of an environmental management system, and enhanced environmental reputation and brand image. Finally, environment-related supplier perceived co-creation value refers to the joint performance improvements suppliers believe are generated by their engagement in environmental activities within the relationships (Jääskeläinen, 2021), e.g. in terms of fulfillment of green product standards, green product development and development of green production processes.

3. Conceptual model and hypotheses development

SOR theory purports that environmental stimuli can influence an individual's internal state, which in turn affects externally selected behaviors such as acceptance or avoidance (Jacoby, 2002). In the SOR framework, stimulus refers to the influence of external environmental factors, organism concerns the individual's cognitive state and judgment in response to environmental stimulation and response is a behavior of approaching or fleeing the environment (Talwar *et al.*, 2021). Thus, the SOR framework suggests that external environmental stimuli trigger cognitive responses in individuals, which leads to changes in their behavior (Russell and Mehrabian, 1974).

The SOR framework has been mostly used in the marketing field to reveal the process and outcome of a series of consumer responses to merchants' marketing actions (Kim and Lennon,

2013; Kumar *et al.*, 2021; Hew *et al.*, 2018). Yet, a few scattered studies have fruitfully used it to examine the adoption and impact of sustainable management practices in the supply chain. Thus, Kudla and Klaas-Wissing (2012) adopted the SOR framework to investigate the reasons behind the adoption of sustainable practices by logistics service providers, while Malhotra (2024) used it to analyze the effects of circular economy practices on sustainable supply chain performance.

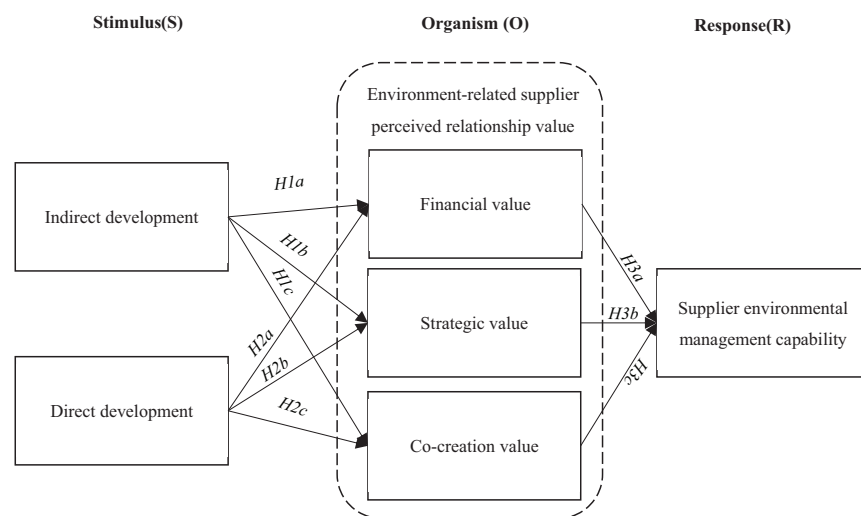
In the present study, the SOR framework is employed to investigate the relationships between buyer-led environmental supplier development, environment-related supplier perceived relationship value and supplier environmental management capabilities. We argue that the adoption of indirect and direct environmental supplier development practices by buying firms represents an environmental stimulus for suppliers, which influences their judgment regarding the financial, strategic and co-creation value they can obtain by engaging in environmental activities within buyer-supplier relationships. This, in turn, impacts the time and effort investment of suppliers in the development of environmental management capabilities. The conceptual model underlying our research is depicted in Figure 1, which summarizes the research hypotheses discussed in the following sections.

3.1 Buyer-led environmental supplier development and environment-related supplier perceived relationship value

3.1.1 Indirect development and environment-related supplier perceived relationship value

ID allows suppliers to identify the environmental requirements of the buying firms, enhances the alignment of goals between the parties and facilitates suppliers' adaptation to the buyers' needs (Maestrini *et al.*, 2021; Pan *et al.*, 2019). For example, Dell Inc. utilizes various methods, including supplier risk assessment, investigations, audits, constructive feedback

Figure 1 Conceptual model



Source: Authors' own work

sessions and corrective actions, to help its Chinese suppliers to assimilate its environmental practices and set their own annual and medium-to-long term emission reduction goals, thereby allowing them to address environmental issues more efficiently [3]. By establishing clear environment-related evaluation criteria for their supplying counterparts, buying firms improve the suppliers' understanding of their environmental expectations, specifically of their environmental requirements concerning material selection, product parameters and production processes. In addition, through feedback from the buying firms on the evaluation results, suppliers can identify the differences between their existing operation mechanisms and the buyers' environmental requirements and clarify the direction of improvement (Sancha *et al.*, 2019). In the subsequent production processes, suppliers will comply with the buyers' waste emission standards and use nontoxic and nonhazardous recyclable materials as much as possible to ensure that they provide their customers with products that meet their environmental standards. This will reduce the costs of returns and rework and allow suppliers to obtain larger orders (Maestrini *et al.*, 2018; Maestrini *et al.*, 2021):

H1a. ID is positively associated with environment-related supplier perceived relationship financial value

ID provides suppliers with access to the buyers' environmental resources. ID relies on clear terms and procedures that establish specifications for suppliers' production, transportation and other processes and propose improvements to suppliers who do not meet the standards (Saghiri and Mirzabeiki, 2021; Sancha *et al.*, 2016). Thanks to the buying firms' environmental reviews and assessments, suppliers can gain a better understanding of the environmental culture and initiatives of their customers and absorb their experience in solving environmental problems (Shumon *et al.*, 2019), thus shortening the learning curve and reducing the learning costs associated to environmental issues. In addition, the implementation of environmental assessment activities requires frequent interactions between the participating organizations (Liu *et al.*, 2017), which allows suppliers to gain information from their buying counterparts around environmental management issues and learn about new technologies, processes and practices in environmental development (Gavronski *et al.*, 2012; Liu *et al.*, 2019). All this leads suppliers to develop a positive and constructive attitude toward environmental development and to perceive the ID practices implemented by their customers as an opportunity rather than a challenge (Shumon *et al.*, 2019), which can allow them to gain competitive advantages by enhancing their environment-related strategic resources (e.g. organizational knowledge or processes and tangible assets):

H1b. ID is positively associated with environment-related supplier perceived relationship strategic value

ID may also create favorable conditions for suppliers to understand that the organizations involved in buyer-supplier relationships have the potential to jointly generate value for mutual benefit (Wagner, 2010). In particular, timely feedback from the buyer on environmental assessment results helps the supplier identify its own environmental shortcomings and

implement improvements to existing products and processes (Saghiri and Mirzabeiki, 2021). In turn, the increased environmental compliance of the supplier to the buyer's environmental standards is a tangible sign of commitment by the supplier side, that strengthens the relationship and the supplier identification with the buyer. Thus, over time, the relationship develops from an arm's length tie into a long-term partnership (Gunasekaran *et al.*, 2015; Capaldo and Messeni Petruzzelli, 2014), thereby encouraging the participating organizations to jointly implement environmental product/process R&D, share environmental and cost information, develop new environment-related knowledge and technologies and finally plan and make decisions that improve their operational and EP:

H1c. ID is positively associated with environment-related supplier perceived relationship *co-creation* value

3.1.2 Direct development and environment-related supplier perceived relationship value

Due to the unpredictable nature of the returns on green investments, suppliers often face a complex trade-off between short-term profitability and long-term environmental sustainability (Trapp and Sarkis, 2016). Buying firms can help suppliers overcome the trade-off through DD initiatives that provide suppliers with technical and financial support for implementing environmental activities. By receiving training from the buyers' technical experts, designing environmental product development with them and conducting site visits to the buyers' premises, suppliers develop a clearer understanding of the long-term environmental benefits of adopting green practices. This, in turn, not only increases the suppliers' confidence in investing time and efforts in environmental activities (Shalique *et al.*, 2022; Saghiri and Mirzabeiki, 2021), but also leads them to develop higher expectations of economic benefits from the relationships with their customers (e.g. reduced costs and/or greater market share) (Lee, 2015). This is the case for supplying partners collaborating with the Chinese sportswear brand Anta in a water conservation initiative from which the suppliers expect to save about 1 million tons of water annually:

H2a. Direct development is positively associated with environment-related supplier perceived relationship financial value

DD provides an important way for suppliers to overcome environmental resource constraints. Most suppliers face a lack of environmental resources to meet the environmental requirements of the market and stakeholders (Wilhelm *et al.*, 2016). DD initiatives on the buyers' side allow suppliers to access the environmental resources and experience of buying firms and/or to absorb critical environmental knowledge and know-how from them (Vachon and Klassen, 2008). For instance, by adhering to the Carbon Leadership Initiative launched by Levi Strauss & Co., Jiaying Kanglong Textile Co. Ltd., a major Chinese supplier to the US global apparel brand, has acquired valuable expertise in advanced carbon and water management techniques [4]. As Saghiri and Mirzabeiki (2021) found, buyers' technical advice and training to suppliers in

product and process design, logistics and energy efficiency can facilitate the transfer of buyers' environmental knowledge to suppliers. This provides suppliers with strategic assets that are not widely and easily available to competitors, thereby increasing their perceived ability of their supply chain relationships to enhance their environmental competitiveness:

H2b. DD is positively associated with environment-related supplier perceived relationship *strategic* value

DD also creates the conditions for truly collaborative and relationally intensive buyer–supplier relationships endowed with significant value co-creation potential. Indeed, buyer-led DD initiatives facilitate the development of a rich social fabric of interpersonal relationships across the boundaries of the participating organizations and of interorganizational relationships based on trust and characterized by open communication channels and reciprocal norms (Qiao *et al.*, 2022; Capaldo and Giannoccaro, 2015). Thus, on the one hand, suppliers increase their trust in the goodwill of the buyers and reduce concerns about their partners' opportunism (Lee and Klassen, 2008), which in turn leads to the development of open communication channels within the relationship, so enhancing the effectiveness of the buyers' development programs. Communication and information sharing are indeed key factors to improve supplier performance (Touboulic *et al.*, 2015). On the other hand, when buyer–supplier relationships are coordinated via a “system” of social mechanisms including interpersonal relationships, trust and reciprocity (Capaldo, 2014), buying firms are eager to support suppliers with both financial resources and the sharing of technical knowledge on environmental issues, which in essence is a buyer-initiated environmental resource transfer activity (Awan *et al.*, 2021). In particular, the development of trust-based relationships leads suppliers to reduce their psychological and organizational barriers to knowledge sharing. In turn, the exchange of valuable knowledge related to the environment creates the conditions for the parties to coproduce tangible and intangible resources (e.g. new environmentally friendly product concepts or processes and new green (inter)organizational capabilities) that cannot be generated independently by both parties (Sancha *et al.*, 2019) and therefore yield relational rents (Dyer and Singh, 1998), leading suppliers to develop strong beliefs in the value co-creation potential of their supply chain relationships:

H2c. DD is positively associated with environment-related supplier perceived relationship *co-creation* value

3.2 Environment-related supplier perceived relationship value and environmental management capability

The three dimensions of environment-related supplier perceived relationship value (i.e. financial, strategic and co-creation) positively affect the proclivity of suppliers to invest in the development of environmental management capabilities.

Given that supplier sustainability practices are driven by instrumental (i.e. profit-seeking) motives (Chen and Chen, 2019; Paulraj *et al.*, 2017), the more suppliers perceive their relationships with buying firms as sources of environment-related economic benefits, and specifically that implementing

sustainable practices may generate significant opportunities for profitability improvement, the more they will be committed to develop environmental management capabilities (Chen and Chen, 2019). In fact, as suppliers learn that participating in the green supplier management practices implemented by their buying counterparts can allow them lower costs, higher purchase volumes and additional business opportunities, they become willing to invest in the environmental training of their employees, in building an environmental management system and in optimizing their supply chain operations so as to actively respond to the green initiatives of their customers. (Liu *et al.*, 2019; Liu *et al.*, 2023a, 2023b):

H3a. Environment-related supplier perceived relationship *financial* value is positively associated with suppliers' environmental management capability

When suppliers perceive that they can expand their environmental knowledge base by accessing physical and human resources and other environmental assets of their partners, they tend to consider the implementation of sustainable practices as less challenging and feel more motivated to directly invest in environmental management (Qiao *et al.*, 2022). In such conditions, suppliers are also encouraged to focus on explorative innovation in environmental management and sustainable operations, which in turn will further improve their ability to address environmental issues (Jia *et al.*, 2023; Villena *et al.*, 2021). Finally, the higher the perceived likelihood of suppliers to access environment-related resources within their supply chain relationships, the greater the suppliers' willingness to reciprocate with practical actions, including a stronger commitment to the development of organizational capabilities specifically devoted to environmental management (Baxter and Kleinaltenkamp, 2015):

H3b. Environment-related supplier perceived relationship *strategic* value is positively associated with suppliers' environmental management capability

Finally, suppliers that perceive their supply chain relationships as sources of environment-related joint value creation experience an increased willingness and ability to invest in the development of environmental management capabilities. On the one hand, the social mechanisms that characterize truly collaborative interorganizational relationships aimed at joint value creation play a major role. Trust-based relationships between customers and suppliers increase the confidence of the parties to invest in environment-related assets within the relationship, while an informal norm of reciprocity induces both of them to respond in kind to the initiatives of the other, and in particular leads suppliers to increase their commitment to the development of environment-related organizational capabilities as a response to their customers' environmental supply chain management initiatives (Qiao *et al.*, 2022). On the other hand, the coproduction of knowledge and capabilities related to environmental management within the relationships increase the suppliers' environmental knowledge base thus enhancing their ability to effectively deal with environmental issues, and specifically to train their employees in environmental awareness, obtain environmental certifications,

reduce environmental impacts in the manufacturing process, and even discipline upstream suppliers' environmental behavior (Shafiq *et al.*, 2022; Lee and Klassen, 2008):

- H3c.* Environment-related supplier perceived relationship *co-creation* value is positively associated with suppliers' environmental management capability

4. Methods

4.1 Sampling and data collection

Our sample is composed of supplier firms in the textile and IT/ICT industries in China. We focused on these industries for the following reasons. First, based on the green supply chain CITI Index released by the Center for Public Environmental Research, the selected industries are those with the best EP [5]. Second, China is the world's largest producer and exporter of textiles and clothing, as well as of IT/ICT appliances, has the world's most comprehensive and complete industrial chain, and is the main supply base for world famous brands such as Apple and Adidas. Finally, China's textile and IT/ICT firms face strict environmental regulations posed by brand owners.

To ensure that respondents had a good understanding of the issues under investigation, we required that they had significant expertise of both their company's operational processes and the environmental requirements of their customers. Specifically, we contacted managers belonging to the sample suppliers' environmental departments and marketing departments to ascertain their willingness to participate in the survey and whether they were experienced in environmental reviews at their companies and in working closely with buyers on environmental issues. In addition, we set questions in the questionnaire about the number of years the respondents had worked in the company and in the industry.

Data were collected in 2021 in two rounds, from June to August and from September to October. 288 questionnaires were collected. In total, 67 invalid questionnaires were eliminated through steps such as outlier test and missing value test. The final sample is composed of 221 questionnaires, yielding an effective response rate of 76.73%. Some basic characteristics of the sample firms and respondents are shown in Table 3.

4.2 Questionnaire

The items employed for measuring the theoretical constructs were largely drawn from relatively mature measurement scales and in some cases adapted to the present study. Since the scales were drawn from English-language literature, while the study was conducted in China, three experts from different fields related to the study's subject were invited to translate the English questionnaire into Chinese (Van de Vijver and Leung, 1997). The Chinese questionnaire was then back-translated into English by a professional translator who was not familiar with the background and purpose of our survey. We also conducted preliminary interviews with 10 supplier companies and asked respondents about their understanding of each topic after completing the questionnaire. Based on the respondents' feedback, we revised all the potentially ambiguous questions. We thus obtained a final questionnaire composed of 35 items, which is reported in Appendix Table A1. All the items were

Table 3 Sample firms' and respondents' characteristics

Characteristics	Frequency	%
Firm size		
Less than 100	63	28.5
100–1,000	75	33.9
1000~10,000	46	20.8
More than 10,000	37	16.8
Industry		
Textile	98	44.34
ICT/IT	123	55.66
Tenure in the industry		
Less than 5 years	21	9.5
5–10 years	76	34.4
more than 10 years	124	56.1
Tenure in the firm		
Less than 5 years	34	15.4
5–10 years	69	31.2
More than 10 years	118	53.4

Source: Authors' own work

measured by a 5-point Likert scale (1 - strongly disagree; 5 - strongly agree).

We measured supplier environmental management capability (EMC) by six items, drawn from Wang *et al.* (2021) and adapted to the purposes of our study. Respondents were asked to provide a comprehensive picture of the EMC of their companies in terms of their internal environmental management activities, environmental evaluations conducted on upstream suppliers and collaborative environmental practices with customers.

ID was measured by six items drawn from Saghiri and Mirzabeiki (2021) and Tachizawa *et al.* (2015), who examined the control-based practices implemented by buyers to ensure suppliers' environmental compliance. DD was measured by the five items employed by Saghiri and Mirzabeiki (2021) to gauge buyer-led environmental supplier development in the form of DD projects run or supported by the buying firms.

Environment-related supplier perceived relationship value was operationalized as a multidimensional construct and measured by three dimensions, namely environment-related supplier perceived relationship financial value (EFV), strategic value (ESV) and co-creation value (ECV). To gauge the financial value dimension, i.e. the economic benefits suppliers perceive they can draw from buyer-supplier relationships by engaging in environmental management activities, we employed four items, that we developed based on La Rocca *et al.* (2012) and Patrucco *et al.* (2019), who focused on the economic returns that suppliers perceive to arise from the relationship over time, including growth in order volume, growth in profitability, development of additional business opportunities and total cost reduction. To assess the strategic value dimension, we designed five items reflecting the strategic resources (including environmental knowledge, technology, brand image and environmental reputation) suppliers perceive they can obtain from their relationships with buying firms by engaging in environmental management activities. Finally, we measured the co-creation value dimension by three items that

we obtained by incorporating environmental management considerations in the approach of Jääskeläinen (2021). Doing so allowed us to gauge improvements in joint performance that suppliers perceive they can derive by engaging in environmental management activities concerning product quality, product development and process development.

Firm size and supplier environmental orientation (SEO) were selected as control variables. Larger suppliers tend to be less likely to exit the market, have a longer-term orientation and are more visible to the public, and therefore pay more attention to environmental issues (Danese *et al.*, 2018; Scott and Nyaga, 2019). In addition, they have more resources to devote to environmental protection activities and are more attentive to their environmental reputation than SMEs. Therefore, they are more likely to actively engage in environmentally friendly practices and to commit to the green supply chain management initiatives of their buying counterparts. For the purposes of our study, four categories of suppliers were identified based on their number of employees: 1 = less than 100 employees; 2 = 100–999 employees; 3 = 1,000–10,000 employees; and 4 = more than 10,000 employees.

Previous scholars have argued that the proactivity of suppliers toward the environment may promote their environmental commitment and effort, which in turn enhances their environmental management capabilities (Yu and Huo, 2019). Thus, we reasoned that, to better examine the impact of external stimuli such as buyer-led green management initiatives on the suppliers' capabilities to deal with environmental issues, we needed to exclude the possibly confounding effect of the suppliers' own environmental proactivity. We therefore controlled for SEO, operationalized by the five items employed by Dai *et al.* (2017).

4.3 Non-response and common method bias

Since we employ cross-sectional survey data collected from a number of different suppliers, our analysis may be prone to systematic errors due to non-response bias and common method bias. To address the threat of non-response bias, we used a t-test to compare the data collected in the two data collection rounds (Armstrong and Overton, 1977). We found no significant differences across the variables between early and late respondents with respect to firm size ($p = 0.239$), industry tenure ($p = 0.476$) and firm tenure ($p = 0.142$). However, the Armstrong and Overton (1977) approach is a weak test (Narasimhan *et al.*, 2013; Mentzer and Flint, 1997). Accordingly, drawing from Mentzer and Flint (1997), we collected demographic information from respondents who agreed to participate but did not complete the survey and then compared firm size, industry tenure and firm tenure between the participant and non-participant groups. The results of the t-test indicate that there are no statistically significant differences between respondents and non-respondents with respect to firm size ($p = 0.452$), industry tenure ($p = 0.378$) and firm tenure ($p = 0.216$), thus suggesting that non-response bias is not an issue in our study.

We adopted several procedures to deal with potential common method bias issues. First, we placed independent and dependent variables on different pages of the electronic questionnaire with different instructions. Second, to avoid order effects, we conducted two rounds of data collection and disrupted the order of the question items when sending the

questionnaire to the respondents (Baker *et al.*, 2016). Third, based on Harman's single-factor approach, we run an exploratory factor analysis and found that, among the seven factors with eigenvalues greater than one, the factor with the highest variance contribution rate explained only 24.94% of total variance. Finally, to control for the effects of an unmeasured latent method factor, we compared our base model with a model including the method factor (Podsakoff *et al.*, 2003; Jääskeläinen, 2021). Results showed that most method factor loadings were statistically not significant and that the average substantively explained variance of the original indicators (0.64) was significantly higher than the average method-based variance (0.35). Hence, we are confident that there are no problems of common method bias in our study.

4.4 Reliability and validity

We calculated the Cronbach's alpha and the combined reliability (CR) coefficients of each construct to assess the reliability of the measurement scales. Results are reported in Table 4 and show that both the alpha and the CR coefficients of each construct exceed the usual 0.7 threshold.

Some of the measurement items in this study were appropriately adapted to, and others were added in accordance with, the research context and purposes. We took two steps to assess the validity of the constructs. First, we performed exploratory factor analysis on EMC, DD, ID, EFV, ESV, ECV and SEO using variance rotated principal component analysis. We found that all the measurement items loaded high on the constructs they were intended to measure and low on the constructs they were not intended to measure, and that there were no multiple components with higher loadings. These results suggest that our measures are unidimensional and have high construct validity (Hair *et al.*, 2021). Second, we evaluated the convergent and discriminant validity of the constructs via validated factor analysis. Results are reported in Table 4. The models generally fit well with $\chi^2/df = 2.466$, $p = 0.00$, RMR = 0.043, CFI = 0.937, GFI = 0.928, AGFI = 0.897 and RMSEA = 0.077. The factor loadings of all the items are above the threshold value of 0.5 and the average variances extracted (AVE) for each construct consistently exceed the recommended value of 0.5, indicating that all the constructs have high convergent validity (Hair *et al.*, 2021). Discriminant validity was assessed by verifying that the correlation coefficients between each construct and the remaining ones was lower than the square root value of the AVE of the focal construct (Fornell and Larcker, 1981). Results are shown in Table 5, which also reports descriptive statistics and correlation values for all the variables.

5. Data analysis and results

Since our conceptual framework includes a set of multiple complex relationships among variables that cannot be examined through regression analysis, we resorted to structural equation modeling (SEM). SEM is a multivariate regression method which serves as an extension of the general linear regression model to accommodate, in one comprehensive model, multiple complex relationships between independent and dependent variables (Amini and Alimohammadlou, 2021). SEM also permits the estimation of the measurement error

Table 4 Reliability and convergent validity

Variables	Measurement items	Factor loadings	Cronbach's alpha	CR	AVE
Suppliers' environmental management capability (EMC)	EMC1	0.757	0.929	0.930	0.692
	EMC2	0.708			
	EMC3	0.936			
	EMC4	0.887			
	EMC5	0.910			
	EMC6	0.765			
Indirect development (ID)	ID1	0.810	0.896	0.908	0.664
	ID2	0.780			
	ID3	0.842			
	ID4	0.834			
	ID5	0.808			
Direct development (DD)	DD1	0.800	0.930	0.932	0.694
	DD2	0.835			
	DD3	0.818			
	DD4	0.806			
	DD5	0.868			
	DD6	0.870			
Environment-related supplier perceived relationship financial value (EFV)	EFV1	0.809	0.906	0.909	0.713
	EFV2	0.834			
	EFV3	0.876			
	EFV4	0.858			
Environment-related supplier perceived relationship strategic value (ESV)	ESV1	0.833	0.838	0.843	0.520
	ESV2	0.692			
	ESV3	0.659			
	ESV4	0.737			
	ESV5	0.671			
Environment-related supplier perceived relationship co-creation value (ECV)	ECV1	0.887	0.886	0.900	0.750
	ECV2	0.881			
	ECV3	0.828			
Supplier environmental orientation (SEO)	SEO1	0.886	0.875	0.879	0.596
	SEO2	0.635			
	SEO3	0.744			
	SEO4	0.672			
	SEO5	0.887			

Source: Authors' own work

Table 5 Descriptive statistics and discriminant validity

Variables	Mean	S.D.	1	2	3	4	5	6	7
1. EMC	3.90	0.79	<i>0.832</i>						
2. ID	3.50	0.94	0.408 **	<i>0.815</i>					
3. DD	3.53	0.88	0.601 **	0.631 **	<i>0.833</i>				
4. EFV	4.10	0.74	0.448 **	0.338 **	0.420 **	<i>0.844</i>			
5. ESV	3.96	0.89	0.557 **	0.286 **	0.605 **	0.466 **	<i>0.721</i>		
6. ECV	4.32	0.51	0.419 **	0.175 *	0.590 **	0.419 **	0.585 **	<i>0.866</i>	
7. SEO	4.43	0.49	0.355 **	0.181 *	0.286 **	0.237 **	0.324 **	0.165 *	<i>0.772</i>

Notes: Diagonal entries (in italic) are the square root of the AVE (average variances extracted). Entries below the diagonal are correlations. ** $p < 0.01$; * $p < 0.05$

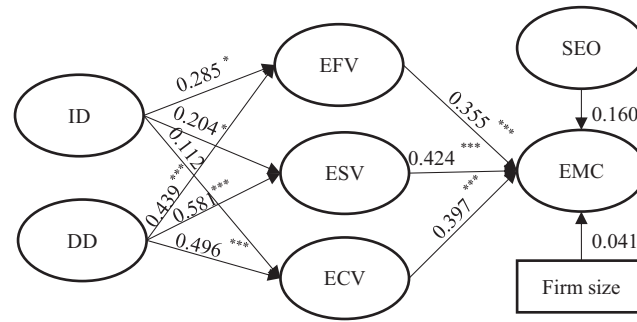
Source: Authors' own work

and the exclusion of its impact from the relationships between latent variables when testing causal models, so allowing for a more accurate test of the variables' effectiveness (Amini and Alimohammadlou, 2021; Bergh *et al.*, 2016). Therefore, using SEM can enhance our understanding of the

relationships among the variables in our conceptual model and improve the accuracy of our analyses.

We used the SEM software Amos 21.0 to validate the hypothesized model shown in Figure 2. The model fit indicators were $\chi^2/df = 2.064$, $p = 0.00$, RMR = 0.037,

Figure 2 Structural equation model



Notes: Hypothesis paths are marked with standardized path coefficient.
*** $P < 0.001$; * $P < 0.05$
Source: Authors' own work

CFI = 0.955, GFI = 0.936, AGFI = 0.905, RMSEA = 0.066, indicating that our model is acceptable (West *et al.*, 2012). Results are summarized in Table 6 and show that ID has a significant positive effect on both EFV ($\beta = 0.285$, $p < 0.05$) and ESV ($\beta = 0.204$, $p < 0.05$). Hypotheses H1a and H1b are therefore supported. Instead, we failed to find a significant effect of ID on ECV ($\beta = 0.112$), which means that hypothesis H1c is not supported. We found positive and significant effects of DD on EFV ($\beta = 0.439$, $p < 0.001$), ESV ($\beta = 0.581$, $p < 0.001$) and ECV ($\beta = 0.496$, $p < 0.001$), which provide support for hypotheses H2a, H2b and H2c, respectively. We also tested the effects of the three dimensions of the environment-related supplier perceived relationship value on EMC. We found that EFV ($\beta = 0.355$, $p < 0.001$), ESV ($\beta = 0.424$, $p < 0.001$) and ECV ($\beta = 0.397$, $p < 0.001$) all exert a positive and significant effect on EMC. Hypotheses H3a, H3b and H3c are therefore supported. As regards the control variables, both Firm size ($\beta = 0.160$, $p < 0.05$) and SEO ($\beta = 0.041$, $p < 0.05$) are not significantly correlated with EMC.

5.1 Robustness tests

We conducted auxiliary analyses to test the robustness of our findings. Drawing from Lee and Klassen (2008), who

identified three key sources of supplier environmental management capability (i.e. buying firms, the suppliers themselves and external organizations), we added external resource support (ERS) to our models to control for the role of governmental and third-party organizations, which may provide suppliers with resources aimed at improving their organizational capabilities to deal with environmental issues. The extent to which our sample suppliers had received environmental incentives and assistance from governmental organizations, as well as resources and help from third-party organizations, was measured by the four question items developed by Zeng *et al.* (2011), using a 5-point Likert scale. Results showed that ID still had a significant positive effect on EFV ($\beta = 0.264$, $p < 0.05$) and ESV ($\beta = 0.198$, $p < 0.05$), while its effect on ECV remained not significant ($\beta = 0.106$, $p > 0.05$). In addition, DD still had positive and significant effects on EFV ($\beta = 0.427$, $p < 0.001$), ESV ($\beta = 0.573$, $p < 0.001$) and ECV ($\beta = 0.484$, $p < 0.001$). Finally, EFV ($\beta = 0.348$, $p < 0.001$), ESV ($\beta = 0.419$, $p < 0.001$) and ECV ($\beta = 0.388$, $p < 0.001$) all had positive and significant effects on EMC. The control variables SEO, Firm size and ERS did not show significant correlations with EMC.

Table 6 Summary of SEM results

Path relationships	Standardized coefficients	<i>p</i> -values	Results
ID → EFV	0.285	0.016	H1a supported
ID → ESV	0.204	0.037	H1b supported
ID → ECV	0.112	0.417	H1c rejected
DD → EFV	0.439	***	H2a supported
DD → ESV	0.581	***	H2b supported
DD → ECV	0.496	***	H2c supported
EFV → EMC	0.355	***	H3a supported
ESV → EMC	0.424	***	H3b supported
ECV → EMC	0.397	***	H3c supported
SEO → EMC	0.160	0.086	–
Firm size → EMC	0.041	0.453	–

Note: *** $p < 0.001$

Source: Authors' own work

Next, given that buyer-led environmental supplier development practices not only improve the environmental management capabilities of suppliers, but also enhance their EP (Wagner, 2010), we replaced EMC with supplier EP as the dependent variable. EP was measured by the four question items developed by Sancha *et al.* (2016), using a 5-point Likert scale. Results showed that the positive and significant effect of ID on EFV ($\beta = 0.197, p < 0.05$) and ESV ($\beta = 0.201, p < 0.05$) still held, while there was no significant effect of ID on ECV ($\beta = 0.101, p > 0.05$). The effects of DD on EFV ($\beta = 0.286, p < 0.01$), ECV ($\beta = 0.462, p < 0.001$) and ESV ($\beta = 0.459, p < 0.001$) remained positive and significant. Finally, EFV ($\beta = 0.188, p < 0.05$), ECV ($\beta = 0.450, p < 0.001$) and ESV ($\beta = 0.392, p < 0.001$) all had significant positive effects on EP. As concerns the control variables, only SEO revealed a significant positive relationship with EP ($\beta = 0.232, p < 0.01$), while firm size did not show a significant effect on EP. Overall, the results of these auxiliary analyses bestow confidence in our findings.

5.2 Mediating effects analysis

We employed bootstrapping procedures to assess the (full vs partial) mediating effects of ECV, ESV and ECV on the relationships between ID/DD and EMC. Results obtained after 1,000 bootstrapping iterations at 95% confidence interval are shown in Table 7. The confidence interval of the direct path from ID to EMC contains 0, which suggests that there is no significant direct effect of ID on EMC ($[-0.016, 0.029], p > 0.05$). However, ID indirectly affects EMC through EFV ($[0.031, 0.123], p < 0.01$) and ESV ($[0.027, 0.103], p < 0.01$), but not through ECV, since the confidence interval of the path ID→ECV→EMC contains 0 ($[-0.020, 0.091], p > 0.05$). Overall, these results suggest that EFV and ESV play a full mediating effect on the relationship between ID and EMC, while ECV does not mediate such relationship. We also found a significant direct effect on DD on EMC ($[0.014, 0.074], p < 0.01$). In addition, DD indirectly affects EMC through EFV ($[0.007, 0.050], p < 0.01$), ESV ($[0.003, 0.043], p < 0.05$) and ECV ($[0.005, 0.026], p < 0.05$). Thus, we conclude that EFV, ESV and ECV play a partial mediating effect in the relationship between DD and EMC.

6. Discussion

Extant research on the effectiveness of buyer-led environmental supplier development remains inconclusive.

In particular, we know little about why and how the environmental supplier development practices implemented by buying firms affect suppliers' environmental management capabilities. To address this gap, we have employed the SOR framework to examine the relationships among buyer-led environmental supplier development, environment-related supplier perceived relationship value and supplier-level environmental management capabilities. The study presents several key findings.

First, our analysis shows a positive and significant effect of ID (i.e. buyer-led environmental supplier development in the form of environmental requirements and audits) on supplier perceived relationship financial and strategic value. On the one hand, differently from Sancha *et al.* (2019), but consistently with Gimenez *et al.* (2012), this finding suggests that suppliers see ID as a set of practices that help them capture economic value from their supply chain relationships. A transparent and fair supplier assessment process creates the conditions for suppliers to understand the environmental expectations of their customers, while timely feedback from the buyers can guide suppliers to carry out environmental activities more effectively (Zhou *et al.*, 2020). This increased EP enhances the environmental efficiency and effectiveness of the suppliers' operations and creates the conditions for them to attract more sales from their buying counterparts (Shafiq *et al.*, 2022). On the other hand, ID is also perceived by suppliers as an effective way to yield environment-related strategic benefits by accessing the buyers' tangible and intangible resources, obtaining from them valuable information and learning technical knowledge about how to deal with environmental issues (Saghiri and Mirzabeiki, 2021; Vachon and Klassen, 2008). While all this improves the ability of suppliers to satisfy the needs of their buying counterparts, it also allows them to strengthen their own knowledge base and overall ability to face environmental problems, so enhancing their attractiveness in the eyes of other possible supply chain partners and their competitiveness in business environments wherein the salience of sustainability issues continues to increase.

Conversely, we did not find a significant positive effect of ID on supplier perceived relationship co-creation value. We submit that, while value co-creation requires truly collaborative and relationally-intense interorganizational relationships aimed at the generation of relational rents (Capaldo, 2007; Dyer and Singh, 1998), buyer firms typically implement ID practices in the context of arm's length ties with their supplying

Table 7 Bootstrapping results

Path relationships	Standardized coefficient	Boot SE	Bias-corrected 95% CI		P
			Lower	Upper	
ID → EMC	0.019	0.013	−0.016	0.029	0.605
ID → EFV → EMC	0.069	0.023	0.031	0.123	0.001
ID → ESV → EMC	0.058	0.020	0.027	0.103	0.001
ID → ECV → EMC	0.051	0.008	−0.020	0.091	0.802
DD → EMC	0.038	0.016	0.014	0.074	0.002
DD → EFV → EMC	0.024	0.010	0.007	0.050	0.001
DD → ESV → EMC	0.019	0.008	0.003	0.043	0.024
DD → ECV → EMC	0.016	0.015	0.005	0.026	0.013

Source: Authors' own work

counterparts aimed at risk avoidance and transaction costs minimization (Lee and Klassen, 2008; Sancha *et al.*, 2016). In such conditions, suppliers will hardly perceive opportunities for joint value creation and performance improvement from engaging in environmental activities within their supply chain relationships.

Second, our research shows that DD (i.e. buyer-led environmental supplier development in the form of DD projects) positively affects supplier perceived relationship financial, strategic and co-creation value. These findings represent useful additions to those by Jääskeläinen (2021) and are consistent with the relational view (Dyer and Singh, 1998). Direct environmental development initiatives occur within collaborative relationships wherein interorganizational coordination is based on social networks, specifically on a system of network-based interconnected social mechanisms such as interpersonal relationships, trust and reciprocity, which influence and reinforce each other (Capaldo, 2014; Qiao *et al.*, 2022). When such a “network governance” (Jones *et al.*, 1997; Capaldo, 2014) occurs, buyers and suppliers feel confident in the value creation potential of their relationships. In particular, focusing on the supplier side, our findings show that suppliers perceive their supply chain relationships not only as sources of economic benefits, but also as valuable assets that yield strategic resources and joint value-creation opportunities.

Interestingly, the results of our SEM analysis reveal that, in our sample, ID has a stronger influence on environment-related supplier perceived financial value when compared to strategic value. Conversely, the impact of DD is stronger on environment-related supplier perceived strategic value, and even stronger on co-creation value, when compared to financial value. On the one hand, this is coherent with previous seminal studies claiming that organizations participating in arm's length interfirm ties are primarily focused on economic benefits such as cost reductions, rather than on the potential strategic advantages of interfirm collaboration (Powell, 1990; Uzzi, 1997). On the other hand, the above findings offer empirical support to extant research in the strategic networks field purporting that, when interorganizational relationships are imbued with trust and characterized by a rich social fabric of interpersonal relationships crossing the boundaries of the participating firms, partners tend to frame alliances as sources of tangible and intangible resources needed to compete, and even more of value co-creation opportunities, rather than of purely economic benefits (Capaldo, 2007; Dyer and Singh, 1998).

Third, we found that each of the three considered dimensions of environment-related supplier perceived relationship value stimulates the development of environmental management capabilities by suppliers. This reminds us that suppliers' engagement in green supply chain management is driven not only by instrumental motives, but also by strategic considerations concerning opportunities for knowledge accessing and learning from customers (Lee and Klassen, 2008; Liu *et al.*, 2019; Allenbacher and Berg, 2023), as well as for coproducing with customers new knowledge and organizational capabilities (Saghiri and Mirzabeiki, 2021; Sancha *et al.*, 2019).

Finally, our mediation analysis sheds further light on the effectiveness of buyer-led supplier development practices by

suggesting the differential mechanisms through which direct and ID influence supplier capabilities. While DD affects supplier environmental management capabilities both directly and indirectly via its impact on the three dimensions of suppliers' perceptions of the value creation potential of their customer relationships (partial mediation), ID does not exert a direct effect on supplier capabilities but affects them only through its impact on environment-related supplier perceived relationship economic and strategic value (full mediation). This finding is consistent and complementary with those by Tachizawa *et al.* (2015), who, adopting the buyer's perspective and focusing on EP at the buyer level, showed that only collaboration with suppliers on environmental issues has a direct impact on performance, while the impact of supplier monitoring is fully mediated by supplier collaboration, or in other words, supplier monitoring can influence performance only through its impact on collaboration. Taken together, our findings and those by Tachizawa *et al.* (2015) suggest that only buyer-led DD initiatives are directly effective on environment-related outcomes at both the buyer and supplier levels, while ID can only exert its influence in an indirect way.

6.1 Theoretical contribution

Three aspects of the theoretical contribution of the present study are worth addressing. First, we have responded to previous calls for adopting a mediation research strategy (Alghababsheh and Galleary, 2021) to shed light on the underlying motivations and mechanisms behind the effectiveness of buyer-led environmental supplier development (Jia *et al.*, 2023; Alghababsheh *et al.*, 2023). However, while previous scholars looked at the suppliers' resource allocation practices as mediators (Saghiri and Mirzabeiki, 2021), we have focused on the suppliers' perceptions of the value they consider they can draw from their supply chain relationships. Our findings suggest that buyer-led environmental supplier development enhances the environmental management capabilities of suppliers by heightening their perceptions of the environment-related value (encompassing the financial, strategic and co-creation dimensions) of their relationships with their buying counterparts.

Second, previous scholars have shown that supplier environmental management capabilities are enhanced by factors laying at the levels of the buyer, the supplier and third-party organizations (Lee and Klassen, 2008; Wang *et al.*, 2021; Wong *et al.*, 2012). Focusing on the first two levels, we have shown that they are strictly connected, specifically that the effectiveness of buyers' indirect and direct environmental development initiatives is mediated by suppliers' perceptions about the ability of their supply chain relationships to generate value. These findings hold true even controlling for the resource support of third-party organizations. Thus, the present study contributes to our understanding of buyer-led supplier development initiatives by pointing to the salience of the supplier perspective (Saghiri and Mirzabeiki, 2021), and specifically by revealing a critical supplier-level psychological mediator of their effectiveness. The more suppliers perceive the economic, strategic and synergistic advantages of focusing on environmental issues in their supply chain relationships, the more they respond to their customers' environmental development initiatives by investing to enhance their ability to

identify and manage environmental problems in a timely and effective manner.

Third, while previous supply chain management scholars have not systematically employed the SOR framework to investigate suppliers' behavioral reactions to buying firms' environmental management practices, our study shows the potential of the SOR framework for doing empirical research in the green supply chain management field from a theoretical perspective that is aware of the role played by psychological factors. Specifically, we have shown that the external stimulus represented by buyer-led environmental supplier development programs translates into an increased supplier engagement in the development of environmental management capabilities through the positive influence that buying firms' programs exert on the suppliers' perceptions of the value creation potential of the relationship. Thus, drawing on SOR theory, we have shed light on the psychological processes—which include environmental stimuli, cognitive reactions and resulting behaviors—by which suppliers respond to the initiatives of their buying counterparts, thereby providing a more nuanced understanding of the psychological and behavioral mechanisms by which buying firms can influence the development of capabilities at the supplier level.

6.2 Managerial and societal implications

This study has important implications for managers of buying and supplying firms, especially in (but not limited to) the textile and IT/ICT industries.

Managers of buying companies who are interested in how to stimulate suppliers to develop environmental management capabilities should consider that DD is suitable to different circumstances. Indeed, it can directly influence the suppliers' willingness to invest in the development of their capabilities. In addition, DD can also enhance the suppliers' responsiveness indirectly, i.e. through its influence on the suppliers' perceptions of the ability of the relationships to generate economic, strategic and co-creation value. This mediated effect holds irrespective of the specific motives of suppliers, that is, irrespective of whether suppliers value more the economic, strategic or value co-creation benefits of supply chain relationships.

This is not to say, however, that buying firms should always resort to DD. In fact, DD projects require significantly more time and financial resources when compared to ID. Thus, buyers should look at the suppliers' prevailing motives to decide whether to opt for direct or ID. In the case of suppliers with instrumental or strategic motives, who value more the economic and resource benefits of supply chain relationships, both ID and DD can be effective, and buying firms can decide whether to adopt assessment-based or collaborative approaches based on their own willingness and ability to devote resources to their relationships with suppliers. Conversely, in case suppliers hold synergistic motives, that is, they are primarily focused on the value co-creation potential of supply chain relationships, buyers have no alternative to DD, since creating the conditions for joint value creation in buyer–supplier relationships requires truly collaborative and relationally-intense interorganizational partnerships, that ID would not be able to promote.

Moreover, since the textile and IT/ICT industries have distinct features, managers of buying companies should design their supplier development strategies in accordance with the specific requirements of each industry, so as to optimize their

impact. In the textile industry, environmental management is primarily concerned with reducing waste and emissions during production to comply with ever-stringent environmental regulations and with growing consumer expectations for sustainability (Shaw *et al.*, 2024). Therefore, buyers can encourage the enhancement of the environmental management capabilities of suppliers by stimulating and helping them to adopt eco-friendly production methods and materials. In the IT/ICT industry, suppliers tend to prioritize carbon reduction and recycling across the product lifecycle in their environmental management endeavors (Borazon *et al.*, 2022). Consequently, a primary way for buying firms to strengthen the environmental management capabilities of their supplying counterparts is encouraging them to introduce innovative energy-efficient technologies.

On the suppliers' side, the present study reminds us of the strategic importance for suppliers to develop environmental management capabilities and to appreciate the role played by their customers in the process. For example, suppliers in the textile industry face numerous environmental management challenges, concerning water consumption, rising customer demand for eco-friendly products, monitoring and reduction of chemical emissions and wastewater treatment (Shaw *et al.*, 2024). In the IT/ICT industry, the rapid turnover of electronic and electrical products results in substantial electronic waste production, which requires suppliers to prioritize electronic waste recycling, energy conservation and emission reduction policies (Wu, 2013). In these contexts, instead of perceiving buyer-led environmental development initiatives as ways for buying firms to shift their environmental responsibilities to their supplying counterparts, suppliers should enhance their ability to seize the strategic opportunities arising from those initiatives and their potential to fuel the growth of environmental management capabilities at the supplier level. Thus, suppliers should not only offer environmental skill training programs to their employees, cultivate high-quality environmental management professionals and establish specialized teams to monitor environmental laws, policies and industry trends and to detect the evolving environmental demands of their major customers, but also invest into establishing and strengthening over time close collaborative relationships with them as a way to continually enhance their knowledge and expertise in environmental management.

We also note that all the above may have significant repercussions at the societal level. In particular, tight collaboration between customers and suppliers and between them and other primary stakeholders such as governmental and nongovernmental organizations, industry associations and consumer organizations, will help all the participating actors to drive environmental initiatives to proactively address the critical environmental challenges of our time. For instance, the Taiwanese government leveraged the collaboration of consumers, industry associations and supply chain firms to establish the “RoHS Service Group”, which provides technical guidance and financial support to IT/ICT manufacturers, promoting the development of environmental regulations and inspection standards (Wu, 2013).

6.3 Limitations and future research directions

The present study has its own limitations, which pave the way for further research. First, we have focused on the positive side of

suppliers' perceptions, i.e. those concerning the value creation potential of buyer–supplier relationships. However, future studies might adopt a wider perspective and consider negative perceptions too, i.e. suppliers' perceptions of the risks associated with buyer–supplier collaboration, to ascertain whether and how they interact with positive suppliers' perceptions in mediating the association between buyer-led supplier development and suppliers' initiatives aimed at capability development.

Second, while our data were drawn from the Chinese textile and IT/ICT industries, future research might test the generalizability of our findings to different industries and countries. In particular, the way suppliers react to ID vs DD initiatives may be especially influenced by the surrounding cultural context, and nontrivial differences between Western and Asian countries are to be expected (Capaldo *et al.*, 2012).

Third, although we have offered theoretically sound arguments in support of the mediating effect of suppliers' perceptions concerning the value creation potential of their customer relationships, our use of cross-sectional data did not allow us to empirically test reverse causality. In other words, we cannot exclude that buyer-led supplier development initiatives have a direct influence on the development of environmental management capabilities at the supplier level, which in turn lead suppliers to develop positive perceptions about the value creation potential of their relationships with customers. We therefore encourage future researchers to employ longitudinal data to compare and contrast the two causal patterns.

Finally, while the supplier perspective adopted here has helped us to shed light on the psychological and behavioral processes by which suppliers respond to buyer-led environmental supplier development initiatives, we acknowledge that integrating data from both buyers and suppliers would provide a more balanced view, especially for complex constructs like value co-creation. We therefore encourage future researchers to employ dyadic data to capture the perceptions of both buyers and suppliers, thereby reaching a more comprehensive understanding of environmental development initiatives in supply chain contexts.

Notes

- 1 www.ipe.org.cn/GreenSupplyChain/BrandStoryDetail.aspx?id=94
- 2 www.ipe.org.cn/GreenSupplyChain/BrandStoryDetail.aspx?id=73
- 3 www.dell.com/zh-cn/dt/corporate/social-impact/esg-resources/reports/fy23-esg-report.htm?hve=%E9%98%85%E8%AF%BB%E6%8A%A5%E5%91%8A#pdfoverlay=/www.delltechnologies.com/asset/zh-cn/solutions/business-solutions/briefs-summaries/delltechnologies-fy23-esg-report.pdf
- 4 www.levistrauss.com/wp-content/uploads/2023/09/2022-LSCo.-Sustainability-Goals-Progress-Update.pdf
- 5 The Green Supply Chain CITI Index dynamically evaluates the world-leading brands' environmental management of their supply chains in China by focusing on such aspects as environmental compliance, energy conservation and emission reduction, and information disclosure.

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Appendix

Table A1. Measured items

Suppliers' environmental management capability	
EMC1	We are ISO14000 certified
EMC2	We conduct supplier environmental evaluations
EMC3	We are able to provide ecological proof of our products
EMC4	We cooperate with our customers to reduce environmental impact in the manufacturing process
EMC5	We have personnel trained in environmental aspects/regulations
EMC6	We have an environmental management system
Buyer-led environmental supplier development	
In the form of setting environmental requirements and audits:	
ID1	Our main customers urge us to take environmental actions
ID2	Our main customers require us to comply with environmental regulations
ID3	We are selected by our main customers based on environmental criteria
ID4	Our main customers evaluate our environmental performance and compliance via their auditors
ID5	Our main customers provide us with feedback on the results of their environment-related evaluations
ID6	Our main customers require us to commit to waste reduction goals
In the form of direct development projects, run or supported by the buyer:	
DD1	Our main customers exchange information with us to improve environmental performance
DD2	Our main customers support the environmental awareness of their suppliers through reports, workshops or seminars
DD3	Our main customers guide/help us to establish our own environmental programs
DD4	Our main customers bring their suppliers (including us) together to share their environmental know-how and problems
DD5	Our main customers financially sustain our environment programs
Environment-related supplier perceived relationship value	
Economic value:	
EFV1	Engaging in environmentally friendly activities within the relationships with our main customers allows us to gain higher profits from the relationships
EFV2	Engaging in environmentally friendly activities within the relationships with our main customers reduces the costs incurred from the relationships
EFV3	Engaging in environmentally friendly activities within the relationships with our main customers allows us to get higher sales from them
EFV4	Engaging in environmentally friendly activities within the relationships with our main customers allows us to yield additional business opportunities from them
Strategic value:	
ESV1	Engaging in environmentally friendly activities within the relationships with our main customers allows us to learn about their environmental initiatives and culture
ESV2	Engaging in environmental activities within the relationships with our main customers allows us to absorb from them useful information and knowledge related to environmental issues
ESV3	Engaging in environmentally friendly activities within the relationships with our main customers enhances our environmental reputation
ESV4	Engaging in environmental activities within the relationships with our main customers allows us to absorb from them critical know-how about how to establish an environmental management system
ESV5	Engaging in environmental activities within the relationships with our main customers enhances our brand image

(continued)

Table A1.

Co-creating value:**ECV1**

Engaging in environmental activities within the relationships with our main customers improves our joint performance in terms of fulfillment of (green) product standards

ECV2

Engaging in environmental activities within the relationships with our main customers improves our joint performance in terms of (green) product development

ECV3

Engaging in environmental activities within the relationships with our main customers improves our joint performance in terms of (green) production process development

Supplier environmental orientation**SEO1**

We always attempt to go beyond basic compliance with laws and regulations on environmental issues

SEO2

Our top managers give high priority to environmental issues

SEO3

We lead the industry in environmental issues

SEO4

We effectively manage the environmental risks that affect our business

SEO5

Our corporate management gives high priority to environmental issues

Source: Author's own work

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