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How institutional pressures and managerial incentives elicit carbon transparency in global supply chains

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Abstract

Carbon transparency, once a niche practice, is increasingly becoming institutionalized. Firms are now required to report not only their operations' carbon emissions but also their suppliers'. This research explores the institutional pressures emanating from buyers and industry peers driving supplier firms to disclose high-quality carbon emission publicly—our concept of carbon transparency. Many firms are increasingly adopting incentives to engage their employees in corporate climate change programs. Thus, we study the impact of three institutional pressures—*coercive*, *mimetic*, and *normative*—and examine when these pressures are more (or less) effective for driving supplier carbon transparency depending on the presence of climate change incentives. We used Carbon Disclosure Project's supply chain program (CDP-SCP) as our research context. To gain deeper insight into the CDP-SCP as well as the drivers and challenges of suppliers' carbon transparency, we conducted interviews with three CDP officials, three CDP-SCP members (i.e., buyers), and six CDP-SCP participants (i.e., suppliers). To test our hypotheses, we used a unique dataset from CDP-SCP and complemented it with four other archival datasets for a sample of 835 suppliers operating in 41 countries during the 2013–2015 period. The results show that suppliers *without* climate change incentives are more vulnerable to coercive and mimetic pressures, whereas suppliers *with* climate change incentives are more receptive to normative pressure in terms of how much carbon transparency they exhibit. Thus, our study proposes an extensive concept of supplier carbon transparency, provides a comprehensive analysis of its external/internal drivers, and reveals when institutional pressures are more/less effective in eliciting supplier carbon transparency. This research also provides strategies for how buyers, suppliers, and CDP can foster more carbon transparency in supply chains.

KEYWORDS

buyer–supplier relationship, CDP, climate change, institutional pressure, transparency

1 | INTRODUCTION

Firms are increasingly pressured to be transparent about the environmental impacts of their business operations and supply chains (The Economist, 2014), especially with increasing awareness of climate change and its potentially detrimental effects. For many firms, a large percentage of their carbon emissions may come from their

supply chains (Blanco, Caro, & Corbett, 2016). As a result, firms increasingly seek transparency regarding the environmental impact of the goods and materials procured from their suppliers (New, 2010; Tapscott, 2003). By obtaining information about their suppliers' environmental goals, initiatives, and performance, firms can leverage this information to develop carbon-footprint labels for their products (van Weele & van Tubergen, 2017), customize their risk-mitigation sustainability programs (Chopra & Sodhi, 2004), and meet reporting requirements (Dhaliwal, Li, Tsang, & Yang, 2011). Thus, firms can benefit in several ways by working with transparent suppliers.

Carbon transparency—the provision of high-quality carbon emission information to stakeholders (Hahn, Reimsbach, & Schiemann, 2015; Ott, Schiemann, & Günther, 2017) was once a niche practice, but is increasingly becoming institutionalized. We focus on carbon transparency in the context of supply chain relationships. Promoting carbon transparency in supply chains is challenging. Supplier firms often symbolically participate in voluntary disclosure programs (Heflin, Subramanyam, & Zhang, 2003; Jira & Toffel, 2013); however, this participation may not always translate into substantive transparency (Marquis, Toffel, & Zhou, 2016; Stanny, 2013). For instance, suppliers avoid answering relevant questions (Stanny, 2013), or they disclose information to a very limited group of stakeholders (Heflin et al., 2003). This symbolic behavior allows suppliers to shield their internal practices from outside scrutiny without disrupting the pursuit of their internal imperatives (Pfeffer & Salancik, 2003). Additionally, this behavior prevents stakeholders (e.g., buyers, NGOs, and policy makers) from making accurate evaluations about the supplier's climate change goals and efforts taken to achieve them. Thus, it is vital to understand *how* and *when* suppliers truly engage in carbon transparency.

Institutional pressures emanating from buyers and industry peers can drive supplier firms toward carbon transparency. Past research (Jira & Toffel, 2013) has shown that *coercive pressure* from an increasing number of buyers is one of suppliers' primary external drivers to participate in voluntary disclosure programs such as the Carbon Disclosure Project's Supply Chain Program (CDP-SCP)—a globally recognized platform in which member firms (i.e., buyers) invite their suppliers to disclose information about their carbon emissions, climate change governance mechanisms, emission reduction initiatives, and the like. While examining the effect of such coercive pressure is certainly worthwhile, other forms of institutional pressure include *mimetic pressure* from industry peers or *normative pressure* from industry leaders that also play a critical role (DiMaggio & Powell, 1983; Hahn et al., 2015). Supplier firms might respond to competitive forces from their peers—*mimetic pressure*—by increasing imitation and copying their industry peers' sustainability practices (Kolk, 2010; Okhmatovskiy & David, 2012). For instance, if many peer companies in the chemical industry disclose their carbon footprint through CDP-SCP, a chemical company could perceive pressure to implement carbon-reduction programs to avoid losing market competitiveness and be interested in accurately communicating such initiatives publicly. Furthermore, in their efforts to seek greater legitimacy, suppliers may promptly follow industry standards laid down by leading firms in their industry—*normative pressure* (DiMaggio & Powell, 1983; Heugens & Lander, 2009). For instance, if an electronic supplier has several leading buyers and industry peers proactively setting industry-wide environmental reporting standards, the supplier is likely to conform with such standards. Clearly, each type of pressure—*coercive*, *mimetic*, and *normative*—plays a unique role in driving supplier transparency. Therefore, we provide a complete picture of how these three distinct institutional forces promote supplier carbon transparency.

Along with these external forces, supplier firms have increasingly implemented internal mechanisms to tackle climate change and to promote sustainability from within (Blanco, Caro, & Corbett, 2017). Research has explored internal drivers facilitating the development of a strategy to tackle climate change. Such drivers include governance structures (Ben-Amar & McIlkenny, 2015), CEO characteristics (Lewis, Walls, Glen, & Dowell, 2014), and corporate culture (Stubbs, Higgins, & Milne, 2013). Yet, the mechanisms to implement such a strategy have been unexplored. Therefore, we focus on climate change incentives that firms are increasingly offering and that are pivotal to operationalizing climate change programs. For firms, such incentives can be fundamental in aligning the daily activities of managers with their company's goals (Eisenhardt, 1985). For example, Intel was one of the first firms to link climate-change issues to its employees' compensation, thereby making the company's sustainability goals the employees' pursuit. Thus, we study whether providing *climate change incentives*—defined as financial and nonfinancial rewards that a firm implements to motivate its employees to attain its climate change goals—promotes carbon transparency.

Because institutional pressures (i.e., coercive, mimetic, and normative) and internal mechanisms (i.e., climate change incentives) inevitably coexist, we also explore how their interaction drives supplier carbon transparency. We argue that the impact of institutional pressures on supplier transparency might depend on *climate change incentives* that supplier firms offer

internally—a topic that has received scant attention in the literature (Hahn et al., 2015; Lee & Tang, 2017). Yet, firms have been known to exhibit varying responses to each institutional pressure (Greenwood, Díaz, Li, & Lorente, 2010; Oliver, 1991) contingent on their internal firm characteristics (e.g., Delmas & Toffel, 2004; Liu, Ke, Wei, Jibao, & Chen, 2010). Offering incentives requires that supplier firms have established goal-setting and goal-monitoring processes that allow them to better assess the pros (e.g., building trust) and cons (e.g., regulatory scrutiny) of increased transparency. We posit that incentives play a crucial role in determining the supplier's transparency decisions in response to different types of institutional pressures. Because managers in supplier firms with climate change incentives are internally motivated, they are in a lesser need of external–*coercive* and *mimetic*–pressures to exhibit carbon transparency. Instead, by carefully examining the pros and cons of providing carbon information to stakeholders, suppliers with climate change incentives are in a better position to determine internally the requisite level of transparency. Conversely, suppliers with climate change incentives are more receptive to *normative pressure* because their managers are motivated to seek legitimacy from their industry leaders, actively engaged in conforming or even setting reporting standards, and leverage tools/resources accessible through industry networks and coalitions. Thus, our study reveals when each institutional pressure can elicit supplier carbon transparency, depending on the provision of climate change incentives in supplier firms.

To build our hypotheses, we integrated the transparency literature and institutional theory and grounded our theory in insights gained from interviews with three CDP officials, three CDP member firms (i.e., buyers), and six CDP-SCP participants (i.e., supplier firms). These interviews helped us gain deeper insights into the CDP-SCP and its data-gathering process; the distinct types of institutional pressures on supplier carbon transparency; and the suppliers' process, motivations, and challenges in disclosing carbon emission information. To test our hypotheses, we collected a unique dataset from CDP-SCP and complemented it with four datasets from ASSET4, the International Union for Conservation of Nature (IUCN), the World Economic Forum (WEF), and the United Nations. By building on two theories and combining archival and interview data, we provide a grounded view of *how* and *when* external and internal forces drive or curb supplier carbon transparency.

Our research makes the following contributions. First, our study contributes to the literature on corporate environmental disclosure (Hahn et al., 2015; Jira & Toffel, 2013; Ott et al., 2017) by providing an extensive concept of *supplier carbon transparency* consisting of three distinct dimensions: comprehensiveness, accuracy, and public disclosure. This enhanced conceptualization is important because suppliers could participate in a disclosure program to avoid their buyers' discontent or retaliation but not answer any questions—a type of symbolic disclosure (Stanny, 2013), avoid answering relevant questions—a type of selective disclosure (Marquis et al., 2016), or choose to disclose information to a limited group of stakeholders (Heflin et al., 2003). Second, although the literature about corporate environmental disclosure has focused on the pressure from NGOs, media, and investors (e.g., Hanke & Stark, 2009; Ott et al., 2017; Reid & Toffel, 2009), it has largely overlooked pressure from supply chain members (e.g., buyers and peers) (Hahn et al., 2015). While Jira and Toffel (2013) were the first to examine how coercive pressure from buyers drive supplier participation in CDP-SCP, we advance these studies by investigating *how* and *when* three relevant institutional pressures—*coercive*, *mimetic*, and *normative*—are effective in eliciting supplier carbon transparency, while controlling for an extensive list of other confounding factors (e.g., NGOs, investors, legal environment). Third, while managerial incentives have been known to play a critical role in improving environmental performance of firms that adopt them (Klassen & Vachon, 2003; Porteous et al., 2015; Sarkis et al., 2011; Vachon & Klassen, 2007; Villena & Gioia, 2018), little is known about how incentives drive firms to show more environmental (particularly carbon) transparency (Plambeck & Taylor, 2015). The results suggest that incentives play an important role in driving supplier firms to disclose high-quality carbon information, especially when normative pressures exist.

2 | THEORY AND HYPOTHESES DEVELOPMENT

2.1 | Supply chain carbon transparency

Firms are interested in increasing their suppliers' carbon transparency for operational, strategic, and regulatory reasons. If suppliers are more transparent about their carbon emissions, buyers can benchmark their performance with competitors and identify cost- and risk-reduction opportunities in their supply chains. As a result, supplier transparency may help buyers make better decisions to mitigate suppliers' risks associated with greenhouse gas (GHG) emissions. Also, buyers interested in developing carbon-footprint product labels to strategically differentiate their products in the market must engage their suppliers in order to collect carbon-emission data (Jira & Toffel, 2013). For instance, as part of its Sustainable

Living Plan, Unilever is aiming to halve its products' environmental footprint. Only 3% of Unilever's carbon footprint is caused by Unilever's factories and ~2% by distribution and transportation network. However, its supplier network is responsible for 29% of Unilever's carbon footprint (van Weele & van Tubergen, 2017). Finally, buyers are under more pressure to quantify their Scopes 1, 2, and 3 GHG emissions (with suppliers being responsible for a large part of the Scope 3 GHG emissions) to meet regulators' requests. For instance, the United States Securities and Exchange Commission requires that publicly traded companies' annual reports include the business, physical, and regulatory risks that climate change poses. Thus, promoting supplier carbon transparency is fundamental for buying firms seeking to excel in the marketplace and comply with regulations.

Based on the transparency literature (for a review see Schnackenberg & Tomlinson, 2016), we define *supplier carbon transparency* as the availability of high-quality, supplier-specific carbon emission information to stakeholders. According to this conceptualization, transparency has three distinct dimensions: comprehensiveness, accuracy, and public disclosure. *Comprehensiveness* refers to the amount of environmental information shared. This metric is important because some suppliers may disclose the minimum information necessary merely to avoid their buyers' discontent. Thus, to be considered transparent, a supplier must present comprehensive carbon information. *Accuracy* is defined as the supplier's effort to provide carbon information that is reliable; its importance stems from the perspective that information cannot be considered transparent if it is deliberately biased and/or unfounded. *Public disclosure* refers to a supplier's publicly sharing relevant carbon information. Such information must be openly shared with all stakeholders; otherwise, the supplier might share information with powerful stakeholders with whom compliance is required (e.g., buyers) but not with others who could further scrutinize such information (e.g., NGOs). Thus, supplier transparency is a function of these three dimensions with each contributing uniquely to the degree of transparency (see Figure 1).

This rigorous conceptualization of supplier carbon transparency is important because supplier firms could opt to disclose selectively (e.g., by not sharing emissions data or the methodology used) (Stanny, 2013), disclose with bias (e.g., by lacking precision in the disclosed information) (Marquis et al., 2016), or disclose to a select group of stakeholders but not to the public (Heflin et al., 2003). Conversely, if a supplier firm discloses more complete and reliable carbon information, a recipient would conclude that the supplier firm is trustworthy (Doorey, 2011), thereby resulting in future competitive advantage. Likewise, if a supplier shares information publicly, a recipient could view the supplier as being highly committed to or at least accountable for its environmental program. For instance, in our CDP-SCP context, suppliers can disclose environmental information only with those requesting buyers (what we call "private disclosure") rather than with all stakeholders (what we call "public disclosure"). The latter is the riskier option for supplier firms because disclosing information to all stakeholders exposes them to greater scrutiny from stakeholders (e.g., NGOs, regulators, and competitors) with potentially divergent interests.

Supplier transparency evidently benefits buyers; however, it is questionable whether increased transparency is always in the supplier firms' best interest. On the one hand, such transparency has economic and reputational advantages. For instance, voluntary disclosure of environmental and social effects might increase a supplier's market share because by disclosing suppliers could gain trust from current buyers (Kalkanci, Ang, & Plambeck, 2016). More transparent suppliers could also attract potential

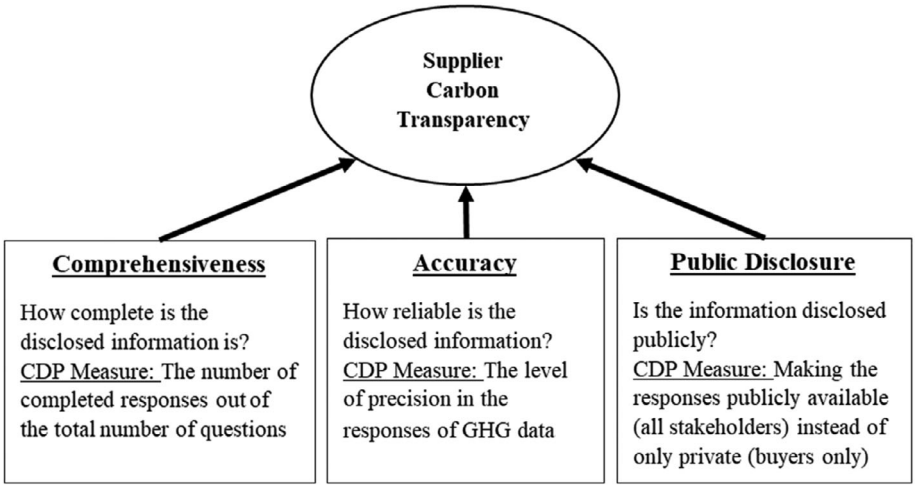

FIGURE 1 Conceptualizing supplier carbon transparency

buyers having a mature sustainability agenda. However, in being transparent, suppliers face not only considerable costs but also uncertainty about how stakeholders will interpret and use the information. Our interviews with three CDP-SCP members (buyers) (see Table 1) and six CDP-SCP participants (suppliers) (see Table 2) revealed that suppliers may risk providing internal environmental data to the following: competitors (who could use such information to their advantage), buyers (who could use data to benchmark and demand significant GHG emission reductions), and regulators (e.g., EPA, which could use such data as grounds for investigation that would increase compliance cost). Table 3 summarizes these benefits/downsides identified in the literature and our interviews.

2.2 | Institutional forces and supply chain carbon transparency

Supply chain carbon transparency has become a widespread corporate practice in recent years. According to the 2018 CDP-SCP report, 5,600 supplier firms participated in the program in response to requests from almost 100 large multinational buyer organizations. In contrast, only 634 supplier firms participated in 2008 when the CDP-SCP was first launched. Today, many suppliers have started disclosing their carbon footprints as a result of growing social expectations and institutional pressures from investors, buyers, competitors, and industry organizations. To examine the external drivers of supplier carbon transparency, we build on institutional theory. According to DiMaggio and Powell (1983), pressures emanate from the institutional environment and push firms to adopt shared notions and routines. Those researchers propose that firms perceive three types of institutional pressures—coercive, mimetic, and normative. *Coercive pressure* originates from regulatory agencies, dominant trading partners, or parent corporations on which the focal firm is dependent (DiMaggio & Powell, 1983; Teo, Wei, & Benbasat, 2003). *Mimetic pressure* results from uncertainty when organizations model themselves after other organizations within their field that they consider progressive or legitimate (DiMaggio & Powell, 1983; Haunschild & Miner, 1997). *Normative pressures* refer to pressures stemming from collective expectations of appropriate and, thus, legitimate behavior within a particular organizational context (DiMaggio &

TABLE 1 Interviews with CDP-SCP members (buyer firms)

Firm	Industry	Country	Why is supplier transparency important?	Ways to promote supplier environmental transparency	Interviewees (titles)
Buyer 1	Consumer products	United States	- Pressure from end customers - Suppliers are part of our extended corporation and our corporate sustainability strategy	- Strategic suppliers should identify two sustainability goals and make them publicly available on their websites - Invitation to the CDP's supply chain program, which is included in supplier scorecard - A specific supplier sustainability award, "best improved CDP"	- Senior Director Sustainable Procurement - EHS&S Senior Manager - Global Energy Director - Manager Procurement Sustainability
Buyer 2	Automotive	United States	- Suppliers bring enough risks to our business - Compliance with regulators' requirements	- Invitation to the CDP's supply chain program - Requirement that every material/component should adhere to environmental, health, and safety requirements (e.g., REACH)	- Head of Sustainability - Supply Chain Sustainability Manager
Buyer 3	Electronics	Netherlands	- Pressure from end customers - Identification of risks and opportunities in the firm's supply chain	- Support with training and tools facilitating transparency and emission reduction initiatives - Along with CDP, the company developed a tool to facilitate disclosure with less experienced suppliers	- Director Supplier Sustainability - Supplier Sustainability Manager

Abbreviation: CDP-SCP, Carbon Disclosure Project's supply chain program.

TABLE 2 Interviews with the CDP-SCP participants (supplier firms)

Firm	Industry	Country	Challenges	Climate change program	Interviewees (titles)
Supplier 1 (Tess)	Plastic	United States China	- Collecting accurate data on carbon emission (Scopes 1–3) - Reporting carbon-reduction initiatives in such a way that stakeholders will use this information negatively	- Managerial incentives - Environmental strategy - Corporate culture	- CEO - EH&S Director
Supplier 2 (Com)	Food service provider	Global (>50 countries)	- Collecting accurate data on carbon emission in each customer's facilities - Global operations with diverse national environmental standards	- Sustainability strategy - CSR committee - Managerial incentives	- HSE Specialist - Regional Director
Supplier 3 (Kem)	Semiconductor	United States	- Judgment by external stakeholders (investors and NGOs) regarding current environmental initiatives - Identifying climate change risks is not a management priority	- Sustainability strategy - Managerial incentives - Sustainability Council	- CSE Manager - Health and Safety Manager
Supplier 4 (Fel)	Electronics manufacturing services	United States Mexico Europe Asia	- Global operations with diverse national environmental standards - Judgment by external stakeholders (e.g., investors and NGOs) on current environmental initiatives - Lack of an integrated management system that includes climate change	- Sustainability strategy - Managerial incentives - Corporate sustainability leadership committee	- CSR & Environmental Responsibility Manager - CSR & Environmental Responsibility Director
Supplier 5 (Jki)	Auto parts manufacturing	United States Mexico Brazil	- Collecting accurate data on emissions (Scopes 1–3) - Lack resources/personnel related to carbon disclosure programs	- Global environmental council - Sustainability strategy	- EH&S Manager - Vice President
Supplier 6 (Dyn)	Auto parts manufacturing	Japan Europe Asia	- Lack of relevant knowledge, tools, personnel to develop a structured climate risk assessment process - Collecting accurate data on emissions (Scopes 1–3)	- Chief executive of Environmental Business - Sustainability strategy	- Director of Safety, Health and Environment - EH&S Manager

Note: For our interviews, we selected supplier firms from a variety of industries and regions. Each one of these interviews lasted at least 60 min.
Abbreviation: CDP-SCP, Carbon Disclosure Project's supply chain program.

TABLE 3 Advantages and disadvantages of transparency

	Description	References
Benefits	- To gain company legitimacy with various stakeholders - To enhance brand reputation and to develop trust with external stakeholders - To leverage transparency as a marketing tool (customers are more willing to purchase products from companies that are more transparent about their operations and products' environmental impacts.) - To signal maturity of the corporate communications' strategy	Schnackenberg and Tomlinson (2016) Ott et al. (2017); Doorey (2011) Jira and Toffel (2013); Supplier and buyer interviews; Neu, Warsame, and Pedwell (1998) Kim and Lyon (2011); Kalkanci et al. (2016)
Costs and risks	- To invest resources in collecting, analyzing, and reporting environmental information (e.g., GHG emissions) to the public - To be exposed to negative market response (investors might penalize firms because they are engaged in voluntary carbon information disclosure.) - To risk providing internal environmental data to competitors (who may use such information to their advantage), customers (who might use data to benchmark and demand significant GHG emission reductions), and government regulators (e.g., EPA who could use such data as grounds for investigation that would increase compliance cost) - To empower external stakeholders (e.g., NGOs and activists) to question companies' sustainability practices - To endanger a company interests (if companies in a sector conceal information, the transparent firm may suffer a disproportionate damage)	Interviews Lev (1992) Jira and Toffel (2013); Interviews Matsumura et al. (2014) Dubbink, Graafland, and Van Liedekerke (2008)

Abbreviation: GHG, greenhouse gas.

Powell, 1983). These institutional forces have been studied in the buyer–supplier relationships to determine how the institutional environment can influence firms' adoption of practices such as total quality management, RFID, information systems (e.g., Bhakoo & Choi, 2013; Liu et al., 2010; Teo et al., 2003), and sustainability capabilities (e.g., Lee & Klassen, 2009; Wilhelm, Blome, Bhakoo, & Paulraj, 2016); however, these forces have been studied less for carbon transparency in supply chains.

Buyers, competitors, and experienced supply chain members can influence supplier firms to exhibit more carbon transparency. First, buyer pressure is instrumental because suppliers respond to their customers' demands to avoid their discontent or retaliation (e.g., Barrientos & Smith, 2007; Brown, Lusch, & Nicholson, 1995). A large number of buyers demanding higher transparency could coerce suppliers to disclose high-quality carbon information publicly because they can penalize suppliers, for example, through contract termination (e.g., French & Raven, 1959; Maloni & Benton, 2000). We call this pressure *coercive pressure*. Second, peer pressure, although relevant, has been the least studied in the transparency literature because most studies have viewed environmental disclosures as a deterministic response to economic and public pressure (e.g., from investors and buyers) (Berthelot, Cormier, & Magnan, 2003). However, supplier firms may imitate transparency practices of other firms in their industries to gain a bigger market share, win contracts, and enhance their reputation; we call this pressure *mimetic pressure* (Escobar & Vredenburg, 2011; Kolk, 2010). Third, suppliers might face pressure to conform with industry-wide environmental reporting standards set by their industry leaders and customers (Bhakoo & Choi, 2013; Liu et al., 2010). Supplier firms conform to these standards because they want to be perceived as legitimate by their leading sustainability supply chain members; we call this pressure *normative pressure*. Thus, we posit that each of these pressures plays a unique role in driving supplier carbon transparency.

While Jira and Toffel (2013) examined how buyers engage suppliers to share GHG information, they focused exclusively on suppliers' decision to participate in the CDP-SCP and showed that such participation is driven by the number of buyers requesting that participation. If suppliers indeed participate, they incur *preparation costs* (i.e., direct expenses for systematically collecting, processing, and sharing climate change information). However, participation and transparency decisions

(comprehensiveness, accuracy, and public disclosure) are different in terms of the costs these decisions incur (Ott et al., 2017). Suppliers that publicly disclose high-quality climate-change information also incur *proprietary costs* (i.e., indirect costs that depend on how diverse stakeholders react to the disclosed information), which are often more uncertain (in contrast to preparation costs). Furthermore, a participation decision differs from a transparency decision because a supplier could symbolically participate in the CDP-SCP to avoid either its buyers' discontent or retaliation (Marquis et al., 2016); but the supplier does not provide useful answers, offers biased information, or shares its information with a limited number of stakeholders. Thus, we propose an extensive concept of supplier carbon transparency—a supplier's decision to share high-quality carbon information publicly. Next, we analyze each of these institutional forces that push suppliers to disclose high-quality carbon information publicly.

2.2.1 | Coercive pressure

Because suppliers are financially dependent on their buyers, buyers are an important source of coercive pressure. Several studies have shown how buyers can push suppliers to participate in environmental disclosure programs (Jira & Toffel, 2013), prompt them to implement environmental management systems (Boiral, 2007; Simpson & Power, 2005), and pressure them to address their environmental shortcomings (Zhu & Sarkis, 2007). For instance, HP requires suppliers to establish science-based targets with the goal of reducing GHG emissions in its supply chain (CDP Report, 2019). Similarly, Johnson & Johnson has urged its key suppliers both to commit to two sustainability goals that are salient to their operations and to publicly disclose those goals on their websites.

We argue that a supplier is responsive to coercive pressure to publicly disclose high-quality carbon information if an increasing number of buyers demand carbon transparency from the supplier. First, a supplier receiving many buyer demands for carbon disclosure might perceive that CDP-SCP is increasingly becoming the global disclosure standard (Jira & Toffel, 2013) and, thus, is encouraged to share more complete and accurate environmental information. Because CDP rates participating suppliers based on the extent/accuracy of carbon disclosures, suppliers could also become more concerned about potentially receiving a low transparency rating that may be viewed as a deficiency among a large pool of buyers. Second, a supplier shares more complete and accurate environmental information to avoid being collectively penalized by a large set of buyers. For example, one of the interviewed suppliers noted that it deals with many buyer inquiries regarding the information it discloses through CDP-SCP. That supplier said, "While some buyers provide general suggestions on how to improve environmental reporting, others are more vocal in requesting improvements in their suppliers' CDP score, and a few others even use this score to negotiate annual carbon emission reductions." Another supplier echoed, "We have to respond to these demands because almost all our largest buyers are CDP supply chain members." Third, the marginal increase in the proprietary costs of publicly disclosing carbon information (Ott et al., 2017) may be viewed as a smaller investment when allocated across the increasing number of buyer requests. As a result, a supplier could feel compelled to share carbon information publicly as more buyers request that the supplier be more transparent. Thus, we hypothesize the following:

H1 *Suppliers that receive more coercive pressure will exhibit higher carbon transparency.*

2.2.2 | Mimetic pressure

Mimetic pressures mainly arise from a firm's perceived success of competitors' actions. In our context, supplier carbon transparency can be viewed as an institutional phenomenon whereby supplier firms imitate their peers' practices even when the benefits are unclear (DiMaggio & Powell, 1983). Several studies have shown how peer pressure can be used to change attitudes, behaviors, and viewpoints of firms within the same industry regarding competitive responses (Klassen & Vachon, 2003), sustainability reporting (Kolk, 2010), and adoption of sustainability practices (Okhmatovskiy & David, 2012). Supplier firms respond to such pressure because they want to prevent peers within the same industry from gaining competitive advantage. Thus, peer pressure can be instrumental in driving carbon transparency; however, it has not been explored in the research stream of supply chain transparency.

We argue that if more peer firms disclose through CDP-SCP, a supplier may be motivated to be more transparent for three reasons. First, a supplier could mimic peers because it faces some uncertainty regarding the trade-offs of emerging sustainability practices (e.g., publicly disclosing high-quality carbon information). Instead of analyzing the pros and cons, a supplier might simply imitate the practices of early adopters within their industries (DiMaggio & Powell, 1983). Second, a supplier may foresee that its buyers can readily compare the CDP scores of the supplier and its peers, potentially making the supplier

vulnerable to more competition. Thus, if an industry is moving toward more environmental transparency, the supplier firm could be compelled to join this effort in order to survive. As one supplier noted,

> "We are one of the few seat providers to the global automotive industry. My direct competitors report to CDP and so do we. A few leading automakers have begun using CDP metrics and compare my company's with our competitors' CDP rating. We have no choice but to outperform in this dimension as well".

As a result, an increasing number of industry peers participating in voluntary disclosure programs can drive the supplier to not only engage in environmental initiatives but also publicly communicate its efforts. Third, according to interviews with CDP-SCP participants, a supplier can anticipate that it will be targeted by external stakeholders (e.g., NGOs, media, and environmental agencies) if it is not sharing high-quality environmental information publicly while its peers are. Thus, we hypothesize the following:

H2 *Suppliers that receive more mimetic pressure will exhibit higher carbon transparency.*

2.2.3 | Normative pressure

The prevalence of a practice in the field creates and strengthens the related norms which, in turn, generate normative pressure on firms and induce them to adopt the prevailing practice (DiMaggio & Powell, 1983; John, Cannon, & Pouder, 2001). In our context, a supplier may perceive pressure to exhibit more transparency if it is exposed to industry-leading buyers and peers who are setting environmental standards (including reporting). This pressure stems from collective expectations of meeting such standards within its industry (Delmas & Toffel, 2004; Heugens & Lander, 2009). For instance, if several leading firms work to collectively set the automotive industry's agenda of environmental standards, an automotive supplier might perceive pressure to implement carbon-emission reduction initiatives to meet such standards and communicate its efforts to maintain its legitimacy in the market. For example, through trade associations or industry organizations such as the Automotive Industry Action Group, leading firms in the automotive industry (e.g., Ford) not only develop the minimum environmental standards that are expected to be followed but also create a common pool of tools and resources that facilitate widespread adoption of such standards in an efficient manner.

We posit that a supplier might respond to normative pressure from industry leaders who themselves prioritize climate change and set industry-wide environmental standards to disclose more carbon information (even if such information is not positive). The main reason for the supplier to conform with transparency norms set by their industry leaders is to remain a legitimate actor in its industry (DiMaggio & Powell, 1983; Heugens & Lander, 2009). As one supplier explained,

> The leading supply chain actors in the automotive industry are members of AIAG's greenhouse gas reporting work group. This group's goal is that suppliers become more aware of GHG emission disclosure... This group assists firms with common tools for calculating/reporting GHG Emissions so any firm in the auto industry uses a common framework.

Another supplier noted,

> it is expected that firms in any tier of the auto supply chain adopt this framework.

To conform to this industry-wide expectation of GHG emission disclosure, suppliers need to change their internal structures/programs to become in line with institutionally appropriate expectations set by their industry leaders. Thus, they will be more transparent about their environmental efforts to showcase their commitment to addressing their shortcomings and complying with industry-wide norms (Oliver, 1991). Relatedly, because industry-wide environmental reporting standards set by leading buyers and peers are often accompanied with tools and protocols that are commonly accepted in the industry, suppliers might adopt such standards to gain some operational efficiencies. Thus, a supplier responds positively to pressure from experienced buyers and peers who collectively set industry reporting norms because it is interested in accruing reputational and operational benefits. Thus, we hypothesize the following:

H3 *Suppliers that experience more normative pressure will exhibit higher carbon transparency.*

2.3 | The influence of internal mechanisms on carbon transparency

Scholars have emphasized corporate strategy's role in defining how firms respond to environmental demands (Corbett & Klassen, 2006; Hanke & Stark, 2009). Previous

research has highlighted the role of top managers (Ben-Amar & McIlkenny, 2015), CEO background (Lewis et al., 2014), and organizational culture (Stubbs et al., 2013) in meeting such demands. In contrast, our focus centers on managerial incentives because our interviewed suppliers indicated that climate change incentives are effective internal drivers of transparency for two reasons. First, having climate change incentives typically means that firms have fully committed to climate change because incentives come only after a well-thought-out process of planning and goal-setting. To have incentives in place, suppliers must have done the following: analyzed the risks that climate change may pose to their operations; identified how they could address such risks; and planned initiatives, policies, and measures designed to reduce their operations' carbon footprint (based on interviews with CDP-SCP participants). Second, other levers such as top management, CEO's background, and culture can play a role in developing a climate-change strategy; however, managerial incentives play a more pivotal role in operationalizing such a strategy. Incentives for managing climate-change issues can help with implementing strategy because such incentives can align the company's goals with the employees' daily activities (Villena, Gomez-Mejia, & Revilla, 2009; Wiseman & Gomez-Mejia, 1998).

Thus, it is reasonable to assume that suppliers with managerial incentives for addressing climate-change issues are in a more mature stage of their climate-change journey. At the very least, goals for the employees' environmental efforts are clearly set and periodically monitored so that incentives/rewards can be granted. To reward their employees, supplier firms may choose monetary (e.g., bonus) and nonmonetary approaches (e.g., employee sustainability award) (Russo & Harrison, 2005). For instance, IBM recognizes employees who excel in pursuing environmental goals by inducting them into the Business Continuity Hall of Fame, whereas Intel ties employee compensation to key environmental metrics and even discloses details about such compensation in its annual report. Thus, we define *incentives* as financial and nonfinancial rewards that a firm implements to motivate its employees to attain its climate change goals.

We posit that incentives could drive supplier firms to exhibit more carbon transparency. Such incentives are designed to help suppliers achieve and communicate their corporate sustainability goals and progress (Lothe, Myrtveit, & Trapani, 1999; Russo & Harrison, 2005). For instance, National Grid, a major utility provider, has a corporate goal of 80% GHG reduction by 2050, with 45% by 2020. To translate such corporate-level goals into managerially relevant objectives, National Grid must set well-defined goals for its managers (e.g., reduced Scope 1 carbon emissions' annual target). To this end, supplier firms must first gather accurate data to establish these goals because the design of managerial incentives will be linked to such goals. Similarly, for managerial incentives to work, supplier firms must periodically track their progress (Kolk & Perego, 2014). Through their goal-setting and goal-monitoring activities, supplier firms with climate change incentives are likely to have collected data on their environmental impact, set specific targets, and even validated such information's accuracy. This availability of rich environmental data allows suppliers to be in a better position to determine the level of transparency their firms should exhibit after carefully examining the pros and cons of doing so.

However, the picture is less clear regarding managers' motivations to be transparent. On the positive side, managers with incentives tied to climate change are motivated to develop and maintain good relationships with external stakeholders (e.g., buyers and NGOs) because these stakeholders may not only offer relevant information supporting managers' environmental efforts but also provide external validation. Sharing more complete and accurate carbon information helps them gain external legitimacy regarding their firms' environmental goals and achievements (Bansal & Clelland, 2004). Such external validation also ensures that managers are rewarded for their personal efforts toward achieving their firm's climate change goals (Delmas & Burbano, 2011; Kolk & Perego, 2014). Additionally, managers may be in favor of disclosing high-quality carbon information to avoid their firms' being viewed as greenwashing firms—firms that mislead consumers about their environmental performance or the environmental benefits of their products or services (Delmas & Burbano, 2011), which could jeopardize any recognition/rewards they and their companies might receive. On the negative side, managers are aware that publicly disclosing carbon information might lead to more stakeholder scrutiny (Marquis et al., 2016). Publicly revealing more information on, for instance, their carbon emission targets, climate-change risks, and environmental initiatives might expose them and their companies to more scrutiny from regulators, buyers, and NGOs. While these competing forces influencing managers' motivations do exist, we expect that suppliers with climate change incentives are better equipped to collect, assemble, and communicate carbon information. Thus, we hypothesize the following:

H4 *Suppliers with managerial incentives for managing climate change issues will exhibit higher carbon transparency.*

2.4 | Joint effect of institutional pressures and managerial incentives on supplier carbon transparency

Although institutional pressure (external drivers) and managerial incentives (internal drivers) can independently elicit supplier carbon transparency, we also investigate their joint effects. Institutional theory can offer rich insights into the underlying reasons for variation in organizational responses to institutional pressures (Greenwood et al., 2010; Oliver, 1991). Thus, firms may exhibit various levels of transparency depending on how they interpret the institutional pressures in the context of their internal firm characteristics (e.g., Delmas & Toffel, 2004; Liu et al., 2010). Our goal is to understand when institutional pressure's impact is more/less pronounced in eliciting supplier carbon transparency contingent on the presence/absence of climate change incentives.

We argue that the efficacy of *coercive pressure* and *mimetic pressure* to drive carbon transparency is stronger for suppliers with no climate change incentives because they are more vulnerable to external demands and their managers are less cautious about the scrutiny their firms could face as a result of increased transparency. In contrast, the impact of *normative pressure* is more pronounced in driving carbon transparency for suppliers with climate change incentives because their managers are interested in meeting industry-wide environmental standards set by leading supply chain partners to enhance their legitimacy in the market and because they are in a better position to leverage resources (e.g., tools) available through industry networks and associations. We develop detailed arguments below, borrowing from literature on transparency and institutional theory.

2.4.1 | Coercive pressure and managerial incentives

We postulate that coercive pressure from buyers will have a stronger impact on carbon transparency for suppliers lacking climate change incentives compared to those with such incentives. These suppliers are more vulnerable to buyers' demands for increased transparency because they lack any internally established mechanisms or agents that may resist these external pressures (Oliver, 1991). In other words, these suppliers are less likely to thoroughly assess trade-offs between the benefits (e.g., increased legitimacy) and potential downsides (e.g., increased scrutiny) resulting from increased transparency because they have not initiated goal-setting and goal-monitoring activities regarding their environmental impacts. Furthermore, in the absence of incentives, managers in such supplier firms will be less cautious (because they have nothing to lose) about the scrutiny that their firms could be exposed to as a result of increased transparency (Short & Toffel, 2007; Stanny, 2013). In contrast, coercive pressure is less relevant for suppliers with climate change incentives because they need less external motivation for being more transparent. In fact, suppliers with climate change incentives are likely to have well-established mechanisms for setting carbon-emission goals, monitoring them, and aligning employee behaviors. These suppliers consider themselves proactive in dealing with climate change issues and are well-equipped to determine the necessary level of transparency based on their internal guidelines and protocols. Because these suppliers prefer following internal guidelines to maintain legitimacy (Okhmatovskiy & David, 2012), external coercive pressure has little effect. Also, because they are better positioned to evaluate the trade-offs between transparency's benefits and downsides, their managers will be able to thoroughly evaluate the risks of exposing their firms (and, consequently, themselves) to public scrutiny (Marquis et al., 2016). As a result, we can expect managers in supplier firms with climate change incentives to be more cautious by not pushing for greater transparency than needed. Therefore, we posit that suppliers with climate change incentives are less responsive to increasing coercive pressures from buyers to exhibit a higher carbon transparency.

H5 *The positive relationship between coercive pressure and supplier carbon transparency is stronger for suppliers that do not have climate change incentives than for suppliers that have such incentives.*

2.4.2 | Mimetic pressure and managerial incentives

We argue that the positive impact of mimetic pressure from industry peers to enhance carbon transparency is stronger for suppliers lacking climate change incentives compared to those with such incentives. Because these suppliers are unlikely to have clearly determined their climate change goals/initiatives—much less monitored and/or assigned rewards for them, they could be more reactive and simply follow their peers' practices (such as disclosing environmental information through CDP-SCP). For these firms, engaging in such "herd" behavior (Barreto & Baden-Fuller, 2006) may increase their chances of being seen as legitimate (Meyer & Rowan, 1977) and prevent negative assessments of their company and product offerings (Oliver, 1991).

Additionally, because their managers are less likely to perceive any risk to their personal welfare (i.e., they have nothing to lose), they may be less cautious about revealing environmental information (Stanny, 2013) and are, consequently, more likely to mimic their industry peers' transparency efforts. Conversely, suppliers with climate change incentives need less external motivation, including peer pressure, to be more transparent. They have an internal environmental agenda and benchmarks to determine the appropriate level of carbon transparency, based on thoroughly assessing its trade-offs (i.e., pros and cons). These suppliers are therefore more likely to follow their internal organizational protocols (Okhmatovskiy & David, 2012) rather than blindly imitate peer firms (Kang & Yanadori, 2011). Also, in the presence of incentives, managers could be more careful about assessing the pros and cons of revealing more environmental information than they already do (Marquis et al., 2016). Thus, the impact of mimetic pressure to exhibit higher levels of carbon transparency is weaker for suppliers with climate change incentives.

H6 *The positive relationship between mimetic pressure and supplier carbon transparency is stronger in suppliers that do not have climate change incentives than in suppliers that have such incentives.*

2.4.3 | Normative pressure and managerial incentives

We argue that normative pressure's positive impact on supplier carbon transparency is stronger for suppliers with an established climate change incentive structure compared to those lacking such a structure. First, because suppliers with climate change incentives already have environmental goals, are monitoring them, and are using incentives as rewards, it is easier for them to reduce the gaps between their current disclosure program and the institutionally accepted reporting standards in their industries. That is, they can promptly address their environmental reporting deficiencies that impede their conformance with industry-wide environmental reporting standards. Their managers will also value their firm's efforts toward being noticed by leading buyers and peers (e.g., they can get some recognition and award) (DiMaggio & Powell, 1983), thereby prompting them to provide more complete and accurate carbon information publicly. In doing so, they might be interested in being one of the early firms in conforming with industry-wide environmental reporting standards. Or, even these managers might proactively engage with industry leaders to participate in setting, rather than merely complying with, industry-wide environmental reporting standards (Okhmatovskiy & David, 2012; Villena, 2019). Second, these suppliers are also better positioned to leverage the common pool of tools/resources (e.g., industry work groups and training) accessible via their industry networks and associations (e.g., AIAG) (Locke, Qin, & Brause, 2007). Consequently, in their efforts to gain access to the "inner circle" of industry networks (Noble & Useem, 1985; Westphal & Zajac, 1997), they will choose to more effectively communicate their environmental efforts accurately, comprehensively, and publicly. Therefore, supplier firms with climate change incentives respond favorably to normative pressure because the benefits (e.g., leveraging industry networks and setting standards) supersede transparency's potential downsides (e.g., regulatory exposure). In contrast, suppliers with no incentives may also be interested in conforming to industry-wide environmental reporting standards; however, they are less equipped to meet the industry-wide reporting standards and/or leverage the resources that their industry networks can offer while their managers are less motivated to improve and disclose their company's environmental performance due to the lack of formal incentives. Thus, we hypothesize the following:

H7 *The positive relationship between normative pressure and supplier carbon transparency is stronger for suppliers that have climate change incentives than for suppliers without such incentives.*

3 | METHODS

3.1 | Research design

Our research integrates qualitative and quantitative data to provide a richer understanding of the research context. We interviewed three CDP officials, three CDP-SCP members (i.e., buyer firms), and six CDP-SCP participants (i.e., supplier firms) to gain deeper insights into the CDP-SCP and its data-gathering process; the levers buyers use to incentivize supplier transparency; and the suppliers' process, motivations, and challenges in disclosing carbon emission information. The interviewed firms represented different industries, regions, and sizes (for further details see Tables 1 and 2). We conducted 20 interviews involving at least 2 informants per firm (see interview protocols in Supporting Information Appendix A1). To test our hypotheses, we used a unique dataset that included information about buyers and suppliers. This dataset was constructed by augmenting the CDP-SCP data with additional proprietary data (e.g., buyer expertise, peer suppliers, and buyer and seller revenue) obtained directly from CDP. We complemented this

dataset with four other data sources: ASSET4, IUCN, the WEF, and the United Nations.

CDP-SCP was created to provide a global disclosure platform through which suppliers can efficiently share information. It is driven by member firms—some of the world's largest organizations that are interested in obtaining information about their suppliers' climate change initiatives and carbon emissions. As of 2015, 89 of the largest buying firms in the world engaged their suppliers through this program. Examples of these buyers (CDP-SCP members) are IBM, Johnson & Johnson, and Walmart, which engage suppliers (CDP-SCP participants) to disclose through CDP-SCP. Buyers invite a subset of their largest suppliers to participate in CDP-SCP thus allowing them to identify and address environmental problems in their supply chains. In line with Jira and Toffel (2013), we consider member firms as "buyers" and firms invited to disclose information as "suppliers." One of the major benefits of CDP-SCP is that it reduces suppliers' reporting burden through a standard questionnaire. Participating suppliers disclose their environmental impact, their environmental management program, and their potential climate changes' risks; share this information with either their buyers (i.e., private disclosure) or all stakeholders (i.e., public disclosure); and state the reliability of the information they share.

We also used the ASSET4 database, which provides environmental, social, and governance information. Researchers have used this database to examine relationships between sustainability and a firm's performance (Cheng, Ioannou, & Serafeim, 2014; Eccles, Ioannou, & Serafeim, 2014). To ensure we had complete information on all supplying firms, we included only public firms in our sample. Although we did not include private firms because of the lack of operational and financial data, those firms may also differ substantially in their efforts to engage in carbon transparency. In fact, they may not face the same kind of risks in making their information publicly available (Berglöf & Pajuste, 2005). After we matched CDP and ASSET 4 datasets, our final sample consisted of 2,060 supplier-year responses from 835 public supplier firms collected between 2013 and 2015. The suppliers represented 10 industry sectors and 41 countries. Tables A2a and A2b in Appendix provide the profile of participating suppliers by industry and country.

3.2 | Measures

3.2.1 | Dependent variables

We used three attributes to measure supplier environmental transparency: comprehensiveness, accuracy, and public disclosure. First, we used comprehensiveness of the disclosed information because it is vital for judging the quality of transparency (Schnackenberg & Tomlinson, 2016). To create this variable, we followed the same procedure used by Jira and Toffel (2013) by using 19 key questions answered by a supplier in the CDP's questionnaire. These questions pertained to the supplier's identification of risks and opportunities associated with climate change, GHG emissions levels, governance of climate change issues, among others (for further details see Table 4). Comprehensiveness was constructed as the sum of the questions answered by the supplier out of these 19 questions. For instance, if a supplier responds to 16 (out of 19) questions, the comprehensiveness measure was recorded as 16 for that supplier. Second, we used Accuracy of the CDP-SCP questionnaire responses provided by the suppliers, who were expected to provide a range of uncertainty associated with their disclosure for Scope 1 emissions. We used the same uncertainty ranges that CDP proposed: more than 90%, 60–90%, 50–60%, 40–50% ... 5–10%, 2–5%, and less than 2% (for further details see Table 5). We used these ranges to construct an ordinal accuracy measure (where low uncertainty indicated higher accuracy), which ranged from 0 to 10. To cross-validate this measure, we selected those suppliers with 5% or less uncertainty and found that they provided high assurance about their carbon emission levels—their disclosure is audited by a third-party firm. Third, suppliers can choose to make their responses to the CDP-SCP available either to all stakeholders (i.e., public disclosure) or only to requesting buyers (i.e., private disclosure). The former is used to measure Public Disclosure. In

TABLE 4 CDP questions included in the comprehensiveness measure

Risk management approach (six questions):	CC2.1a (frequency, results reported, geographical areas, risk considered), CC2.1b, CC2.1c
GHG emission level (five questions):	CC8.2, CC8.3, CC8.4, CC8.4a (relevance Scope 1, relevance Scope 2)
GHG emission reduction (three questions):	CC3.3a (number of projects and total estimate of CO_2), CC3.3b (description of activity)
Governance of climate change (two questions):	CC2.1b, CC2.1c
Engagement in climate change issues in its supply chain (three questions):	CC14.4, CC14.4a, and CC14.4b.

Abbreviations: CDP, Carbon Disclosure Project; GHG, greenhouse gas.

TABLE 5 CDP protocol used to construct accuracy measure

Level of uncertainty in carbon disclosures	Accuracy
Less than or equal to 2%	10
More than 2% but less than or equal to 5%	9
More than 5% but less than or equal to 10%	8
More than 10% but less than or equal to 20%	7
More than 20% but less than or equal to 30%	6
More than 30% but less than or equal to 40%	5
More than 40% but less than or equal to 50%	4
More than 50% but less than or equal to 60%	3
More than 60% but less than or equal to 90%	2
More than 90% but less than or equal to 100%	1

Abbreviation: CDP, Carbon Disclosure Project.

our sample, 245 (38.7%) suppliers disclosed publicly in 2013; 289 (40.0%) in 2014; and 291 (40.7%) in 2015.

We also created an overarching composite measure—*Transparency*—in line with our concept of carbon transparency. Therefore, we treat *Transparency* as a formative construct which is "caused" by its three indicators (i.e., comprehensiveness, accuracy, and public disclosure) (Diamantopoulos & Winklhofer, 2001). Thus, a change in any one of the three formative indicators will lead to a change in the latent construct. Specifically, we used exploratory factor analysis (EFA) (Jolliffe & Basilevsky, 1997; Mertler & Reinhart, 2016) to obtain a single factor constructed from the three indicators. The use of EFA is widespread in the operations management literature (Shah & Ward, 2003). Out of the other possible methods (i.e., principal factor, iterated factor, and maximum likelihood) to obtain factors, the principal component method provided the best communality and generated a single unique component. We used the commonly applied eigenvalues rule to retain a single factor—*Transparency*—that exhibited an eigenvalue (1.43) greater than one. Using this single factor, we were able to explain more than 48% of the total variance in the data. The second and third components had eigenvalues substantially less than one and were, hence, dropped (Kaiser, 1960). Since factor scores are computed using the weighted averages using factor loadings on the three dimensions as weights, this method is more accurate than using a simple average (Lastovicka & Thamodaran, 1991). Apart from their extensive use (Frohlich & Westbrook, 2001; Primo & Amundson, 2002; Shah & Ward, 2003), similar methods for dimension reduction have been used in economics to create composite (i.e., index) measures for economic variables such as personal consumption, social welfare, and so forth (Abeyasekera, 2003).

3.2.2 | Independent variables

We describe the various sources of institutional pressures experienced by the supplier firm. First, we measured the degree of coercive pressure on suppliers based on the number of buyer requests. This variable captured the number of buyers requesting that a particular supplier share its climate change information through the CDP-SCP (Jira & Toffel, 2013); we log transformed the variable to reduce skew. Second, we measured the degree of mimetic pressure as the number of participating supplier firms in CDP-SCP belonging to the focal supplier firm's industry based on the Global Industry Classification Standard (GICS); we calculated the natural logarithm of this variable to reduce skew. Because the strongest mimetic pressures arise from geographically collocated industry peers (Pouder & St. John, 1996), we constructed the measure for mimetic pressure based on peer firms belonging to the same geographic region (i.e., North America, South America, Africa, Asia, Europe, or Oceania). Third, CDP rates its members (i.e., buyers) and participants (i.e., suppliers) based on their performance (e.g., emission reduction) from "A" to "E." To achieve an "A" performance, a firm must comply with the following: its response must be publicly available, has maximum scores regarding absolute emissions performance in Scopes 1 and 2, must have disclosed gross global Scopes 1 and 2 figures, scores maximum points for verification/assurance of Scopes 1 and 2, and has a validated environmental sustainability reputation reported in external sources. Thus, an "A" rating indicates environmental sustainability leadership. To measure normative pressure, we averaged the percentage of (a) A-rated buyers out of the total buyers requesting participation from the supplier firm and (b) A-rated industry peers out of the total participating peer firms. Thus, we focus on leading environmental firms within a specific industry, as indicated by CDP. Finally, *climate change incentives* were measured as a binary variable (1: capturing whether the supplier provided incentives for managing climate change issues; 0: otherwise). While data on buyer requests, buyer sustainability ratings, and suppliers' industry were obtained directly from CDP, the information on managerial incentives and transparency decisions was obtained from supplier responses to the CDP-SCP questionnaire.

3.2.3 | Control variables

To account for confounding factors and potential omitted variable bias, we included an extensive set of control variables. We grouped them into four categories: economic and operational performance, stakeholder pressure,

strategic drivers, and industry and country characteristics. We also ensured that our controls were consistent with studies using CDP as the context (Jira & Toffel, 2013; Ott et al., 2017).

First, we controlled for the various suppliers' characteristics. These measures were obtained from ASSET4. Larger firms are more engaged in greenwashing (Wickert, Scherer, & Spence, 2016) although they are under tighter stakeholder scrutiny regarding their sustainability engagement and, thus, are more inclined to disclose environmental information (Locke et al., 2007; Reid & Toffel, 2009). Firms with poor financial track records might have fewer resources to engage in environmental programs and, thus, be less transparent (Gray, Javad, Power, & Donald Sinclair, 2001; Stanny & Ely, 2008). We measured a supplier firm's size using sales (*Revenues*) and profitability using return on equity (*Profitability*). We also included the firm's *age*, which could affect the maturity of a supplier's climate- change initiatives. These variables were log transformed to reduce skew.

Second, we controlled for the various sources of stakeholder pressures. Consistent with Jira and Toffel (2013) and Marquis et al. (2016), we measured environmental NGO pressure at the country level using data obtained from the IUCN. The measure *Country NGO Density* captured the number of IUCN environmental NGOs in the supplier country per million population—a good proxy for the pressure from environmental NGOs in a particular country (Hafner-Burton & Tsutsui, 2005). We also controlled for investor pressure (Flammer, 2013) using a dummy variable, *Participation in CDP's Investor Program* (coded 1: if a supplier participated and 0: otherwise). CDP provided this measure for each participating supplier. We also included an indicator for *Kyoto Annex I Country* (coded 1: if a supplier's country is exposed to strict climate change regulations and 0: otherwise), which controls for the country-specific differences in environmental regulations (UN Framework Convention on Climate Change, 2010).

Buyer power can also influence supplier transparency. Several studies show that power differences between a buyer and a supplier determine behaviors within the relationship; for example, a supplier could be less opportunistic (thus showing higher transparency) if dealing with a comparatively large and powerful buyer (Huo, Tian, Yu, & Zhang, 2019; Villena & Craighead, 2017). Hence, to control for this effect, we included *Buyer–Supplier Revenue Difference*, calculated as the logarithm of the difference between the focal supplier's sales and the average sales of the buyers requesting information from the focal supplier. Both pieces of information were provided by CDP.

Third, we controlled for operational and strategic drivers that might be relevant to the specific CDP-SCP context. We controlled for *Years Since First Participation* in the CDP-SCP because our interviews revealed that suppliers are likely to be transparent based on their accumulated experience in this program. The CDP provided this data for all years since the program's introduction in 2008; this variable was log transformed. Also, because suppliers with a recent track record of poor environmental performance are less likely to be transparent (Marquis et al., 2016), we controlled for the change in *GHG emissions performance* with a binary measure (1: the supplier's GHG emissions performance improved relative to previous year and 0: otherwise). This measure comes from the CDP-SCP questionnaire. Furthermore, operational characteristics, such as ISO 14000 certification, may drive transparency. We controlled for *ISO 14000 Certification* as a binary variable indicating whether at least one of the supplier's facilities was certified. This information was gathered from ASSET4. Finally, we controlled for several internal attributes such as *Climate Change Strategy* and *Climate Change Board Representation* because they can influence on the level of transparency (Ben-Amar & McIlkenny, 2015). These attributes were measured as a binary variable (1: whether climate change was integrated into the supplier's business strategy and whether the highest level of direct responsibility for climate change rested with a member on the board of directors; 0: otherwise).

Fourth, we controlled for various industry and country characteristics. We assessed the supplier's exposure to climate-change regulations using the *Industry Average GHG Intensity* to capture the supplier's exposure to climate change risks. In line with Jira and Toffel (2013), we controlled for *Industry Average Buyer Requests* and *Industry Average Profitability*. The calculations were based on the four-digit GICS code. To control for all other unobservable industry environmental norms (e.g., chemical industry's responsible care program), we included 10 industry dummy variables in our models. We also included the binary variable *Other Industry Membership* to indicate whether the supplier served more than one industry sector because such suppliers would face pressure from diverse buyers. Furthermore, we controlled for the country's global competitiveness as estimated by the WEF. Specifically, we used the Environmentally Adjusted Global Competitiveness Index (EGCI), which captures the nation's economic competitiveness, accounting for differences in managing of natural resources. This variable accounts for the various competitive motivations for engaging in environmental initiatives. We also included the suppliers' *Country GDP Per Capita* to account for country-level resource availability. To control

TABLE 6 Summary statistics and correlations

No	Variables	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11
1	Comprehensiveness	16.489	3.186	1.0000										
2	Accuracy	8.139	2.730	0.3952*	1.0000									
3	Public Disclosure	0.589	0.492	0.0954*	0.0909*	1.0000								
4	Coercive Pressure	0.921	0.839	0.2529*	0.1273*	0.0542*	1.0000							
5	Normative Pressure	0.310	0.184	−0.0203	−0.0314	0.0390*	−0.0490*	1.0000						
6	Mimetic Pressure	4.652	0.654	−0.0338*	−0.0216	−0.1011*	0.1594*	0.0437*	1.0000					
7	Climate-Change Incentives	0.765	0.424	0.3672*	0.3231*	0.1247*	0.1565*	−0.0340	−0.1257*	1.0000				
8	Sales	16.809	2.383	0.1517*	0.1587*	−0.0495*	0.1361*	−0.0086	−0.0218	0.2039*	1.0000			
9	Profitability	4.713	0.245	0.0387*	0.0212	0.0222	0.0188	−0.0159	−0.0672*	0.0480*	−0.1107*	1.0000		
10	Years in Operation	3.523	0.606	0.1082*	0.0425*	0.0389*	0.1144*	−0.0039	−0.0656*	0.1155*	0.0241	0.0789*	1.0000	
11	Country NGO Density	0.470	0.421	0.0709*	0.0574*	0.0692*	−0.0232	0.0265	−0.0977*	−0.0392*	−0.3444*	0.0133	−0.0285	1.0000
12	Participation in Investor Program	0.722	0.448	0.2774*	0.2813*	0.4386*	0.1587*	0.0255	−0.1105*	0.2757*	0.0716*	0.0630*	0.1320*	0.0907*
13	Kyoto Annex Country	0.867	0.340	0.1098*	0.0285	−0.0360*	0.1113*	0.0197	−0.0694*	−0.0067	−0.3048*	0.0491*	0.0707*	0.3299*
14	Buyer–Supplier Revenue Difference	24.989	1.695	0.0210	0.0197	−0.0528*	0.0594*	0.1907*	−0.0092	0.0859*	0.2559*	0.0288	0.0881*	−0.1331*
15	Years Since First Participation	3.345	2.333	0.2622*	0.1711*	0.0980*	0.5283*	−0.1369*	0.0968*	0.1693*	0.0508*	0.0816*	0.1504*	0.0298
16	GHG Emissions Performance	0.524	0.500	0.0905*	0.0508*	0.0505*	0.0417*	−0.0048	−0.0499*	0.0453*	−0.0100	−0.0235	0.0650*	0.0784*
17	ISO Certification	0.370	0.483	0.2172*	0.1233*	0.0025	0.1937*	0.0083	0.0662*	0.1235*	0.2201*	−0.0374*	0.0821*	0.0703*
18	Climate-Change Strategy	0.912	0.283	0.4107*	0.2949*	0.0381*	0.1328*	−0.0174	−0.0672*	0.4091*	0.1825*	0.0047	0.0966*	0.0601*
19	Climate-Change board Responsibility	0.752	0.432	0.2503*	0.2186*	0.0695*	0.0613*	−0.0226	−0.0773*	0.2782*	0.1790*	0.0002	0.0795*	0.1188*
20	Industry Average GHG Intensity	491.076	724.628	0.0393*	0.0712*	0.0408*	−0.0477*	−0.0764*	−0.3193*	0.0716*	0.0250	−0.0481*	0.0231	0.0363*
21	Industry Average Buyer Requests	3.713	1.181	−0.0590*	−0.0650*	−0.0573*	0.3070*	0.0001	0.4589*	−0.0559*	0.0289	−0.0714*	−0.1089*	−0.0778*

TABLE 6 (Continued)

No	Variables	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11
22	Industry Average Profitability	4.714	0.056	0.0575*	−0.0218	0.0233	−0.1130*	0.0151	−0.3114*	0.0648*	−0.0879*	0.2234*	0.0679*	0.0632*
23	Other Industry Membership	0.068	0.252	0.0730*	0.0498*	0.0483*	0.1604*	−0.0383*	0.0089	0.1134*	0.0011	−0.0023	0.0802*	0.0007
24	Country EGCI Index	5.366	0.563	0.1121*	0.0598*	−0.0558*	0.0725*	−0.0635*	0.0484*	−0.0065	−0.0587*	−0.0142	−0.0245	0.4796*
25	Country GDP Per Capita	44,447.230	14,117.510	0.0750*	0.0013	−0.0035	0.1478*	−0.0094	−0.0505*	−0.0671*	−0.2059*	0.0569*	0.0510*	0.3896*

S. no	Variables	12	13	14	15	16	17	18	19	20	21	23	24	25
1	Comprehensiveness													
2	Accuracy													
3	Public Disclosure													
4	Coercive Pressure													
5	Normative Pressure													
6	Mimetic Pressure													
7	Climate-Change Incentives													
8	Sales													
9	Profitability													
10	Years in Operation													
11	Country NGO Density													
12	Participation in Investor Program	1												
13	Kyoto Annex Country	0.0412*	1											
14	Buyer–Supplier Revenue Difference	0.0323	0.0242	1										
15	Years Since First Participation	0.2253*	0.0601*	−0.0123	1									
16	GHG Emissions Performance	0.0609*	0.0882*	−0.034	0.0440*	1								
17	ISO Certification	0.1494*	0.0515*	0.0922*	0.1996*	−0.0121	1							
18	Climate-Change Strategy	0.1936*	0.0164	0.0850*	0.1426*	0.0995*	0.1630*	1						

(Continues)

TABLE 6 (Continued)

S. no	Variables	12	13	14	15	16	17	18	19	20	21	23	24	25
19	Climate-Change Board Responsibility	0.1854*	0.0474*	0.0473*	0.1319*	0.0664*	0.1717*	0.2930*	1					
20	Industry Average GHG Intensity	0.0708*	0.0159	−0.0391*	0.0137	−0.0036	0.0470*	0.0833*	0.0939*	1				
21	Industry Average Buyer Requests	−0.0855*	−0.0837*	−0.0432*	0.1518*	−0.0888*	0.0026	−0.0546*	−0.0527*	−0.1696*	1			
22	Industry Average Profitability	0.0528*	0.1289*	0.0870*	−0.0087	0.0464*	−0.0238	0.0288	0.0259	−0.2161*	−0.3232*	1		
23	Other Industry Membership	0.1017*	0.0528*	0.0024	0.2043*	0.0514*	0.0834*	0.0605*	0.0715*	0.0746*	−0.0023	−0.012	1	
24	Country EGCI Index	0.0209	0.5594*	0.0456*	0.1039*	0.0376*	0.1310*	0.0665*	0.1378*	−0.0551*	−0.0056	0.0287	0.0128	1
25	Country GDP Per Capita	0.0599*	0.7055*	0.0711*	0.1016*	0.0810*	−0.0137	−0.0316	−0.0453*	−0.0560*	−0.0527*	0.0756*	0.0252	0.6604*

Note: $N = 2{,}060$; $^*p < .10$.

Abbreviations: EGCI, Environmentally Adjusted Global Competitiveness Index; GHG, greenhouse gas.

for all other unobservable country-level factors (e.g., government policies on issues such as carbon trading), we included country dummies. Finally, we included year dummies to control for any common macroeconomic events (e.g., changes in global environmental sentiment) that may affect suppliers over time. Notably, the industry, country, and year-fixed effects should account for various unobservable factors not directly controlled for in our regression models. Table 6 reports the summary statistics and correlations for the variables.

4 | ECONOMETRIC ANALYSIS

4.1 | Model specification

The temporal sequence of the CDP-SCP program and the data-generating process of our variables are worth noting (see Figure 2). First, CDP-SCP members invite their suppliers into the program (Jira & Toffel, 2013). In response, suppliers decide whether to participate. This participation decision leads to a first-stage self-selection, which we modeled using Heckman's (1979) two-step approach. For nonparticipating suppliers, CDP provided us data on the number of buyer requests, industry membership, and country of operation. Thus, we used a probit specification to model the first-stage participation decision as a function of buyer requests as well as industry and country characteristics. These variables not only directly control for buyer pressure but also account for pressure from industry peers and stakeholders. To satisfy the exclusion restriction, we added two instruments—*CDP Country Diffusion* and *CDP Industry Diffusion*—in the first-stage regression; these variables are not included in the second stage (Cameron & Trivedi, 2009). The instruments respectively measure the total cumulative suppliers invited to participate in CDP-SCP in the focal supplier's country and industry for the given year. The second-stage models predict participating suppliers' transparency decisions (*Comprehensiveness*, *Accuracy*, and *Public Disclosure*), while accounting for the participation decision. For our second-stage models, we used the following specification to test our hypotheses:

$$
\begin{aligned}
Transparency\,DV_{jict} = F(&\beta_0.X_{jict} + \beta_1.Coercive\ Pressure \\
&+ \beta_{2.}\ Mimetic\ Pressure + \beta_3.Normative\ Pressure \\
&+ \beta_4.Climate\ Change\ Incentives \\
&+ \beta_{14.}\ Coercive\ Pressure \times Climate\ Change\ Incentives \\
&+ \beta_{24}.Mimetic\ Pressure \times Climate\ Change\ Incentives \\
&+ \beta_{34}.Normative\ Pressure \times Climate\ Change\ Incentives
\end{aligned}
$$

where the indices refer to supplier j in industry i located in country c and year t. $F(.)$ indicates the link function

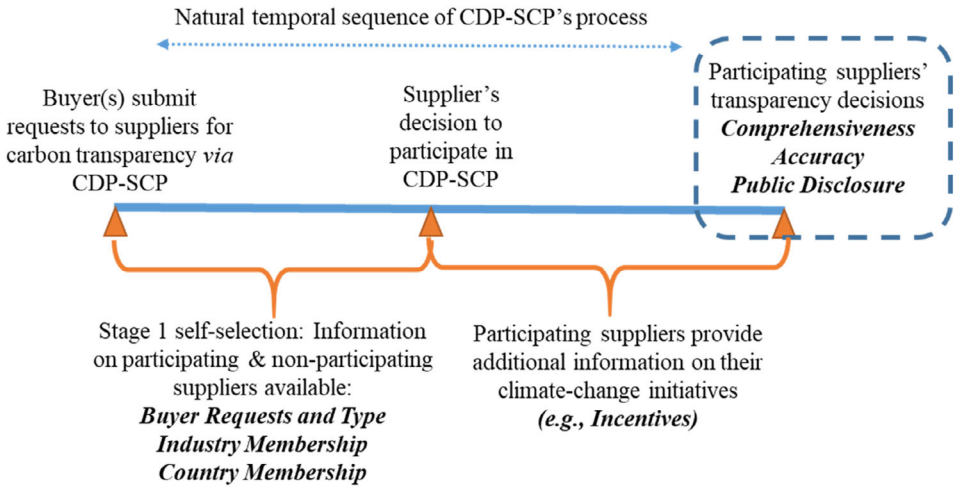

FIGURE 2 CDP-SCP data-gathering timeline. CDP-SCP, Carbon Disclosure Project's supply chain program

used for the specific dependent variable. The term X_{jict} represents the common set of control variables. β represents the hypothesized variables' set of coefficients. Stata 14.1 was used for analysis.

To verify that Heckman models were indeed necessary to obtain unbiased estimates, we compared differences in the estimates from Heckman models with naïve OLS and probit models (i.e., ignoring selection), which indicated potential problems with self-selection in our setting (results available upon request). We also conducted additional diagnostics, which are reported below. While we specifically account for one form of endogeneity (i.e., self-selection), we will address other potential endogeneity concerns later in Section 4.3.

4.2 | Results

First, we examined whether there was evidence of selection bias in our sample. As expected, we found the presence of selection bias, as indicated by Wald's tests for independent equations. The Wald's tests rejected the null hypothesis of no selection for two of our dependent variables (i.e., *Comprehensiveness* and *Public Disclosure*). Because we observed (a) evidence of self-selection in models explaining two out of the three dependent variables and (b) significant effects for several coefficients in the first-stage participation model, we conclude that accounting for selection is important to obtain unbiased estimates. The first-stage results are provided in Appendix A3. Specifically, the instruments were significant predictors of supplier participation in CDP-SCP, which should make the first-stage selection model stronger (Cameron & Trivedi, 2009; Heckman, 1979). Below we discuss our results based on Heckman models. Although not hypothesized, we discuss results from the first-stage model. It is worth noting that *Coercive Pressure* has a positive and significant effect ($\beta = 1.75$, $p < .01$) on CDP-SCP participation, which corresponds with Jira and Toffel's (2013) finding. Also, *Mimetic Pressure* has a negative and significant effect ($\beta = -1.257$, $p < .01$) on CDP-SCP participation. Thus, both types of pressures may affect suppliers' symbolic participation in CDP-SCP.

We next examine the impact of external pressure on our three supplier transparency measures. *Coercive Pressure* has a significant effect on *Comprehensiveness* ($\beta = 0.494$, $p < .01$) and *Accuracy* ($\beta = 0.116$, $p < .10$), but a nonsignificant effect on *Public Disclosure* ($\beta = -0.054$). *Coercive Pressure* has a significant effect on *Transparency* ($\beta = 0.112$, $p < .01$). *Mimetic Pressure* has a nonsignificant main effect on *Comprehensiveness* ($\beta = -0.029$), *Accuracy* ($\beta = -0.061$), *Public Disclosure* ($\beta = 0.056$), and *Transparency* ($\beta = -0.009$). *Normative Pressure* has a nonsignificant effect on *Comprehensiveness* ($\beta = 0.242$) and *Accuracy* ($\beta = -0.125$) but a statistically significant effect on *Public Disclosure* ($\beta = 0.304$, $p < .05$). Also, *Normative Pressure* has a nonsignificant effect on *Transparency* ($\beta = 0.061$). Overall, we find support for H1 (i.e., using *Comprehensiveness*, *Accuracy*, and *Transparency* as DVs) and partial support for H3 (i.e., using *Public Disclosure* as DV). We do not find support for H2.

We find that *Climate Change Incentives* have a positive and significant effect on *Comprehensiveness* ($\beta = 1.097$, $p < .01$) and *Accuracy* ($\beta = 0.858$, $p < .01$) but not on *Public Disclosure* ($\beta = 0.164$). *Climate Change Incentives* have a positive and significant effect on *Transparency* ($\beta = 0.397$, $p < .01$). These results support H4. We suspect that the lack of a significant effect on *Public Disclosure* might indicate that suppliers with climate change incentives could outweigh the risks of making responses public (i.e., greater scrutiny from stakeholders with potentially divergent goals—see Table 1) over the potential benefits (e.g., building trust). Thus, suppliers with climate change incentives may show their

preference for limited transparency (i.e., sharing information only with requesting buyers).

We now discuss the interaction effects. The results show that the interaction effect between *Climate Change Incentives* and *Coercive Pressure* is negative and significant in terms of *Comprehensiveness* ($\beta = -0.792$, $p < .01$), *Accuracy* ($\beta = -0.412$, $p < .01$), and *Public Disclosure* ($\beta = -0.198$, $p < .1$). This interaction effect is also significant for *Transparency* ($\beta = -0.256$, $p < .01$). Thus, H5 is supported. Next, the results also show that the interaction effect between *Climate Change Incentives* and *Mimetic Pressure* is negative and significant for *Comprehensiveness* ($\beta = -0.220$, $p < .05$) but not for *Accuracy* ($\beta = 0.082$) and *Public Disclosure* ($\beta = -0.097$). Once again, this interaction effect is significant for *Transparency* ($\beta = -0.035$, $p < .10$). Thus, H7 is supported for one out of the three dimensions of supplier transparency as well as for the overall construct. Finally, the results also show that the interaction effect between *Climate Change Incentives* and *Normative Pressure* is positive and significant for *Accuracy* ($\beta = 1.177$, $p < .05$) but not for *Comprehensiveness* ($\beta = 0.559$) and *Public Disclosure* ($\beta = 0.035$). However, this interaction effect is supported for *Transparency* ($\beta = 0.346$, $p < .01$). Thus, H6 is supported for one out of the three dimensions of supplier transparency as well for as the overall construct. These results suggest that institutional pressure's role in promoting supplier carbon transparency is contingent on the provision of climate change incentives. In other words, merely examining the effects of external pressures independently might lead us to wrong conclusions without acknowledging the role of climate change incentives.

To interpret these interactions, we present Figures 3–5. They show that although suppliers with climate-change incentives may be more transparent on average, they are less responsive to *Coercive Pressure* or *Mimetic Pressure* for increased transparency. Conversely, suppliers without climate change incentives exhibit greater levels of carbon transparency under increasing *Coercive Pressure* or *Mimetic Pressure*. Additionally, as hypothesized, suppliers with climate change incentives exhibit an increased level of transparency under increasing *Normative Pressure* compared to suppliers without climate change incentives (Table 7).

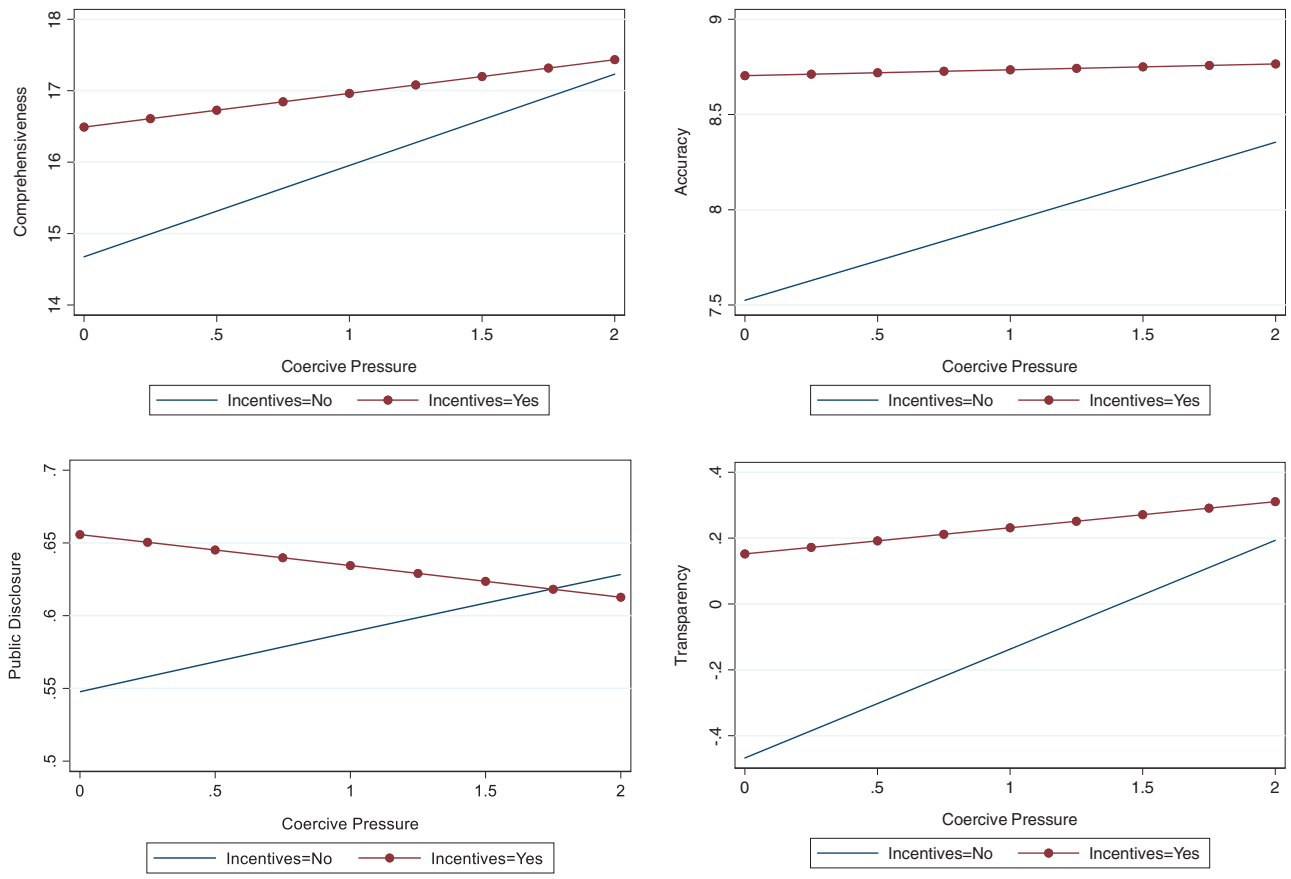

FIGURE 3 Statistically significant interaction effects for H5

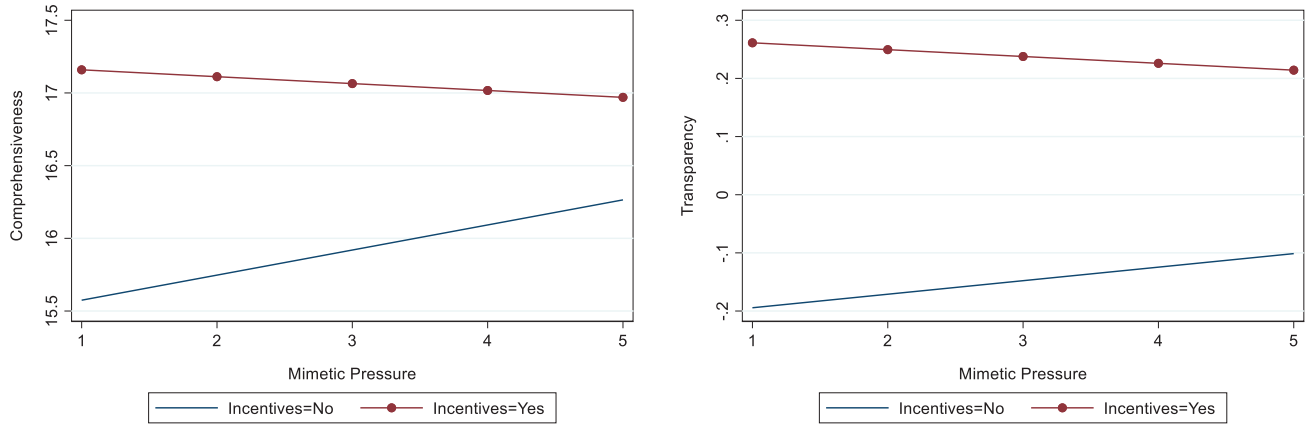

FIGURE 4 Statistically significant interaction effects for H6

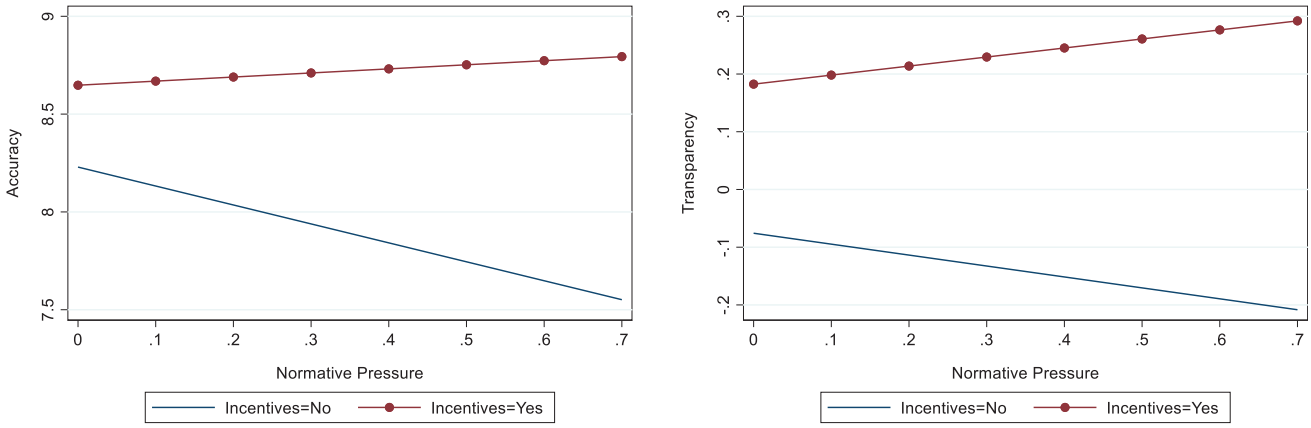

FIGURE 5 Statistically significant interaction effects for H7

4.3 | Lingering endogeneity concerns

We now discuss potential sources of endogeneity. First, omitted variable bias should not be a concern in our analysis because we accounted for an extensive set of control variables in our models (in addition to 10 industry dummies and 41 country dummies) to alleviate estimation problems due to omitted variable bias. These variables control for various aspects of management commitment, investor pressure, environmental NGO pressure, among other confounding factors. Second, self-selection into the CDP-SCP program might be a source of endogeneity. Only transparent suppliers might participate in the CDP-SCP program, which could potentially bias our estimates. To directly address this concern arising from self-selection, we used Heckman selection models. Third, there may be lingering concerns related to simultaneity, especially between *Climate Change Incentives* and transparency measures—*Comprehensiveness*, *Accuracy*, and *Public Disclosure*, which we address using instrumental variables and the control function (CF) approach.

We use the CF approach to address endogeneity concerns. While equivalent to 2SLS in linear models, the CF approach is better suited to address endogeneity for ordinal/binary dependent variables (Wooldridge, 2010) and offers a less complicated alternative for addressing endogenous interaction effects (Ebbes, Papies, & van Heerde, 2017). Specifically, we estimate a first-stage probit regression with *Climate Change Incentives* as the dependent variable and save the residuals from this regression. Subsequently, using the CF approach (Wooldridge, 2015) involves including these fitted residuals as an additional regressor in the second stage (i.e., supplier transparency models). For the first-stage model, we used two instruments satisfying the inclusion and exclusion restrictions (Wooldridge, 2010). These instruments have a strong relationship with our independent variables but should not theoretically affect our dependent variables. As instruments for *Climate Change*

TABLE 7 Main results for supplier transparency dimensions (Heckman selection approach)

Variables	(1) Comp.	(2) Accuracy	(3) Public disclosure	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public disclosure	(8) Transparency
Coercive Pressure (H1)	0.494***	0.116*	−0.054	0.112***	1.171***	0.466***	0.127	0.331***
	(0.061)	(0.064)	(0.060)	(0.017)	(0.087)	(0.127)	(0.113)	(0.030)
Mimetic Pressure (H2)	−0.029	−0.061	0.056	−0.009	0.173	−0.135	0.144	0.023
	(0.100)	(0.085)	(0.090)	(0.027)	(0.109)	(0.203)	(0.164)	(0.032)
Normative Pressure (H3)	0.242	−0.125	0.304**	0.061	−0.168	−0.968***	0.276*	−0.189
	(0.390)	(0.189)	(0.130)	(0.067)	(0.882)	(0.217)	(0.147)	(0.147)
Climate Change Incentives (H4)	1.097***	0.858***	0.164	0.397***	2.406***	0.527	0.682**	0.634***
	(0.195)	(0.158)	(0.117)	(0.070)	(0.313)	(0.622)	(0.323)	(0.085)
Coercive Pressure × Incentives (H5)					−0.792***	−0.412***	−0.198*	−0.256***
					(0.095)	(0.106)	(0.119)	(0.026)
Mimetic Pressure × Incentives (H6)					−0.220**	0.082	−0.097	−0.035*
					(0.100)	(0.171)	(0.112)	(0.019)
Normative Pressure × Incentives (H7)					0.559	1.177***	0.035	0.346***
					(0.694)	(0.144)	(0.110)	(0.131)
Revenue	0.091***	−0.003	−0.027	0.012*	0.090***	−0.004	−0.027	0.011
	(0.030)	(0.028)	(0.023)	(0.007)	(0.032)	(0.029)	(0.023)	(0.007)
Profitability	0.096	0.034	−0.116*	0.004	0.113	0.036	−0.114	0.008
	(0.118)	(0.088)	(0.070)	(0.021)	(0.112)	(0.088)	(0.071)	(0.020)
Age	0.007	−0.090	−0.081	−0.030	0.039	−0.073	−0.072	−0.019
	(0.079)	(0.096)	(0.072)	(0.027)	(0.075)	(0.093)	(0.076)	(0.025)
Country NGO Density	0.162	−0.565***	−0.159	−0.120*	0.251	−0.606***	−0.120	−0.107
	(0.373)	(0.189)	(0.333)	(0.072)	(0.370)	(0.217)	(0.351)	(0.067)
Participation in CDP's Investor Program	0.288***	0.514***	1.247***	0.378***	0.292***	0.517***	1.257***	0.379***
	(0.079)	(0.119)	(0.067)	(0.028)	(0.078)	(0.115)	(0.066)	(0.025)
Kyoto Annex I Country	1.504	0.087	1.423*	0.512*	1.128	−0.056	1.309*	0.398
	(0.984)	(0.861)	(0.773)	(0.308)	(0.916)	(0.970)	(0.751)	(0.291)
Buyer–Supplier Revenue Difference	−0.065***	−0.037	−0.035*	−0.025**	−0.069***	−0.041	−0.037*	−0.026**
	(0.023)	(0.034)	(0.019)	(0.011)	(0.023)	(0.033)	(0.020)	(0.011)
Years Since First Participation	0.056**	0.079***	−0.004	0.026***	0.049*	0.075***	−0.006	0.023***
	(0.026)	(0.020)	(0.020)	(0.006)	(0.026)	(0.020)	(0.020)	(0.007)

TABLE 7 (Continued)

Variables	(1) Comp.	(2) Accuracy	(3) Public disclosure	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public disclosure	(8) Transparency
GHG Emissions Performance	0.156***	0.086	0.069	0.055**	0.162***	0.091	0.069	0.058**
	(0.055)	(0.093)	(0.058)	(0.027)	(0.056)	(0.098)	(0.060)	(0.028)
ISO 14000 Certification	0.493***	−0.085*	−0.017	0.066**	0.475***	−0.093*	−0.022	0.060*
	(0.108)	(0.051)	(0.068)	(0.033)	(0.109)	(0.052)	(0.067)	(0.033)
Climate Change Business Strategy	2.242***	0.679***	−0.219	0.506***	2.136***	0.622***	−0.243	0.471***
	(0.164)	(0.219)	(0.257)	(0.050)	(0.187)	(0.213)	(0.240)	(0.046)
Climate Change Board Representation	0.357**	0.267*	0.127*	0.139***	0.311**	0.242*	0.118*	0.124**
	(0.146)	(0.139)	(0.068)	(0.054)	(0.146)	(0.133)	(0.067)	(0.052)
Industry Average GHG Intensity	0.000**	−0.000	0.000*	0.000	0.000**	−0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry Average Buyer Requests	−0.108***	−0.093	−0.042	−0.046***	−0.104***	−0.095	−0.043	−0.045***
	(0.035)	(0.074)	(0.043)	(0.014)	(0.040)	(0.070)	(0.043)	(0.013)
Industry Average Profitability	−0.611	−3.767***	0.347	−0.835**	−0.771	−3.791***	0.299	−0.876**
	(0.768)	(0.854)	(0.923)	(0.383)	(0.751)	(0.864)	(0.943)	(0.393)
Other Industry Membership	−0.346***	−0.015	−0.003	−0.065*	−0.245**	0.028	0.024	−0.034
	(0.114)	(0.086)	(0.094)	(0.035)	(0.115)	(0.084)	(0.099)	(0.036)
ECGI	−0.948***	0.156	−0.458	−0.211	−0.866**	0.232	−0.450	−0.179
	(0.368)	(0.372)	(0.418)	(0.138)	(0.377)	(0.376)	(0.419)	(0.132)
Country GDP Per Capita	−0.000	−0.000	−0.000**	−0.000**	−0.000	−0.000	−0.000*	−0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	20.277***	26.974***	3.009	4.985*	19.191***	27.015***	2.635	4.744*
	(5.215)	(5.391)	(6.371)	(2.637)	(4.930)	(5.454)	(6.485)	(2.625)
Supplier Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,060	2,060	2,060	2,060	2,060	2,060	2,060	2,060
Log Likelihood	−5,726.615	−5,379.617	−2,171.584	−3,038.120	−5,714.093	−5,373.166	−2,169.064	−3,020.143

Note: Results from Heckman selection models; industry, year and country dummies included; *$p < .1$; **$p < .05$; ***$p < .01$; CDP country diffusion and CDP industry diffusion are used as instruments for the first-stage selection equation.

Abbreviations: CDP, Carbon Disclosure Project; EGCI, Environmentally Adjusted Global Competitiveness Index; GHG, greenhouse gas.

TABLE 8 Incentives (managers only vs. all employees)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Coercive Pressure	0.480***	0.109*	−0.049	0.108***	1.145***	0.435***	0.132	0.320***
	(0.060)	(0.060)	(0.059)	(0.016)	(0.097)	(0.127)	(0.114)	(0.030)
Mimetic Pressure	0.008	−0.069	0.056	−0.005	0.211	−0.113	0.145	0.035
	(0.114)	(0.085)	(0.088)	(0.028)	(0.132)	(0.226)	(0.164)	(0.039)
Normative Pressure	0.212	−0.174	0.281**	0.042	−0.152	−0.965***	0.274*	−0.186
	(0.369)	(0.201)	(0.133)	(0.067)	(0.875)	(0.208)	(0.149)	(0.148)
Incentives (Managers Only)	1.121***	0.839***	0.182	0.400***	2.457***	0.880	0.576*	0.700***
	(0.172)	(0.185)	(0.114)	(0.069)	(0.166)	(0.772)	(0.319)	(0.136)
Incentives (All Employees)	0.938***	0.765***	0.107	0.342***	2.198*	−0.189	0.974**	0.501***
	(0.207)	(0.069)	(0.124)	(0.049)	(1.228)	(0.470)	(0.447)	(0.165)
Incentives (Managers Only) × Coercive Pressure					−0.754***	−0.429***	−0.186	−0.251***
					(0.099)	(0.103)	(0.116)	(0.027)
Incentives (All Employees) × Coercive Pressure					−0.847***	−0.251**	−0.215	−0.234***
					(0.117)	(0.124)	(0.136)	(0.033)
Incentives (Managers Only) × Mimetic Pressure					−0.223***	−0.017	−0.085	−0.054*
					(0.037)	(0.214)	(0.113)	(0.029)
Incentives (All Employees) × Mimetic Pressure					−0.211	0.245*	−0.133	−0.008
					(0.346)	(0.136)	(0.135)	(0.049)
Incentives (Managers Only) × Normative Pressure					0.381	1.224***	0.260*	0.354**
					(0.737)	(0.222)	(0.147)	(0.152)
Incentives (All Employees) × Normative Pressure					0.830	0.799***	−0.657***	0.213
					(0.680)	(0.237)	(0.208)	(0.139)
Revenue	0.102***	0.012	−0.026	0.017***	0.102***	0.006	−0.027	0.016**
	(0.034)	(0.025)	(0.023)	(0.006)	(0.038)	(0.027)	(0.023)	(0.006)
Profitability	0.078	0.030	−0.114	0.000	0.093	0.033	−0.112	0.005
	(0.118)	(0.087)	(0.070)	(0.022)	(0.112)	(0.092)	(0.074)	(0.022)
Age	0.009	−0.084	−0.084	−0.028	0.045	−0.075	−0.075	−0.019
	(0.076)	(0.093)	(0.071)	(0.026)	(0.073)	(0.092)	(0.076)	(0.025)
Country NGO Density	0.168	−0.524***	−0.162	−0.111	0.246	−0.603***	−0.109	−0.104*
	(0.372)	(0.184)	(0.331)	(0.069)	(0.357)	(0.209)	(0.364)	(0.054)

TABLE 8 (Continued)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Participation in CDP's Investor Program	0.264***	0.497***	1.248***	0.370***	0.269***	0.509***	1.259***	0.373***
	(0.074)	(0.113)	(0.068)	(0.026)	(0.075)	(0.117)	(0.067)	(0.024)
Kyoto Annex I Country	1.434	0.021	1.478*	0.493*	1.066	−0.009	1.423*	0.410
	(0.948)	(0.927)	(0.770)	(0.284)	(0.795)	(1.040)	(0.755)	(0.259)
Buyer–Supplier Revenue Difference	−0.067***	−0.035	−0.035*	−0.024**	−0.071***	−0.037	−0.037*	−0.026**
	(0.023)	(0.037)	(0.019)	(0.012)	(0.024)	(0.036)	(0.022)	(0.012)
Years Since First Participation	0.062**	0.088***	−0.004	0.029***	0.054*	0.085***	−0.006	0.026***
	(0.029)	(0.023)	(0.020)	(0.008)	(0.029)	(0.023)	(0.021)	(0.008)
GHG Emissions Performance	0.169***	0.090	0.061	0.057*	0.175***	0.096	0.056	0.059*
	(0.054)	(0.105)	(0.060)	(0.029)	(0.056)	(0.110)	(0.062)	(0.030)
ISO 14000 Certification	0.491***	−0.103*	−0.021	0.061*	0.472***	−0.111*	−0.023	0.056
	(0.107)	(0.062)	(0.069)	(0.034)	(0.108)	(0.065)	(0.069)	(0.035)
Climate Change Business Strategy	2.219***	0.646***	−0.223	0.494***	2.113***	0.598***	−0.245	0.462***
	(0.170)	(0.226)	(0.258)	(0.051)	(0.193)	(0.219)	(0.245)	(0.047)
Climate Change Board Representation	0.386**	0.264*	0.119*	0.142**	0.343**	0.237*	0.111	0.128**
	(0.162)	(0.140)	(0.068)	(0.057)	(0.162)	(0.136)	(0.069)	(0.056)
Industry Average GHG Intensity	0.000***	−0.000*	0.000*	0.000	0.000**	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry Average Buyer Requests	−0.113***	−0.097	−0.045	−0.048***	−0.110***	−0.096	−0.047	−0.047***
	(0.033)	(0.076)	(0.044)	(0.014)	(0.039)	(0.070)	(0.044)	(0.013)
Industry Average Profitability	−0.313	−3.625***	0.282	−0.763**	−0.468	−3.741***	0.203	−0.827**
	(0.745)	(0.864)	(0.977)	(0.376)	(0.671)	(0.910)	(1.008)	(0.385)
Other Industry Membership	−0.331***	0.001	−0.019	−0.062*	−0.238*	0.040	0.008	−0.032
	(0.122)	(0.086)	(0.094)	(0.033)	(0.125)	(0.089)	(0.097)	(0.034)
ECGI	−0.991**	0.134	−0.465	−0.224	−0.888**	0.164	−0.517	−0.205
	(0.385)	(0.360)	(0.417)	(0.137)	(0.396)	(0.367)	(0.425)	(0.137)
Country GDP Per Capita	−0.000	−0.000	−0.000**	−0.000**	−0.000	−0.000	−0.000**	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	18.732***	26.013***	3.398	4.574*	17.483***	26.781***	3.508	4.516*
	(4.864)	(5.359)	(6.700)	(2.579)	(4.024)	(5.788)	(7.004)	(2.567)

(Continues)

TABLE 8 (Continued)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Supplier Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,060	2,060	2,060	2,060	2,060	2,060	2,060	2,060
Log Likelihood	−5,756.788	−5,425.332	−2,180.917	−3,075.755	−5,744.560	−5,417.080	−2,176.147	−3,058.584

Note: Heckman selection models; industry, year and country dummies included; *$p < .1$; **$p < .05$; ***$p < .01$; CDP country diffusion and CDP industry diffusion are used as instruments for the first-stage selection equation.
Abbreviations: CDP, Carbon Disclosure Project; EGCI, Environmentally Adjusted Global Competitiveness Index; GHG, greenhouse gas.

Incentives, we used the average value of climate change incentives for the focal supplier's (a) country and (b) industry, excluding the focal supplier. These two average variables will be related to the *Climate Change Incentives* for the focal firm because country-specific and industry-specific norms can lead to institutionalization of similar practices (Kostova & Zaheer, 1999). However, the average climate change incentives for the country or industry should not be theoretically related to the focal supplier firm's transparency decisions; therefore, these variables should not be correlated with the error terms. The results using the CF approach (see Appendix Table A4) are in line with our main results.

4.4 | Additional robustness checks

4.4.1 | Different schemes for managerial incentives

Firms have various types of incentive structures related to climate change. Focusing on two prominent ones—the scope of incentive (affecting "all employees" vs. "only managers") and the type of incentive (financial vs. nonfinancial), we examined their different impacts on transparency. First, one could surmise that offering incentives to all employees in a firm is advisable. Yet, the main effects of incentives of "only managers" and "all employees" on supplier transparency seem comparable (see Table 8). When considering the interaction effects with institutional pressures, we observe that offering incentives to "only managers" seems to generate arguably stronger but certainly comparable effects (both in terms of magnitude and significance of estimates) to situations whereby incentives were offered to "all employees." Thus, to promote transparency decisions, it might suffice to offer incentives to only senior managers because they may play a fundamental role in their companies' transparency decisions. Second, when considering financial (e.g., bonus) versus nonfinancial (e.g., awards) incentives, the results show that the main effect of these two types of incentives on supplier transparency seems largely comparable (see Table 9). Similarly, when considering the interaction effects with institutional pressures, we observe that offering "financial" incentives generates mostly comparable results to "nonfinancial" incentives, both in terms of magnitude and significance of estimates. Despite the widespread use of financial incentives, our results reveal that nonfinancial incentives might also have a substantial influence on increased transparency, especially when institutional pressures are present.

TABLE 9 Incentives (financial vs. nonfinancial)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Coercive Pressure	0.483***	0.112*	−0.048	0.109***	1.149***	0.447***	0.130	0.322***
	(0.061)	(0.060)	(0.060)	(0.016)	(0.096)	(0.127)	(0.116)	(0.030)
Mimetic Pressure	0.007	−0.071	0.057	−0.005	0.220*	−0.115	0.147	0.037
	(0.114)	(0.086)	(0.090)	(0.028)	(0.114)	(0.227)	(0.171)	(0.036)
Normative Pressure	0.226	−0.165	0.281**	0.046	−0.160	−0.967***	0.268*	−0.189
	(0.378)	(0.192)	(0.132)	(0.069)	(0.874)	(0.220)	(0.149)	(0.148)
Incentives (Nonfinancial)	1.041***	0.778***	0.211**	0.379***	3.101***	0.410	0.911	0.777***
	(0.224)	(0.151)	(0.107)	(0.067)	(0.451)	(0.949)	(0.619)	(0.165)
Incentives (Financial)	1.081***	0.832***	0.145	0.386***	2.158***	0.706	0.605**	0.613***
	(0.169)	(0.152)	(0.122)	(0.063)	(0.345)	(0.594)	(0.250)	(0.084)
Incentives (Nonfinancial) × Coercive Pressure					−0.791***	−0.251**	−0.221*	−0.225***
					(0.160)	(0.121)	(0.123)	(0.038)
Incentives (Financial) × Coercive Pressure					−0.770***	−0.417***	−0.190	−0.252***
					(0.097)	(0.109)	(0.123)	(0.027)
Incentives (Nonfinancial) × Mimetic Pressure					−0.331***	0.062	−0.130	−0.067*
					(0.098)	(0.252)	(0.171)	(0.041)
Incentives (Financial) × Mimetic Pressure					−0.180	0.034	−0.083	−0.035**
					(0.111)	(0.168)	(0.097)	(0.018)
Incentives (Nonfinancial) × Normative Pressure					−0.609	1.040***	−0.098	0.096
					(0.924)	(0.218)	(0.403)	(0.142)
Incentives (Financial) × Normative Pressure					0.782	1.138***	0.037	0.376***
					(0.693)	(0.163)	(0.176)	(0.139)
Revenue	0.100***	0.010	−0.023	0.017***	0.098***	0.006	−0.022	0.016**
	(0.037)	(0.024)	(0.024)	(0.006)	(0.037)	(0.025)	(0.023)	(0.007)
Profitability	0.078	0.026	−0.107	0.001	0.087	0.023	−0.106	0.002
	(0.114)	(0.088)	(0.071)	(0.021)	(0.107)	(0.090)	(0.069)	(0.021)
Age	0.012	−0.084	−0.081	−0.028	0.041	−0.067	−0.073	−0.018
	(0.079)	(0.092)	(0.071)	(0.027)	(0.074)	(0.090)	(0.075)	(0.025)
Country NGO Density	0.189	−0.511***	−0.164	−0.105	0.236	−0.531**	−0.137	−0.097
	(0.379)	(0.176)	(0.330)	(0.069)	(0.366)	(0.208)	(0.334)	(0.068)

(Continues)

TABLE 9 (Continued)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Participation in CDP's Investor Program	0.270***	0.498***	1.255***	0.372***	0.282***	0.500***	1.266***	0.375***
	(0.075)	(0.117)	(0.066)	(0.026)	(0.074)	(0.116)	(0.065)	(0.024)
Kyoto Annex I Country	1.416	0.001	1.504**	0.490*	1.091	−0.238	1.427*	0.371
	(0.963)	(0.929)	(0.759)	(0.282)	(0.939)	(1.035)	(0.763)	(0.269)
Buyer–Supplier Revenue Difference	−0.066***	−0.034	−0.034*	−0.024**	−0.069***	−0.039	−0.035*	−0.026**
	(0.022)	(0.037)	(0.020)	(0.012)	(0.023)	(0.036)	(0.021)	(0.012)
Years Since First Participation	0.062**	0.087***	−0.004	0.028***	0.051*	0.084***	−0.006	0.026***
	(0.029)	(0.022)	(0.020)	(0.008)	(0.029)	(0.023)	(0.021)	(0.008)
GHG Emissions Performance	0.171***	0.091	0.062	0.058*	0.182***	0.097	0.062	0.061*
	(0.053)	(0.108)	(0.060)	(0.030)	(0.058)	(0.113)	(0.062)	(0.032)
ISO 14000 Certification	0.495***	−0.101	−0.024	0.062*	0.482***	−0.108*	−0.027	0.058*
	(0.106)	(0.062)	(0.069)	(0.034)	(0.108)	(0.063)	(0.069)	(0.034)
Climate Change Business Strategy	2.222***	0.647***	−0.220	0.495***	2.117***	0.591***	−0.243	0.461***
	(0.168)	(0.225)	(0.256)	(0.050)	(0.190)	(0.219)	(0.237)	(0.046)
Climate Change Board Representation	0.387**	0.264*	0.120*	0.143**	0.347**	0.235*	0.113*	0.128**
	(0.163)	(0.140)	(0.068)	(0.057)	(0.171)	(0.135)	(0.068)	(0.058)
Industry Average GHG Intensity	0.000***	−0.000*	0.000*	0.000	0.000***	−0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry Average Buyer Requests	−0.109***	−0.095	−0.045	−0.047***	−0.104***	−0.096	−0.045	−0.046***
	(0.035)	(0.074)	(0.043)	(0.014)	(0.040)	(0.069)	(0.042)	(0.013)
Industry Average Profitability	−0.351	−3.642***	0.268	−0.775**	−0.521	−3.662***	0.208	−0.818**
	(0.734)	(0.890)	(0.977)	(0.383)	(0.747)	(0.898)	(0.995)	(0.397)
Other Industry Membership	−0.328***	0.002	−0.016	−0.060*	−0.244*	0.045	0.007	−0.033
	(0.126)	(0.083)	(0.095)	(0.034)	(0.132)	(0.087)	(0.098)	(0.036)
ECGI	−0.997***	0.128	−0.463	−0.225*	−0.933**	0.216	−0.464	−0.195
	(0.385)	(0.358)	(0.416)	(0.136)	(0.426)	(0.362)	(0.423)	(0.130)
Country GDP Per Capita	−0.000	−0.000	−0.000**	−0.000**	−0.000	−0.000	−0.000**	−0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	18.895***	26.161***	3.325	4.611*	18.079***	26.116***	3.048	4.408*
	(4.814)	(5.449)	(6.757)	(2.600)	(4.575)	(5.555)	(6.908)	(2.628)

TABLE 9 (Continued)

Variables	(1) Comp.	(2) Accuracy	(3) Public	(4) Transparency	(5) Comp.	(6) Accuracy	(7) Public	(8) Transparency
Supplier Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,060	2,060	2,060	2,060	2,060	2,060	2,060	2,060
Log Likelihood	−5,757.557	−5,425.424	−2,181.039	−3,076.826	−5,743.867	−5,419.249	−2,178.338	−3,059.305

Note: Heckman selection models; industry, year and country dummies included; *$p < .1$; **$p < .05$; ***$p < .01$; CDP country diffusion and CDP industry diffusion are used as instruments for the first-stage selection equation.

Abbreviations: CDP, Carbon Disclosure Project; EGCI, Environmentally Adjusted Global Competitiveness Index; GHG, greenhouse gas.

4.4.2 | Alternative transparency measures

To address the concern of common-source bias (i.e., the climate change incentives' variables and the transparency decisions coming from the same source), we used three alternate proxies for supplier transparency. First, we used the *CDP score* (0–100), which captures the supplier firm's overall transparency rating evaluated independently by CDP. This score is measured based on the level of detail of responses related to climate issues and has been used by Fabrizio and Kim (2019) to measure carbon transparency. Hence, it captures not only the firm's willingness to report information but also the quality and depth of this information. The average CDP score increased between 7 and 9% year-on-year, suggesting that the CDP-SCP is driving supply chain transparency. This objective transparency measure was used by Ben-Amar and Mcllkenny (2015). Second, we calculated *Accuracy* based on a range of uncertainty associated with the suppliers' disclosure of Scope 1 emissions. To further validate this measure, we used an alternate measure, *Third-Party Assurance*. Some suppliers engage a third-party firm to audit their carbon footprint and emission reporting information; thus, we expect these suppliers to report more accurate carbon information to CDP. Third, we used *Public Sustainability Reporting*, which represents a firm's decision to publicly release a sustainability report. This willingness to release a report was used as a transparency criterion by Dubbink et al. (2008) and Fernandez-Feijoo, Romero, and Ruiz (2014). It is worth noting that this measure was obtained from a separate database (ASSET4). In our sample, 238 (37.6%) out of 632 suppliers published a sustainability report in 2013; 374 (51.8%) out of 722 in 2014; and 590 (82.6%) out of 714 in 2015. The results using alternative measures are consistent with our main findings except for H3 (see Table 10). We conjecture that while normative pressure may generally be viewed as positive, suppliers may still be unwilling for their environmental reports to undergo third-party audits.

4.4.3 | Excluding suppliers in countries with stricter reporting regulations

It is plausible that our results are driven by suppliers in countries with mandatory reporting laws. Countries such as Australia, Belgium, Denmark, France, and Sweden require firms to make CSR-related disclosures. Thus, suppliers in those countries are likely to make public environmental disclosures. Such mandatory reporting requirements could also enhance environmental disclosures' reliability, thereby enhancing comprehensiveness

TABLE 10 Alternative transparency metrics

Variables	CDP score	Third-party assurance	Public CSR report	CDP score	Third-party assurance	Public CSR report
Coercive Pressure (H1)	1.103***	−0.026	0.166***	2.941***	−0.151	0.199**
	(0.251)	(0.058)	(0.054)	(0.733)	(0.120)	(0.091)
Mimetic Pressure (H2)	0.295	0.128	0.055	1.466	0.315***	0.066
	(0.782)	(0.086)	(0.166)	(1.115)	(0.107)	(0.156)
Normative Pressure (H3)	0.090	−0.428***	−0.090	−11.092***	−1.178***	−0.490
	(2.455)	(0.106)	(0.285)	(1.613)	(0.152)	(0.596)
Climate Change Incentives (H4)	11.982***	0.461***	0.162*	13.559***	0.748***	0.060
	(0.781)	(0.086)	(0.095)	(4.629)	(0.197)	(0.261)
Coercive Pressure × Incentives (H5)				−2.139***	0.143	−0.040
				(0.830)	(0.111)	(0.095)
Mimetic Pressure × Incentives (H6)				−1.213	−0.188***	−0.009
				(1.263)	(0.064)	(0.053)
Normative Pressure × Incentives (H7)				15.162***	0.934***	0.537
				(2.121)	(0.240)	(0.441)
Revenue	2.573***	0.111***	0.201***	2.534***	0.105***	0.200***
	(0.230)	(0.028)	(0.017)	(0.229)	(0.028)	(0.018)
Profitability	1.092	0.365***	0.012	1.069	0.362***	0.008
	(0.811)	(0.127)	(0.089)	(0.824)	(0.124)	(0.091)
Age	−0.135	0.077	0.071	−0.021	0.073	0.074
	(0.693)	(0.072)	(0.046)	(0.686)	(0.071)	(0.047)
Country NGO Density	−1.995	0.179	0.592***	−1.964	0.196	0.578***
	(2.375)	(0.270)	(0.180)	(2.398)	(0.267)	(0.167)
Participation in CDP's Investor Program	7.979***	0.660***	0.441***	8.086***	0.669***	0.444***
	(0.646)	(0.166)	(0.085)	(0.640)	(0.166)	(0.088)
Kyoto Annex I Country	13.313*	−0.125	3.337***	11.174	−0.204	3.301***
	(7.513)	(1.630)	(0.700)	(7.349)	(1.597)	(0.690)
Buyer–Supplier Revenue Difference	−0.507**	−0.046***	−0.011	−0.524***	−0.044***	−0.012
	(0.210)	(0.014)	(0.021)	(0.195)	(0.013)	(0.021)
Years Since First Participation	0.264	−0.014	0.007	0.239	−0.013	0.007
	(0.174)	(0.027)	(0.022)	(0.159)	(0.027)	(0.021)
GHG Emissions Performance	−0.205	0.111*	−0.019	−0.116	0.118*	−0.017
	(0.544)	(0.064)	(0.055)	(0.508)	(0.067)	(0.056)
ISO 14000 Certification	1.313**	−0.157	0.875***	1.232**	−0.163	0.873***
	(0.583)	(0.135)	(0.100)	(0.592)	(0.135)	(0.098)
Climate Change Business Strategy	7.483***	0.763***	0.264***	7.294***	0.813***	0.272***
	(1.199)	(0.200)	(0.073)	(1.197)	(0.184)	(0.070)
Climate Change Board Representation	4.931***	0.297**	0.214*	4.703***	0.291**	0.208*
	(1.372)	(0.132)	(0.116)	(1.372)	(0.130)	(0.118)
Industry Average GHG Intensity	0.002***	0.000	0.000	0.002***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry Average Buyer Requests	−0.487	0.070	−0.053	−0.491	0.074	−0.052
	(0.415)	(0.059)	(0.043)	(0.360)	(0.060)	(0.044)

TABLE 10 (Continued)

Variables	CDP score	Third-party assurance	Public CSR report	CDP score	Third-party assurance	Public CSR report
Industry Average Profitability	9.212	−1.263	1.046	8.706*	−1.324	1.053
	(5.786)	(0.941)	(1.000)	(5.246)	(0.973)	(1.013)
Other Industry Membership	2.497***	0.103	0.387**	2.862***	0.104	0.389**
	(0.939)	(0.180)	(0.162)	(0.967)	(0.180)	(0.165)
ECGI	3.383	0.359	−0.302	4.336	0.382	−0.269
	(3.110)	(0.785)	(0.316)	(3.031)	(0.785)	(0.310)
Country GDP Per Capita	−0.000	−0.000	−0.000***	−0.000	−0.000	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	−59.414**	−0.222	−8.444**	−63.812**	−0.322	−8.559**
	(27.125)	(8.570)	(4.115)	(28.620)	(8.540)	(4.118)
Supplier Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,060	2,060	2,060	2,060	2,060	2,060
Log Likelihood	−9,208.507	−1,565.273	−2,076.847	−9,196.741	−1,563.527	−2,075.945

Note: Heckman selection models; industry, year and country dummies included; *$p < .1$; **$p < .05$; ***$p < .01$; CDP country diffusion and CDP industry diffusion are used as instruments for the first-stage selection equation.
Abbreviations: CDP, Carbon Disclosure Project; EGCI, Environmentally Adjusted Global Competitiveness Index; GHG, greenhouse gas.

and accuracy (Dhaliwal et al., 2011). To account for this potential concern, we ran all models after excluding 98 suppliers from countries with mandatory reporting regimes. The results did not change qualitatively (see Appendix Table A5) although we did find that mimetic pressure plays a relatively less important role, possibly because suppliers may be less concerned about comparisons involving carbon transparency in countries with less stringent reporting restrictions.

5 | DISCUSSION

Firms are increasingly being pressured to report their environmental efforts and performance related to not only their operations but also their supply chains. The latter is more difficult because firms must collect information from their global suppliers who meet different national regulatory requirements (Drake, 2018) and have various levels of environmental commitment (Lee & Klassen, 2009). CDP-SCP was created to provide a global disclosure platform through which suppliers can efficiently share information about their climate-change risks, initiatives, and performance. Using the CDP-SCP context and building on institutional theory and transparency literature, this study proposes an extensive concept of supplier carbon transparency; examines three institutional pressures—coercive, mimetic, and normative—driving supply chain carbon transparency; and reveals when these pressures are more/less effective in the presence of climate change incentives.

In 2008, when the CDP-SCP was launched, buying firms' major goal was to promote supplier participation. Jira and Toffel (2013) were the first to examine the drivers of supplier participation. Consistent with their study, we find that buyer coercive pressure is associated with greater supplier participation in CDP-SCP (results in the first-stage participation model). Yet, CDP-SCP is now a widespread global platform for climate change disclosure. Thus, the most pressing issue for buying firms is not merely prompting suppliers to participate in this program but also encouraging them to disclose their carbon emission information more comprehensively, accurately, and publicly (CDP Report, 2017). While buyer coercive pressure may foster supplier participation in CDP-SCP, we find that its influence on supplier carbon transparency is significant and magnified for suppliers with no climate change incentives. We also added two other relevant institutional pressures—mimetic and normative—which might prompt supplier firms to show more transparency.

Thus, our study distinguishes suppliers' participation from suppliers' transparency using a sequential model that more accurately captures CDP-SCP's process and reveals how and when three institutional pressures are more effective in fostering supplier carbon transparency. The results (Table 7) account for pressures from other stakeholders (i.e., NGOs and investors); include factors examined in past studies (e.g., environmental performance, ISO 14001 certification and CDP-SCP experience); are robust for three alternative measures of supplier transparency (Table 10); and account for endogeneity (Table A4 in Appendix).

5.1 | Contributions

Our study contributes to the research stream on corporate environmental disclosure (Hahn et al., 2015; Ott et al., 2017) by proposing a more complete concept of carbon transparency composed of three distinct dimensions—comprehensiveness, accuracy, and public disclosure. This enhanced conceptualization is important because supplier firms can participate in CDP-SCP to merely avoid their buyers' discontent but do not answer any relevant questions, provide biased information, or disclose information to a limited set of stakeholders—all being problematic from a theoretical and practical standpoint. Supplier participation in CDP-SCP could be used as a symbolic rather than a substantive commitment to carbon transparency. Thus, we propose that transparency is a function of how complete and accurate the disclosed information is and whether such information is public. Each dimension contributes uniquely to the level of high-quality environmental information shared with all stakeholders. Our concept of supplier carbon transparency aligns with Schnackenberg and Tomlinson's (2016) work showing that transparency is not a unidimensional concept but instead is multidimensional.

While corporate environmental transparency studies have primarily focused on pressure from investors, environmental NGOs, and the media (e.g., Flammer, 2013; Marquis et al., 2016; Reid & Toffel, 2009), they have overlooked the pressure from supply chain actors such as customers (i.e., buying firms in our case) and peers (i.e., supplier firms). To the best of our knowledge, Jira and Toffel's (2013) study is the only one focusing on how (coercive) buyer pressure prompts suppliers to participate in CDP-SCP. Building on institutional theory and complementing it with our interviews, our research expands this research stream by studying three sources of institutional pressure (from buyers, supplier peers, and leading supply chain actors) and uncovering when each pressure is more effective in driving supply chain carbon transparency—an underexplored research area (Hahn et al., 2015). While controlling for sources of pressure from investors and NGOs, our research shows that the effect of buyer coercive pressure and supplier mimetic pressure on supplier carbon transparency is more pronounced for suppliers with no climate change incentives. Our interviews suggest such suppliers lack goal-setting and goal-monitoring activities related to climate change, leaving them more vulnerable to external demands. Interestingly, these suppliers exhibit greater transparency, including their environmental deficiencies. For example, they disclose that have significantly fewer emission-reduction projects (mean = 5.2; $p < .001$) on average compared to suppliers with climate change incentives (mean = 11.9). In contrast, the pressure from leading buyers and peers who set environmental reporting standards in the industry is more effective for those suppliers with climate change incentives. Our interviews reveal that such suppliers are better prepared to (a) conform with industry-wide environmental standards to remain legitimate and (b) leverage resources their professional networks can offer.

Our study also contributes to the literature on sustainable supply chain management. Past studies have shown how buyer pressure can drive suppliers to adopt environmental management programs (Klassen & Vachon, 2003; Locke, 1997; Villena & Gioia, 2018). However, less is known about the factors driving suppliers to be transparent about their environmental efforts, risks, and performance (Plambeck & Taylor, 2015). These factors are relevant to buyers because they can benefit from direct and spillover effects of working with more transparent suppliers. In addition to buyers customizing their risk-mitigation strategies, pursuing strategies to better differentiate their products, and complying with regulations, buyers could indirectly enhance their reputation by working with transparent suppliers that have gained legitimacy from some stakeholders. Our study shows that suppliers that have established climate change incentives exhibit a higher level of transparency; however, they are less receptive to either buyer coercive or supplier mimetic pressure. We argue that these suppliers are better equipped internally to assess carbon transparency's trade-offs and need less from external motivation to show transparency. In contrast, these suppliers are more responsive to pressure from leading sustainability supply chain actors. We argue that their managers are motivated to receive operational and reputational benefits from industry environmental leaders.

In summary, by integrating two research streams—corporate environmental transparency and institutional theory—and by complementing them with our interviews, we provide a more comprehensive view of supply

TABLE 11 Summary of results

	Hypotheses	Comprehensiveness	Accuracy	Public disclosure	Transparency
H1	Coercive pressure increases supplier transparency	+	+		+
H2	Mimetic pressure increases supplier transparency				
H3	Normative pressure increases supplier transparency			+	
H4	Managerial incentives increase supplier transparency	+	+		+
H5	Incentives reduce the effect of coercive pressure	+	+	+	+
H6	Incentives reduce the effect of mimetic pressure	+			+
H7	Incentives enhance the effect of normative pressure		+		+

Note: + indicates support for hypothesis.

chain carbon transparency's external and internal drivers and reveal when these drivers are more/less efficient. Table 11 reports that almost all hypotheses related to coercive pressure were supported (7 out of 8) compared to those for mimetic (2 out of 8) or normative (2 out of 8) pressures. Thus, we conclude that coercive pressure from customers has strong influence on the individual dimensions as well as overall transparency, particularly for those suppliers with no managerial incentives. Pressure from peers can push suppliers with no managerial incentives to disclose more complete environmental information whereas pressure stemming from industry-wide reporting norms set by industry leaders prompt suppliers with managerial incentives to disclose more accurate environmental information. The partial support for hypotheses associated with mimetic/normative pressure may be due to the current stage of evolution for supply chain carbon transparency. As climate change becomes a central topic across multiple industries and more suppliers and buyers become mature in their climate change journey, we conjecture that mimetic pressure and normative pressure will gain more relevance. As of now, buyers seem to be the most powerful drivers of change.

Regarding the three transparency dimensions, Table 11 reports that we find relatively weaker support for public disclosure. We conjecture that these results might be due to two reasons: the coarse operationalization of Public Disclosure (i.e., 0/1) and the high risks that this specific transparency dimension carries (Ott et al., 2017). Although CDP-SCP is a voluntary disclosure platform, suppliers may perceive that sharing carbon information publicly with all stakeholders puts them at a risk of being exposed to negative reaction and increased scrutiny. Our results hint that suppliers may be willing to disclose comprehensive, accurate information privately with their customers (i.e., CDP members) rather than publicly with all stakeholders. Although methodologies of calculating GHG emission are more solid and compiling the necessary data has becoming easier—all enhancing the amount and accuracy of the information, suppliers are still cautious about how some stakeholders (e.g., competitors or regulators) could use their carbon information that may have detrimental impact on their future. In fact, there was only a marginal increase in the percentage of suppliers making their information publicly available during the 3 years we investigated (38.7% in 2013; 40% in 2014; and 40.7% in 2015), which remains a challenge to date as a similar percentage of suppliers reported publicly in 2019 (43%).

5.2 | Managerial implications

Our study has implications for buyers seeking to minimize climate change risks and to meet their GHG goals through greater supplier carbon transparency. First, to elicit more transparent behaviors from suppliers who are less mature in their climate change journey, a greater number of buyers should request such suppliers to disclose through CDP-SCP. Such disclosure requires buyers to proactively work with (a) their competitors to request common suppliers to engage in CDP-SCP and (b) CDP to target suppliers that have already been invited but still are not CDP-SCP participants. This effort could prompt suppliers to disclose more accurate carbon information publicly. Second, to elicit more transparency from suppliers who are mature in their climate-change journey, leading buyers working to set industry-wide environmental reporting standards play a pivotal role. Most use their industry associations to collaboratively work with their top suppliers to offer common tools and technical training that allow suppliers to assess their environmental challenges, embark on carbon-reduction programs, and have a common framework to report such efforts publicly. Some interviewed suppliers noted that such support boosts their confidence to engage other stakeholders and

consultants. Other suppliers stated that leading sustainability buyers should reinforce their effort to engage more suppliers so that industry-wide environmental reporting standards are perceived as bipartisan rather than buyer-dominant. Thus, buyers in general should seek collaboration with competitors and CDP to create more pressure on suppliers to disclose carbon information publicly, whereas buyers who are industry leaders should revamp their efforts to engage more suppliers to develop industry-wide environmental reporting standards.

This study also has implications for suppliers. Suppliers lacking incentives to address their climate change issues are more vulnerable to pressure from buyers and peers. Thus, they should work to develop a climate change strategy and implement related managerial incentives soon; otherwise, they will be more vulnerable to losing competitiveness within their industry (e.g., peers gaining contracts due to their CDP rating) and jeopardizing business with existing buyers (e.g., using the CDP-SCP rating as a supplier sustainability KPI) and potential ones (e.g., using the CDP-SCP rating as a supplier selection criterion). These suppliers must take a more proactive role in developing their climate-change plans to remain competitive. They might, for instance, provide sustainability training to their personnel and join industry efforts to tackle climate-change issues. For those suppliers that have identified climate-change risks to their operations and that offer managerial incentives, they should continue collaborating with leading sustainability buyers and peers so that together they can elevate the industry's environmental reporting standards. These suggestions are regardless of the scope (only managers vs. all employees) and type of incentives (financial vs. nonfinancial) supplier firms provide.

Finally, our research has implications for the CDP. Its supply chain program is a widespread global platform through which suppliers disclose their carbon emission data. However, our interviews with CDP-SCP members and participants show that little effort goes into helping suppliers improve over time and communicating such improvement to the public. We suggest that CDP should partner with its members to initiate a program in which these members' climate change expertise can be available to suppliers as well as to incentivize these members to monitor supplier progress (e.g., how CDP-SCP ratings improve over time). Also, the CDP does not provide incentives for suppliers to publicly disclose their carbon emission data to date. The suppliers we interviewed noted that a few buyers include the CDP-SCP rating in their supplier scorecards thus incentivizing them to improve their environmental performance. Likewise, if the CDP included public disclosure as another criterion for assessing supplier performance (such that suppliers could receive higher CDP ratings if they disclose publicly), suppliers could have another incentive to disclose publicly. Last, CDP should pressure members to use their internal sources (e.g., supplier sustainability scorecards and risk management tools) to identify suppliers participating in CDP-SCP. Our interviews with buyers and CDP officials revealed that buyers have used the amount spent as the primary criterion for inviting suppliers to CDP-SCP. Yet, in doing so, buyers might miss suppliers that are less environmentally mature or that pose higher environmental risks but that could be more transparent if asked for information.

5.3 | Limitations and opportunities for future research

Despite its contributions, our research has some limitations. First, we focus exclusively on transparency of suppliers' carbon emissions and acknowledge that other environmental (e.g., water) and labor (e.g., overtime) dimensions are equally important. Likewise, we focus on CDP-SCP; however, CDP offers other programs (e.g., forest). Future studies should examine whether our findings hold for other dimensions and programs. Second, the CDP members are mainly large, global buying organizations and, therefore, have high purchasing power. Hence, our findings may not be generalizable to other buyers that either do not partner with institutions such as the CDP or are small- or medium-size organizations. Third, suppliers participating in the CDP-SCP program have the largest expenditures for each CDP-SCP member (buyer). Therefore, the results might not apply to less critical supplier firms. Fourth, while some overlap among our three institutional pressures is possible and at times natural (DiMaggio & Powell, 1983), we believe that our results provide managerially relevant and theoretical insights laying the foundation for future work in supply chain carbon transparency. Fifth, relative to our three transparency dimensions, we find weak support for our hypothesis related to the *Public Disclosure* (only 2 out of 7 hypotheses received support, see Table 11). We surmise that this could either be due to the operationalization of *Public Disclosure* as a binary variable or because the proprietary costs associated with public disclosure may be much higher relative to the two other dimensions (Ott et al., 2017). Finally, future research could explore how the CDP-SCP has penetrated deeper into the supply chain. In 2016, only 23% of supplier firms reported engaging with their own (tier-two) suppliers in GHG emissions and climate change strategies. This percentage will likely increase as more suppliers mature in their sustainability journey. Future research will uncover key insights into

how to involve suppliers and sub-tier suppliers in addressing climate change in global supply chains.

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ENDNOTES

[1]https://www.theguardian.com/sustainable-business/2014/jun/26/green-executive-compensation-intel-alcoa-pay. Retrieved May 5, 2017

[2]A firm may be concerned about revealing proprietary information through voluntary disclosure such as CDP-SCP. For example, its competitor might use a firm's GHG emission to assess its operational growth and efficiency while NGOs may use the same information to exert pressure on the firm to improve environmental performance. Because how each stakeholder will react is unpredictable, the associated indirect costs are highly uncertain.

[3]https://www.jnj.com/caring/citizenship-sustainability. Retrieved July 19, 2017

[4]The Automotive Industry Action Group is a professional network that seeks to develop a common framework for quality, environmental, and social improvements in the automotive industry.

[5]https://www.theguardian.com/sustainable-business/2014/jun/26/green-executive-compensation-intel-alcoa-pay. Retrieved May 5, 2017

[6]https://www.cdp.net/en/scores-2017/climate-change-scoring-methodology. Retrieved July 25, 2018

REFERENCES

Abeyasekera, S. (2003). Multivariate methods for index construction. In *Household Surveys in Developing and Transition Countries: Design, Implementation and Analysis* (pp. 1–21). United Nations Statistics Division.

Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal*, *47*(1), 93–103.

Barreto, I., & Baden-Fuller, C. (2006). To conform or to perform? Mimetic behaviour, legitimacy-based groups and performance consequences. *Journal of Management Studies*, *43*(7), 1559–1581.

Barrientos, S., & Smith, S. (2007). Do workers benefit from ethical trade? Assessing codes of labour practice in global production systems. *Third World Quarterly*, *28*(4), 713–729.

Ben-Amar, W., & McIlkenny, P. (2015). Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment*, *24*(8), 704–719.

Berglöf, E., & Pajuste, A. (2005). What do firms disclose and why? Enforcing corporate governance and transparency in central and Eastern Europe. *Oxford Review of Economic Policy*, *21*(2), 178–197.

Berthelot, S., Cormier, D., & Magnan, M. (2003). Environmental disclosure research: Review and synthesis. *Journal of Accounting Literature*, *22*, 1–44.

Bhakoo, V., & Choi, T. (2013). The iron cage exposed: Institutional pressures and heterogeneity across the healthcare supply chain. *Journal of Operations Management*, *31*(6), 432–449.

Blanco, C., Caro, F., & Corbett, C. J. (2016). The state of supply chain carbon footprinting: Analysis of CDP disclosures by US firms. *Journal of Cleaner Production*, *135*, 1189–1197.

Blanco, C., Caro, F., & Corbett, C. J. (2017). An inside perspective on carbon disclosure. *Business Horizons*, *60*(5), 635–646.

Boiral, O. (2007). Corporate greening through ISO 14001: A rational myth? *Organization Science*, *18*(1), 127–146.

Brown, J. R., Lusch, R. F., & Nicholson, C. Y. (1995). Power and relationship commitment: Their impact on marketing channel member performance. *Journal of Retailing*, *71*(4), 363–392.

Cameron, A. C., & Trivedi, P. K., (2009). *Microeconometrics using stata* (Vol. 5, p. 706). College Station, TX: Stata press.

CDP Report. (2017). Missing Link: Harnessing the power of purchasing for a sustainable future.

CDP Report. (2019). Cascading commitments: Driving ambitious action through supply chain engagement.

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, *35*(1), 1–23.

Chopra, S., & Sodhi, M. M. S. (2004). Managing risk to avoid supply-chain breakdown. *MIT Sloan Management Review*, *46*, 53–61.

Corbett, C. J., & Klassen, R. D. (2006). Extending the horizons: Environmental excellence as key to improving operations. *Manufacturing & Service Operations Management*, *8*(1), 5–22.

Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, *54*(1), 64–87.

Delmas, M., & Toffel, M. W. (2004). Stakeholders and environmental management practices: An institutional framework. *Business Strategy and the Environment*, *13*(4), 209–222.

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review*, *86*(1), 59–100.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research*, *38*(2), 269–277.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, *48*(2), 147–160.

Doorey, D. J. (2011). The transparent supply chain: From resistance to implementation at Nike and Levi-Strauss. *Journal of Business Ethics*, *103*(4), 587–603.

Drake, D. F. (2018). Carbon tariffs: Effects in settings with technology choice and foreign production cost advantage. *Manufacturing and Service Operations Management*, *20*(4), 667–686.

Dubbink, W., Graafland, J., & Van Liedekerke, L. (2008). CSR, transparency and the role of intermediate organisations. *Journal of Business Ethics*, *82*(2), 391–406.

Ebbes, P., Papies, D., & van Heerde, H. J. (2017). Dealing with endogeneity: A nontechnical guide for marketing researchers. In C. Homburg, M. Klarmann, and A. Vomberg, eds. *Handbook of market research* (pp. 1–14). Cham, CH: Springer International Publishing.

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, *60*(11), 2835–2857.

Eisenhardt, K. M. (1985). Control: Organizational and economic approaches. *Management Science*, *31*(2), 134–149.

Escobar, L. F., & Vredenburg, H. (2011). Multinational oil companies and the adoption of sustainable development: A resource-based and institutional theory interpretation of adoption heterogeneity. *Journal of Business Ethics*, *98*(1), 39–65.

Fabrizio, K. R., & Kim, E.-H. (2019). Reluctant disclosure and transparency: Evidence from environmental disclosures. *Organization Science*, *30*(6), 1207–1231.

Fernandez-Feijoo, B., Romero, S., & Ruiz, S. (2014). Effect of stakeholders' pressure on transparency of sustainability reports within the GRI framework. *Journal of Business Ethics*, *122*(1), 53–63.

Flammer, C. (2013). Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Academy of Management Journal*, *56*(3), 758–781.

French, J. R. P., & Raven, B., (1959). The bases of social power. In D. Cartwright, ed., *Studies in Social Power* (pp. 150–167). Institute for Social Research, Ann Arbor: MI.

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: An international study of supply chain strategies. *Journal of Operations Management*, *19*(2), 185–200.

Gray, R., Javad, M., Power, D. M., & Donald Sinclair, C. (2001). Social and environmental disclosure and corporate characteristics: A research note and extension. *Journal of Business Finance and Accounting*, *28*(3–4), 327–356.

Greenwood, R., Díaz, A. M., Li, S. X., & Lorente, J. C. (2010). The multiplicity of institutional logics and the heterogeneity of organizational responses. *Organization Science*, *21*(2), 521–539.

Hafner-Burton, E. M., & Tsutsui, K. (2005). Human rights in a globalizing world: The paradox of empty promises. *American Journal of Sociology*, *110*(5), 1373–1411.

Hahn, R., Reimsbach, D., & Schiemann, F. (2015). Organizations, climate change, and transparency: Reviewing the literature on carbon disclosure. *Organization and Environment*, *28*(1), 80–102.

Hanke, T., & Stark, W. (2009). Strategy development: Conceptual framework on corporate social responsibility. *Journal of Business Ethics*, *85*(SUPPL. 3), 507–516.

Haunschild, P. R., & Miner, A. S. (1997). Modes of interorganizational imitation: The effects of outcome salience and uncertainty. *Administrative Science Quarterly*, *42*(3), 472–500.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, *47*, 153–161.

Heflin, F., Subramanyam, K. R., & Zhang, Y. (2003). Regulation FD and the financial information environment: Early evidence. *The Accounting Review*, *78*(1), 1–37.

Heugens, P., & Lander, M. W. (2009). Structure! Agency! (and other quarrels): A meta-analysis of institutional theories of organization. *Academy of Management Journal*, *52*(1), 61–85.

Huo, B., Tian, M., Yu, T., & Zhang, Q. (2019). The dilemma of inter-organizational relationships: Dependence, use of power and their impacts on opportunism. *International Journal of Operations and Production Management*, *39*(1), 2–23.

Jira, C. F., & Toffel, M. W. (2013). Engaging supply chains in climate change. *Manufacturing & Service Operations Management*, *15*(4), 1–19.

John, C. H., Cannon, A. R., & Pouder, R. W. (2001). Change drivers in the new millennium: Implications for manufacturing strategy research. *Journal of Operations Management*, *19*(2), 143–160.

Jolliffe, I. T., & Basilevsky, A. (1997). Statistical factor analysis and related methods: Theory and applications. *Biometrics*, *53*(1), 388.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, *20*(1), 141–151.

Kalkanci, B., Ang, E., & Plambeck, E. L. (2016). Strategic disclosure of social and environmental impacts in a supply chain. In *Environmentally responsible supply chains* (pp. 223–239). Springer, Cham.

Kang, S. C., & Yanadori, Y. (2011). Adoption and coverage of performance-related pay during institutional change: An integration of institutional and agency theories. *Journal of Management Studies*, *48*(8), 1837–1865.

Kim, E.-H., & Lyon, T. (2011). When does institutional investor activism increase shareholder value ?: The Carbon Disclosure Project. *The B.E. Journal of Economic Analysis & Policy*, *11* (1), 1–29.

Klassen, R. D., & Vachon, S. (2003). Collaboration and evaluation in the supply chain: The impact on plant-level environmental investment. *Production and Operations Management*, *12*(3), 336–352.

Kolk, A. (2010). Trajectories of sustainability reporting by MNCs. *Journal of World Business*, *45*(4), 367–374.

Kolk, A., & Perego, P. (2014). Sustainable bonuses: Sign of corporate responsibility or window dressing? *Journal of Business Ethics*, *119*(1), 1–15.

Kostova, T., & Zaheer, S. (1999). Organizational legitimacy under conditions of complexity: The case of the multinational enterprise. *Academy of Management Review*, *24*(1), 64–81.

Lastovicka, J. L., & Thamodaran, K. (1991). Common factor score estimates in multiple regression problems. *Journal of Marketing Research*, *28*(1), 105.

Lee, H. L., & Tang, C. S. (2017). Socially and environmentally responsible value chain innovations: New operations management research opportunities. *Management Science*, *2016*, 2682.

Lee, S. Y., & Klassen, R. D. (2009). Drivers and enablers that foster environmental management capabilities in small-and medium-sized suppliers in supply chains. *Production and Operations Management*, *17*(6), 573–586.

Lev, B. (1992). Information disclosure strategy. *California Management Review*, *34*(4), 9–32.

Lewis, B. W., Walls, J. L., Glen, W., & Dowell, S. (2014). Difference in degrees: CEO characteristics and firm environmental disclosure. *Strategic Management Journal*, *35*(5), 712–722.

Liu, H., Ke, W., Wei, K. K., Jibao, G., & Chen, H. (2010). The role of institutional pressures and organizational culture in the firm's

intention to adopt internet-enabled supply chain management systems. *Journal of Operations Management*, *28*(5), 372–384.

Locke, E. A. (1997). The motivation to work: What we know. *Advances in Motivation and Achievement*, *10*, 375–412.

Locke, R. M., Qin, F., & Brause, A. (2007). Does monitoring improve labor standards? Lessons from Nike. *Industrial and Labor Relations Review*, *61*(1), 3–31.

Lothe, S., Myrtveit, I., & Trapani, T. (1999). Compensation systems for improving environmental performance. *Business Strategy and the Environment*, *8*(6), 313–321.

Maloni, M., & Benton, W. C. (2000). Power influences in the supply chain. *Journal of Business Logistics*, *21*(l), 49–73.

Marquis, C., Toffel, M. W., & Zhou, Y. (2016). Scrutiny, norms, and selective disclosure: A global study of greenwashing. *Organization Science*, *27*(2), 483–504.

Matsumura, E. M., Rachna, P., & Sandra, C. V. (2014). Firm-value effects of carbon emissions and carbon disclosures. *The Accounting Review*, *89*(2), 695–724.

Mertler, C. A., & Reinhart, R. V. (2016). *Advanced and multivariate statistical methods: Practical application and interpretation* (6th ed.). New York: Taylor & Francis.

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, *83*(2), 340–363.

Neu, D., Warsame, H., & Pedwell, K. (1998). Managing public impressions: Environmental disclosures in annual reports. *Accounting, Organizations and Society*, *23*(3), 265–282.

New, S. (2010). The transparent supply chain. *Harvard Business Review*, *88*(10), 11.

Noble, C., & Useem, M. (1985). The inner circle: Large corporations and the rise of business political activity in the U.S. and U.K. *Political Science Quarterly*, *100*(1), 167.

Okhmatovskiy, I., & David, R. J. (2012). Setting your own standards: Internal corporate governance codes as a response to institutional pressure. *Organization Science*, *23*(1), 155–176.

Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, *16*(1), 145–179.

Ott, C., Schiemann, F., & Günther, T. (2017). Disentangling the determinants of the response and the publication decisions: The case of the carbon disclosure project. *Journal of Accounting and Public Policy*, *36*(1), 14–33.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford University Press, Stanford, CA: Stanford Business Books.

Plambeck, E. L., & Taylor, T. A. (2015). Supplier evasion of a buyer's audit: Implications for auditing and compliance with labor and environmental standards. *Manufacturing & Service Operations Management*, *18*(2), 184–197.

Porteous, A. H., Sonali V. R., & Hau, L. L. (2015). Carrots or sticks? Improving social and environmental compliance at suppliers through incentives and penalties. *Production and Operations Management*, *24*(9), 1402–1413.

Pouder, R., & St. John, C. H. (1996). Hot spots and blind spots: Geographical clusters of firms and innovation. *Academy of Management Review*, *21*(4), 1192–1225.

Primo, M. A. M., & Amundson, S. D. (2002). An exploratory study of the effects of supplier relationships on new product development outcomes. *Journal of Operations Management*, *20*(1), 33–52.

Reid, E. M., & Toffel, M. W. (2009). Responding to public and private politics: Corporate disclosure of climate change strategies. *Strategic Management Journal*, *30*(11), 1157–1178.

Russo, M. V., & Harrison, N. S. (2005). Organizational design and environmental performance: Clues from the electronics industry. *Academy of Management Journal*, *48*(4), 582–593.

Sarkis, J., Qinghua Z., & Kee-hung, L. (2011). An organizational theoretic review of green supply chain management literature. *International journal of production economics*, *130*(1), 1–15.

Schnackenberg, A. K., & Tomlinson, E. C. (2016). Organizational transparency: A new perspective on managing trust in organization-stakeholder relationships. *Journal of Management*, *42*(7), 1784–1810.

Shah, R., & Ward, P. T. (2003). Lean manufacturing: Context, practice bundles, and performance. *Journal of Operations Management*, *21*(2), 129–149.

Short, J. L., & Toffel, M. W. (2007). Coerced confessions: Self-policing in the shadow of the regulator. *Journal of Law, Economics, and Organization*, *24*(1), 45–71.

Simpson, D. F., & Power, D. J. (2005). Use the supply relationship to develop lean and green suppliers. *Supply Chain Management*, *10*(1), 60–68.

Stanny, E. (2013). Voluntary disclosures of emissions by US firms. *Business Strategy and the Environment*, *22*(3), 145–158.

Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate Social Responsibility and Environmental Management*, *15*(6), 338–348.

Stubbs, W., Higgins, C., & Milne, M. (2013). Why do companies not produce sustainability reports? *Business Strategy and the Environment*, *22*(7), 456–470.

Tapscott, D. (2003). *The naked corporation: How the age of transparency will revolutionize business*. Vol. 128. New York: Free Press.

Teo, H. H., Wei, K. K., & Benbasat, I. (2003). Predicting intention to adopt Interorganizational linkages: An institutional perspective. *MIS Quarterly: Management Information Systems*, *27*(1), 19–49.

The Economist. (2014). *Corporate transparency: The openness revolution*. Retrieved from https://www.economist.com/business/2014/12/11/the-openness-revolution.

UN Framework Convention on Climate Change. (2010). Status of ratification of the Kyoto Protocol. Retrieved from http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php.

Vachon, S., & Klassen, R. D. (2007). Supply chain management and environmental technologies: the role of integration. *International Journal of Production Research*, *45*(2), 401–423.

van Weele A., & van Tubergen, K. (2017). *Responsible purchasing: moving from compliance to value creation in supplier relationships* (pp. 257–278). Sustainable Supply Chains. Springer, Cham.

Villena, V. H. (2019). The missing link? The strategic role of procurement in building sustainable supply networks. *Production and Operations Management*, *28*(5), 1149–1172.

Villena, V. H., & Craighead, C. W. (2017). On the same page? How asymmetric buyer–supplier relationships affect opportunism and performance. *Production and Operations Management*, *26*(3), 491–508.

Villena, V. H., & Gioia, D. A. (2018). On the riskiness of lower-tier suppliers: Managing sustainability in supply networks. *Journal of Operations Management*, *64*, 65–87.

Villena, V. H., Gomez-Mejia, L. R., & Revilla, E. (2009). The decision of the supply chain executive to support or impede supply chain integration: A multidisciplinary behavioral agency perspective. *Decision Sciences*, *40*(4), 635–665.

Westphal, J. D., & Zajac, E. J. (1997). Defections from the inner circle: Social exchange, reciprocity, and the diffusion of board Independence in U.S. corporations. *Administrative Science Quarterly*, *42*(1), 161–183.

Wickert, C., Scherer, A. G., & Spence, L. J. (2016). Walking and talking corporate social responsibility: Implications of firm size and organizational cost. *Journal of Management Studies*, *53*(7), 1169–1196.

Wilhelm, M. M., Blome, C., Bhakoo, V., & Paulraj, A. (2016). Sustainability in multi-tier supply chains: Understanding the double agency role of the first-tier supplier. *Journal of Operations Management*, *41*, 42–60.

Wiseman, R. M., & Gomez-Mejia, L. R. (1998). A behavioral agency model of managerial risk taking. *Academy of Management Review*, *23*(1), 133–153.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. Cambridge, MA: The MIT Press.

Wooldridge, J. M. (2015). Control function methods in applied econometrics. *Journal of Human Resources*, *50*(2), 420–445.

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18–19), 4333–4355.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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