

RESEARCH ARTICLE

Enhancing sustainable supply chains through traceability, transparency and stakeholder collaboration: A quantitative analysis

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Abstract

Traceability and transparency are essential for sustainability in complex global supply chains (SCs), but they remain elusive goals in practice. Scholars and practitioners consistently advocate collaboration amongst SC stakeholders as a means of enhancing them, yet little is known regarding their interrelation and contribution to sustainability. We adopt the SC practice-based view (SCPV) to propose and test an explanatory model elucidating how to deploy collaboration, traceability and transparency to achieve triple bottom line (TBL) performance within global SCs. Focusing on the paramount example of complex fashion-apparel SCs, we analyse the insights gained from 139 suppliers—typically ignored in favour of focal firms—using Partial Least Squares Structural Equations Modelling. Our results provide a concrete battery of not-necessarily complex or inimitable activities empirically proven to help put traceability and transparency into practice to achieve TBL performance. The SCPV approach contends that everyday practices, activities and relationships amongst SC stakeholders underpin TBL performance.

KEYWORDS

fashion-apparel, PLS-SEM, stakeholder collaboration, sustainable supply chains, traceability, transparency, triple bottom line (TBL)

1 | INTRODUCTION

Concerns about sustainable development began to surge in the late 20th century, influenced prominently by the publication of the Brundtland Report (1987), which established key principles to meet present needs without compromising future generations (UN General Assembly, 1987). It served as a cornerstone to lay the groundwork for

the United Nation's 17 Sustainable Development Goals (SDGs)—including stakeholder collaboration as a goal in its own right—and their 169 targets and shaped the 2030 Agenda for sustainable development.

Concurrently, industrial activities began expanding across complex supply chains (SCs), requiring responsible management to harness development potential whilst minimising environmental and social

Abbreviations: BCa, Bias-corrected and accelerated; ChetCo, Chetna Coalition; EC, European Commission; ERP, extended producer responsibility; EU, European Union; IPE, Institute of Public & Environmental Affairs; ITMA, International Textile Machinery Association; NACE, Statistical Classification of Economic Activities in the European Community (acronym in Spanish); NGO, non-governmental organisation; PBV, practice-based view; PLS-SEM, partial least squares structural equations modelling; RBV, resource-based view; RFID, radio frequency identification; RQs, research questions; SABI, Iberian Balance Analysis System (acronym in Spanish); SC, supply chain; SCM, supply chain management; SCPV, supply chain practice-based view; SDGs, sustainable development goals; SSCM, sustainable supply chain management; TBL, triple bottom line; TTfS, traceability and transparency for sustainability; UN, United Nations; UNECE, United Nations Economic Commission for Europe; VIF, variance inflation factors; VRIN, valuable, rare, inimitable, and non-substitutable.

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risks (Appelbaum & Gereffi, 1994; Pedersen & Andersen, 2015). Achieving sustainability requires understanding and managing the links between society, business and the environment (Welford, 1998). The widespread adoption of the 2030 Agenda by governments, civil society, citizens and the private sector only reinforces this need for concerted actions.

In this context, Sustainable Supply Chain Management (SSCM) has emerged as the strategic management approach for companies and other SC stakeholders to achieve profits whilst striving to have at least a neutral impact on the natural and social environment (Carter & Rogers, 2008; Pagell & Wu, 2009; Seuring & Müller, 2008). Traceability and transparency are recognised as crucial prerequisites for SSCM (Geissdoerfer et al., 2023; Kirchherr et al., 2022), particularly as SCs' global dispersion creates visibility challenges beyond direct suppliers (Guo et al., 2015; Malik et al., 2021).

Whilst SC traceability refers to the ability to retrace steps backwards and forward, verifying processes and tracking products' history and locations (Barratt & Oke, 2007), SC transparency is 'acting in a way that enables others, both internal and external stakeholders, to perceive and understand what the company does, as well as the quality disclosure of the information needed for this' (Gold & Heikkurinen, 2018, p. 321). This definition encompasses two complementary transparency dimensions (and literature streams): the behavioural/relational one, related to own actions and how others perceive them (Gold & Heikkurinen, 2018; Gupta, 2010), and the disclosure dimension, related to revealing information (Alwaysheh & Klassen, 2010; Egels-Zandén et al., 2015).

Along these lines, the macro-concept of Traceability and Transparency for Sustainability (TTfS) is the ability to combine SC information-sharing and visibility to ensure the reliability of sustainability claims and provide chain actors with access to accurate, trusted, timely and operationally useful information (Garcia-Torres, & L., Rey-Garcia, M., and Seuring, S., 2019). Consequently, TTfS underscores the intricate relationship between traceability and transparency in achieving SSCM (Closs et al., 2011).

However, there is still no consensus on the relationship between traceability and transparency (Malik et al., 2021). Some scholars have claimed that traceability is necessary to guarantee SC transparency (Stranieri et al., 2017); whilst, others refer to it as the necessary antecedent for traceability (Fraser et al., 2020); and others consider it is an umbrella term comparable to the disclosure of 'traceability information' (e.g., Egels-Zandén et al., 2015).

Similarly, little empirical evidence has so far supported the connection between traceability, transparency and corporate sustainability—conceptualised here as the integrated enhancement of environmental, social and economic dimensions, that is, triple bottom line performance (TBL performance)—(Dyllick & Hockerts, 2002; Elkington, 1998). Most of the published works either present mixed results and trade-offs amongst the three sustainability dimensions (Conca et al., 2021; Egels-Zandén et al., 2015; Wognum et al., 2011), or do not address all three of them (Malik et al., 2021; Marconi et al., 2017). Recently, some qualitative studies (e.g., Adhi Santharm & Ramanathan, 2022; Fraser et al., 2020; León Bravo et al., 2022) have

further explored the TTfS concept, providing qualitative empirical evidence for the rather theoretical assumptions that link stakeholder collaboration with deeper TTfS (Rinaldi et al., 2022; UNECE, 2021).

In line with this, our study aims to contribute to the still underexplored 'how to' of TTfS (Kamann et al., 2019; Malik et al., 2021) by offering larger-scale quantitative empirical evidence from suppliers' perspectives. It examines the links between stakeholder collaboration and TTfS and their combined effect on TBL performance, potentially extending beyond firms' and SCs' boundaries. For this, it draws on SC practice-based view (SCPV) postulates to see collaboration, traceability and transparency as *non-necessarily inimitable* interorganisational practices driving TBL performance (Bromiley & Rau, 2016; Carter et al., 2017). The goal is to not only help fashion brands comply with regulatory and market demands but to also spread sustainability practices across global SCs, sectors and industries to, ultimately, impact society.

Specifically, our work links collaboration, traceability and transparency to superior performance, proposing and testing an explanatory model on how to deploy traceability and transparency for sustainable global SCs. For this, we examine traceability, transparency and stakeholder collaboration beyond firm boundaries. TBL performance is measured at the firm (i.e., supplier) level, as it subsequently impacts overall performance at the SC level, due to the critical role suppliers play in improving the sustainability of manufacturing companies and the importance of upstream sustainability risks (Govindan et al., 2023; Hofmann et al., 2014). Thus, focusing on the fashion-apparel industry as a prime example of complex global SCs where advancing traceability and transparency is crucial (Rinaldi et al., 2022), our study aims to answer two main research questions (RQs):

- RQ1. How does stakeholder collaboration enhance traceability and transparency within (fashion-apparel) SCs?
- RQ2. How do stakeholder collaboration, traceability and transparency contribute to TBL performance within (fashion-apparel) SCs?

The article is structured as follows: Section 2 presents the theoretical background and our hypotheses. Sections 3 and 4 describe the methodology and results, subsequently discussed in Section 5. Section 6 outlines the main limitations and suggests future research avenues that stem from this study, and Section 7 summarises the conclusions.

2 | THEORETICAL BACKGROUND AND HYPOTHESES

2.1 | SCPV, corporate sustainability and SSCM

2.1.1 | SCPV

Building on Penrose's (1959) *The Theory of the Growth of the Firm*, many scholars started to see organisations as collections of heterogeneous resources driving growth and competitive advantage. This

perspective led to theories like the resource-based view (RBV) and the relational view, which explain how firms or SCs achieve competitive advantage through their valuable, rare, inimitable and non-substitutable ('VRIN') resources and capabilities (physical, human and organisational) (Barney, 1991) or inter-firm routines and processes (Dyer & Singh, 1998). These theories, however, have failed to explain how common, imitable practices contribute to firm and SC performance (Brömer et al., 2019).

The practice-based view (PBV) introduced by Bromiley and Rau (2014) and extended to the SC level by Carter et al. (2017) addresses this gap by focusing on 'publicly known, imitable activities or practices amenable to transfer across firms' as drivers of performance rather than of competitive advantage at the firm and SC levels. The PBV defines 'practices' as 'sets of activities that a variety of firms might execute', and it is the use of these 'publicly available management practices' that serves to drive performance (Bromiley & Rau, 2014, p. 1249). The PBV's SC perspective includes 'practices that span two or more organizations in the SC' as performance drivers and categorises performance as 'the economic, social and/or environmental (TBL) performance of an organisation, dyad or network' (Carter et al., 2017, p. 116).

According to the PBV and SCPV perspectives, performance is dependent on (i) the use of specific practices/sets of practices; (ii) how these practices are implemented; (iii) their interaction with other practices within the firm; and (iv) competitors' behaviours (Bromiley & Rau, 2014; Carter et al., 2017).

It goes without saying that imitable practices are not synonymous with straightforward or obvious activities. These practices, or their combination, can also be complex (both technologically and in other aspects), spanning various domains, from strategy formulation to implementation, and involving specific tasks at all organisational levels. As Bromiley and Rau pose: 'Essentially, any practice that provides specific guidelines to managers on how to behave becomes a potential explanation of [the] firm performance variable in the PBV' (Bromiley & Rau, 2014, p. 1250).

Additionally, since (bounded rational) managers decide how to use and combine activities and practices, focusing on imitable practices that can be widely adopted and collectively implemented does not conflict with their potential to drive superior performance in specific companies and SCs.

2.1.2 | Corporate sustainability and SSCM

Corporate sustainability is often understood through the lens of Elkington's TBL as the intersection where the three sustainability dimensions—environmental, social and economic—converge without one being sacrificed for the benefit of the others (Elkington, 1998; Henry et al., 2019; Isil & Hernke, 2017). This paper adopts the same understanding and equates corporate sustainability with integrated outcomes across all three dimensions.

With the pioneering Brundtland Report (UN General Assembly, 1987), the ever-greater importance of social and environmental

concerns led to the emergence of SSCM, which came to disrupt traditional Supply Chain Management (SCM). SSCM research has emphasised sustainability practices, from Seuring and Müller's (2008) strategies on supplier management and sustainable products, to Carter and Rogers' (2008) focus on risk management, transparency, culture and strategy, or Pagell and Wu's (2009) SSCM model that integrated traditional SCM practices with new behaviours like traceability and transparency.

Traditional SCM aimed to achieve competitive advantages through inimitable practices and resources (Carter & Rogers, 2008; Seuring & Müller, 2008). This legacy has shaped SSCM research to focus on unique practices that provide competitive benefits rather than understanding which imitable practices may lead to TBL performance. Consequently, the extended use of RVB and related lenses and the search for complex practices that firms and SCs can conceal and protect followed suit. However, there is an urgent need to understand which imitable and widely available practices can achieve this and how they do so, as democratising sustainability practices is essential in SSCM to extend positive TBL performance across firms, SCs and beyond their boundaries (Brömer et al., 2019). Recently, researchers have begun to identify which intra- and inter-organisational practices deliver TBL results that are transferable across firms and SCs, ultimately impacting society (Henry et al., 2019). A paramount example can be found in Brömer et al. (2019) who, employing case studies in the German chemical industry, propose an SSCM framework that links sustainability practices, both internal and external (the latter performed in collaboration with other organisations), to TBL performance. They emphasise the importance of standards, certifications and supplier management for internal practices and supplier development, long-term relationships, collaboration, traceability and transparency for external practices. They call for further research that can refine and test this framework in other business contexts to potentially provide insights on the impact concrete practices have on each TBL performance dimension.

This article builds on that work, focusing on the latter three practices (collaboration, traceability and transparency), all of which are crucial for sustainability in global fashion-apparel SCs. We explain these concepts and their interrelations of these practices next. We also provide further details on the different activities, behaviours and routines that comprise them in the methodology section.

2.2 | SSCM practices in fashion-apparel SCs

2.2.1 | Stakeholder collaboration

Traditional SCM defines collaboration's ultimate aim as building collaborative and not competitive advantages, that is, mutual benefits derived from a network of interdependent relationships fostered by strategic collaboration (Chen & Paulraj, 2004; Ellram & Cooper, 1990). This forms the backbone of SSCM since 'sustainability cannot be achieved in isolation, requiring the involvement of SC members'

(Soosay & Hyland, 2015, p. 621). Based on this, we postulate the following umbrella hypothesis which we will subsequently develop:

H1. Stakeholder collaboration is positively associated to TBL performance.

For sustainability, collaboration within the SC compels non-traditional SC stakeholders to participate, fostering new collaborative formulas that extend beyond vertical, horizontal and lateral efforts and include them in their relationships (Pagell & Wu, 2009; Seuring & Müller, 2008; Touboulic & Walker, 2015). Thus, within SSCM, collaboration emphasises collaborative practices between peers/competitors (e.g., between focal firms or between suppliers) and between traditional and non-traditional SC actors such as NGOs, private institutions and foundations, forming multistakeholder collaborations (Doorey, 2011; Plambeck et al., 2012). In these so-called cross-sector collaborations, multiple organisations (private-sector partners and competitors, governments, NGOs, etc.) work together to pool their expertise and resources and engage in inclusive, collaborative decision-making to tackle complex problems, such as SC sustainability (Chen et al., 2017; Koschmann et al., 2012). Frequently referred to as cross-sector partnerships or alliances (Austin & Seitanidi, 2012; van Tulder et al., 2016), they play a key role in developing and transitioning to sustainable business models (Rey-Garcia et al., 2020) and are increasingly involved in addressing sustainability issues in SCs (Johnson et al., 2018). Within collaboration literature, there is a particular stream that considers alliance portfolios (i.e., the aggregate number of formal alliances or initiatives in which companies participate) as a distinct unit of analysis, warranting the specific consideration of various dimensions. One such dimension is size, referring to the number of alliances, which is linked to positive outcomes, such as innovation outputs or technological performance, though this link often depends on the type of alliances and is not considered in isolation (Baum et al., 2000; Wassmer, 2010).

Consequently, stakeholder collaboration comprises two variables that this study examines individually: SC collaborative relationships, that is, interorganisational relationships with the different stakeholders (suppliers, clients, peers/competitors, NGOs or other stakeholders without contractual relationships) fostered by strategic collaboration; and the alliance portfolio size, that is, the number of associations/initiatives/networks/clusters the company belongs to (hereafter, the 'number of associations').

Besides providing a more nuanced understanding of stakeholder collaboration dynamics, this distinction also facilitates analysing different practices/activities in terms of their imitability, visibility or formal character. Both may be easily imitable, but whilst the perception that a firm collaborates can emerge from both informal and formal activities not always visible beyond SC boundaries, belonging to associations implies making formal alliances visible (e.g., by adhering to industry associations, networks, clusters or standards; and by signing collaboration agreements with NGOs, etc.).

Regarding collaborative relationships, seen as critically valuable organisational/SC assets under the SCPV lens (Carter et al., 2017;

Rey-Garcia et al., 2019), they are assumed to have a direct and positive relationship with SC sustainability (Gold et al., 2010; Sancha et al., 2016).

Traditionally, collaborative relationships in SCs were mostly paired to operational outcomes (through cost, quality, delivery, flexibility, etc.); nowadays, they are seen as a necessary condition for environmental and social performance since 'a company is no more sustainable than its SC' (Ellram & Cooper, 1990; Govindan et al., 2023; Krause et al., 2009, p. 18). Sharing sustainability information, even with competitors, can provide greater business value than hiding it (Doorey, 2011). Partnerships between traditional and non-traditional SC stakeholders and buyer-supplier and peer-to-peer collaborative efforts have been demonstrated to bring about TBL (out) performance, mainly through improved efficiency, knowledge-sharing and development practices (Chen et al., 2017), as well as easing SC sustainability risk and impact management (Rinaldi et al., 2022).

Even in the countless (traditional) examples linking collaboration to operational and economic outperformance, related to efficiency, quick delivery, customer satisfaction and so on, there is frequent evidence of environmental and social (out)performance, associated to resource efficiency or risk management, amongst others. Additionally, examples illustrating the positive effects on environmental and social dimensions have recently ballooned, as has the number of cross-sectoral initiatives created to this end (Johnson et al., 2018). Likewise, these initiatives regularly show associated operational and economic improvements: Toyota's 'Just-in-Time' system is used as a paramount example of collaboration with suppliers to achieve resource efficiency and minimum delivery time to customers; similarly, fashion retailer, Zara, increases customer satisfaction by mobilising information from customers to suppliers to meet market demands in record time or by forming logistical alliances to meet customer service requests without increasing the number of warehouses (Dyer & Nobeoka, 2000; Ellram & Cooper, 1990).

Regarding cross-sectoral initiatives for sustainability, the Zero Carbon Supply Chain Project launched by the Institute of Public & Environmental Affairs (IPE)—a non-profit environmental research organisation in Beijing, China—has helped improve the environmental performance of various Chinese factories and their SCs. This improvement is due to whistleblowing and incentivising effects of a database of environmental information created through joint effort by companies, governments, NGOs, research organisations and other stakeholders (Plambeck et al., 2012; <https://www.ipe.org.cn/about/about.aspx>). Focused on the social dimension but delivering TBL value, the Chetna Coalition (ChetCo) was born as a 'highly collaborative sourcing model for ethical fashion' in which ethical fashion brands would make small, long-term commitments that, collectively, would satisfy the total demand for Chetna's organic cotton and support the growth and development of its organic farming community whilst securing organic raw material (Garcia-Torres & Rey-Garcia, 2020, <https://chetnacollection.com/>).

Furthermore, the number of associations in which a company takes part can, itself, have a positive relationship with TBL performance. This can be attributed to several factors, including the

expanded pool of partners from which to access knowledge and other resources and the synergetic benefits of using and accumulating knowledge over time, often referred to as the intrinsic value of 'collaboration know-how'. Not in vain, 'firms with larger alliance portfolios are likely to see greater survival rates of their alliances' (Al-Tabbaa et al., 2021; Lahiri & Narayanan, 2013, p. 1043).

Thus, we posit the following sub-hypotheses:

H1a. Collaborative relationships are positively associated to TBL performance.

H1b. The number of associations companies belong to is positively associated to TBL performance.

2.2.2 | SC traceability and transparency

As discussed above, TTFS encompasses organisational and interorganisational capabilities that combine activities and practices involving both traditional and non-traditional SC stakeholders. This integration is believed to contribute to effective SSCM and superior TBL performance (Garcia-Torres, & L., Rey-Garcia, M., and Seuring, S., 2019).

Regarding SC traceability, despite its high monetary and organisational costs (Cheng & Simmons, 1994; Malik et al., 2021), it is commonly and positively related to economic performance as a tool for total quality or just-in-time systems, as it enhances flexibility, inventory performance and operational agility (Alfaro & Rábade, 2009; Kamann et al., 2019; Marconi et al., 2017). Additionally, it contributes to process quality and security, safeguarding brand reputation, facilitating product differentiation (Kamann et al., 2019; Roth et al., 2008) and mitigating reputational risks and financial losses by enabling the identification of the exact SC location of potentially defective products (Malik et al., 2021; Skilton & Robinson, 2009). In terms of the environmental and social dimensions, and based on the saying, 'you cannot measure what you cannot detect; you cannot control what you cannot measure; you cannot manage what you cannot control,' we can assume that SC traceability is an indispensable precondition, especially since misuse and breaches often go undetected in final products (Cheng & Simmons, 1994, p. 5; Wilhelm et al., 2016). Environmentally, the positive association may come from resource use optimisation through less spoilage and fewer returns, as well as improved control over pesticides, chemicals and CO₂ emissions across the SC (Alfaro & Rábade, 2009; Wilhelm et al., 2016). This association can also stem from its essential contribution to circular models and reverse SCs (Geissdoerfer et al., 2023; Rinaldi et al., 2022). Socially, SC traceability helps prevent labour abuses like child labour, excessive overtime and modern slavery, which cannot be ascertained in end products (Cole & Aitken, 2019; Wilhelm et al., 2016).

Thus, it follows:

H2. SC traceability is positively associated to TBL performance.

With respect to SC transparency, it is viewed as a means rather than an end and a crucial element for complex SC sustainability of (Egels-Zandén et al., 2015; Mol, 2015). It serves as a marketing tool that transforms tracked information into customer trust through, inter alia, labelling, adding economic value to social and environmental improvements in products and influencing purchasing decisions (Dubbink et al., 2008; Egels-Zandén et al., 2015; Gupta, 2010), enabling customers to make informed choices (Geissdoerfer et al., 2023; Rinaldi et al., 2022). Regarding the environmental dimension, the literature associates transparency, especially its disclosing/reporting side, to improved environmental performance, since it provides inside-out insights into what is happening in the SC, thus fostering internal and external surveillance (Pagell & Wu, 2009; Wognum et al., 2011). The latter also impacts the social side, as it safeguards SC actors from being abused in any way, becoming a 'strong element of social responsibility' (Pagell & Wu, 2009, p. 49). Additionally, SC transparency can stimulate institutional learning and behavioural changes, both by making best practices manifest and by encouraging managers to ameliorate the aspects that need to be reported and disclosed (Doorey, 2011).

Therefore, we postulate that:

H3. SC transparency is positively associated to TBL performance.

2.2.3 | The intricate relationship between SC traceability and transparency

Although acknowledging the potential, bidirectional relationships and interaction effects between traceability and transparency (Malik et al., 2021), this study supports the position that traceability is transparency's antecedent. This is motivated by the fact that good traceability offers opportunities to track products and their processes, thus contributing to 'better' transparency in the sense of providing verified information for buyers and consumers, helping them make better-informed decisions and easing the way for sustainable (or circular) transitions (Rinaldi et al., 2022; Wognum et al., 2011). SC traceability collects product and process information throughout the chain, and SC transparency, alongside its behavioural component, determines the extent of quality information disclosed to internal or external stakeholders (Skilton & Robinson, 2009). A practical example can be found in MUD Jeans 'Remo key,' a tiny card attached to their recycled products with a QR-code-enabled track-and-trace feature that links to a website with background and previous life information about each item—where and how the jeans were recycled, the exact proportion of recycled content, or, water, CO₂ and energy savings (<https://mudjeans.com/blogs/geen-categorie/blog-remo-for-transparency>). Textiles are intentionally at the top of the list of products regulated by the new EU Digital Product Passport that will facilitate the traceability of product data through the items' entire lifecycle 'to enhance SC transparency' no later than 2030 (European Parliamentary Research Service, 2024). Indeed, McGrath et al. (2021) highlight the importance of what they call 'dialogic technologies', that is,

purpose-built systems designed to promote dialogue and information-sharing across the SC to improve transparency practices amongst the actors (McGrath et al., 2021).

Therefore, we posit:

H4. SC traceability is positively associated to SC transparency.

2.2.4 | Stakeholder collaboration and SC traceability and transparency

The information and resource-sharing inherent to stakeholder collaboration, together with its public dissemination, suggest a positive association between collaborative relationships and SC traceability and transparency (Beske & Seuring, 2014; Cao & Zhang, 2011; Chen & Paulraj, 2004; Garcia-Torres et al., 2022).

Regarding traceability, improvements may be achieved from collaborative practices between suppliers and retailers. Such practices include sharing products with the same origins (Closs et al., 2011), conjoint technological investments between SC members and associations (Soosay & Hyland, 2015) and consortium audits undertaken by joint initiatives such as the Bangladesh Accord on Fire and Building Safety and the RMG Sustainability Council (Huq et al., 2016; <https://www.rsc-bd.org/en>). The latter initiatives constitute remarkable examples of collaboration between brands, suppliers and trade unions in the fashion-apparel industry.

Stakeholder collaboration is also expected to provide a higher degree of transparency insofar as collaborative relationships promote technical, operational or financial assistance amongst actors, whilst the willingness to collaborate implies the determination to share information (Marshall et al., 2016; Soosay & Hyland, 2015).

In fact, the example of the Remo key mentioned above and the public-private partnerships that the European Commission will be promoting at the global, regional and bilateral levels to support the ongoing development and implementation of an international framework on transparency and traceability for sustainable and circular fashion-apparel (EC, 2022) are successful cases of collaboration to facilitate traceability and transparency.

Thus, we posit the following hypotheses, embracing the collaboration literature stream that considers the number of alliances as relevant when analysing collaboration (Wassmer, 2010):

H5. Stakeholder collaboration is positively related to SC traceability.

H5a. Collaborative relationships are positively related to the deployment of SC traceability.

H5b. The number of associations companies belong to is positively related to the deployment of SC traceability.

H6. Stakeholder collaboration is positively related to SC transparency.

H6a. Collaborative relationships are positively related to the deployment of SC transparency.

H6b. The number of associations companies belong to is positively related to the deployment of SC transparency.

Figure 1 below depicts our research model.

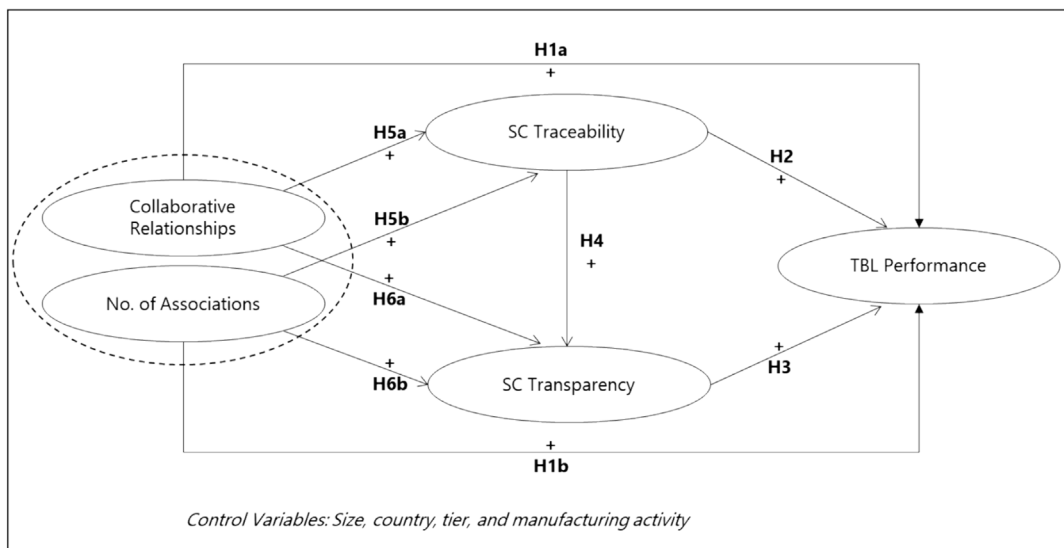


FIGURE 1 Research model.

3 | METHODOLOGY

To test our research model, we gathered data from a sample of fashion suppliers in Portugal and Spain through a questionnaire that adapted scales from the literature, where possible. Companies were asked to self-assess their companies' collaboration, traceability, transparency and TBL performance and provide general and structural information such as their tier and whether or not they carried out manufacturing activities.

The use of perceptual scales, as is the case in our study, is commonly utilised and accepted in business management research when objective measures are not available, accessible or appropriate (Boiral et al., 2015; Dess & Robinson, 1984; Heras-Saizarbitoria et al., 2016). Whilst these perceptual scales have been shown to meet validity and reliability requirements, their development, implementation and analysis necessitate rigorous attention (Dess & Robinson, 1984; Ketokivi & Schroeder, 2004).

In the following section, we describe our methodology, from the early stages of sample conception to questionnaire design and data collection, in addition to the various mechanisms we implemented to ensure the rigour of our research.

3.1 | Sample definition

The initial population comprised Portuguese and Spanish fashion apparel, fabric and/or yarn suppliers. We chose this industry due to its exemplification of complex global SCs, highlighting its significant role in Europe's manufacturing sector. Specifically, it contributes 3% of the total value added and employs 6% of the continent's workforce, with Portugal and Spain as key players, especially in apparel. Selecting these two neighbouring countries helps mitigate cultural differences that might hinder the comparability of the answers gathered by perceptual scales (Ketokivi & Schroeder, 2004). Our emphasis is on suppliers because, as mentioned, even though the potential for sustainable consequences increases as players move upstream in the chain, supplier-focused research is currently overlooked in favour of studies centred on retailers and brands (Huq et al., 2016). The SABI Bureau van Dijk Database facilitated our mapping and search for the target population using NACE codes.

3.2 | Survey instrument development and data collection

To ensure the instrument's validity, we contrasted and blended insights from academia and industry during the questionnaire-building stage in search of scientific rigour and to ensure the industry items were easy to understand/applicable (Petter et al., 2007). The aim was to guarantee both content validity, that is, that the items forming the construct fully captured the meaning of the latent concept the construct represents (Boudreau et al., 2001; Petter et al., 2007; Straub et al., 2004), and face validity, that is, ensuring that the items were

understandable and unambiguous for the target respondents, consisting of senior managers in the supplier companies.

The survey-building process comprised an extensive review of the literature on the scales and indexes measuring the constructs. We also examined industry literature and traceability, transparency and sustainability initiatives to search for relevant items that might help to complement and adapt the academic scales. Next, we distributed a preliminary instrument (first developed in English and then translated into Portuguese and Spanish) to experts from academia and industry for feedback. Third, we conducted a pilot test with the questionnaire with potential informants/respondents at an international trade fair (Modtissimo, Porto, September 2018). Then, the research team discussed the insights until agreeing on the face validity of the items that make up each construct. Finally, we conducted a final round of validation. A total of 11 experts from industry and academia participated in the instrument's validation.

This process also attempted to minimise the potential common-method bias associated to data collected via a single method, as is the case in this study, that is, the impact that the instructions given in the survey or social desirability might have (Kock, 2015; Podsakoff et al., 2003).

Aligned with the aim of the study, we purposely designed the predictor variables as polyadic (i.e., not just one echelon of the SC) to gather SC states or behaviours as the primary level of analysis. In each case, and given that we collected information from only one member of the SC (supplier companies within the fashion-apparel SC), we chose or composed the items in the measuring scales to ensure that the information about other SC actors could be unequivocally ascertained from those responding to the questionnaire. Aware of the challenges of gathering information about TBL performance for other actors in the chain, we decided to keep the dependent variable as monodic, thus measuring performance just at the company (i.e., supplier) level.

The full questionnaire, which included additional questions regarding the research topic, is available on request from the authors. In the following section, we explain the different scales and items used to measure and test this study's research model, summarised in Table 1 below along with the literature scales/definitions on which they are based. Questions comprised 5-point Likert scales, with higher scores denoting higher levels of agreement with a particular statement, except for the number of associations, position in the chain, manufacturing activity (directly queried in the survey) and the information regarding size and country of origin that we obtained from secondary sources (i.e., SABI database).

3.2.1 | Stakeholder collaboration

In line with the described literature, we measured stakeholder collaboration by means of two variables: 'Collaborative relationships' (COLLRP) and 'Number of associations' (ASSOC). COLLRP refers to the extent to which there is collaboration with different traditional and non-traditional SC actors (enquired by means of a 5-point Likert scale). The questionnaire enquired about the responding companies'

TABLE 1 Questionnaire items/scales.

| Constructs and measures | Survey questions/item wording and response options/secondary sources | Adapted from/previously used |
|--------------------------------------|--|--|
| Collaborative relationships (COLLRP) | 5-point Likert scale: Rate the extent (1 = not at all; 5 = completely) to which: | Cao et al. (2010); Cao & Zhang (2011); Chen et al. (2017); Garcia-Torres et al. (2019); Paulraj et al. (2015); Sancha et al. (2016); Yachon & Klassen (2008) |
| Mode 'A' | | |
| COLLRP1 | Your company collaborates with its suppliers | |
| COLLRP2 | Your company collaborates with its clients | |
| COLLRP3 | Your company collaborates with its peers/competitors | |
| COLLRP4 | Your company collaborates with NGOs or other stakeholders without contractual relationships | |
| No. of associations (ASOCC) | Open response: | Own elaboration |
| ASSOC1 | Please state the number of associations/initiatives, networks or clusters your company belongs to: | |
| SC traceability (TRACE) | 5-point Likert scale: Rate the extent (1 = not at all; 5 = completely) to which: | Regulation (EC) 178/2002 |
| Mode 'A' | | |
| TRACE1 | Traces the origin of the product upstream outside your company | |
| TRACE2 | Tracks and traces the destination and origin of the product within the boundaries of your company | |
| TRACE3 | Tracks the destination of the product downstream outside your company | |
| SC transparency (TRANSP) | 5-point Likert scale: Rate the extent (1 = not at all; 5 = completely) to which: | Egels-Zandén et al. (2015); Gold & Heikkurinen (2018) |
| Mode 'A' | | |
| TRANSP1 | The supplier acts in a way that enables others to perceive and understand what the company does | |
| TRANSP2 | The supplier discloses its suppliers' names | |
| TRANSP3 | The supplier discloses its suppliers' sustainability conditions | |
| TRANSP4 | The supplier discloses its internal sustainability conditions | |
| TRANSP5 | The supplier discloses its own codes of conduct and internal policies (including buying practices) | |
| TRANSP6 | Your company acts in a way that enables others to perceive and understand what the company does | |
| TRANSP7 | Your company discloses its suppliers' names | |
| TRANSP8 | Your company discloses its suppliers' sustainability conditions | |
| TRANSP9 | Your company discloses internal sustainability conditions | |
| TRANSP10 | Your company discloses its own codes of conduct and internal policies (including buying practices) | |

TABLE 1 (Continued)

| Constructs and measures | Survey questions/item wording and response options/secondary sources | Adapted from/previously used |
|-------------------------|---|------------------------------|
| TBL performance (TBLPF) | 5-point Likert scale: Rate the performance of your company compared to its competitors (1 = much worse than competitors; 5 = much better than competitors) in regards to: | Yang et al. (2011) |
| Mode 'A' | | |
| ENV/PF | Environmental performance | |
| SOC/PF | Social performance | |
| ECPF | Economic performance | |
| Control variables | | |
| SIZE | Natural logarithm of total assets. | |
| COUNTRY | 1 = Spain; 0 = Portugal | |
| POSITION IN SC | 1 = direct suppliers; 0 = indirect suppliers | |
| MANUFACTURING | 1 = yes; 0 = no | |

behaviours. We assumed reciprocity from the collaboration actor involved in each item. ASSOC served to gather the number of associations, initiatives, networks or clusters in which the responding companies participated. As the existence of other actors in those associations is also assumed, both COLLRP and ASSOC are considered polyadic constructs gathering/inferring information at the SC level.

3.2.2 | SC traceability

Consistent with the lack of empirical development in the academic literature, finding validated scales that might serve as proper proxies to measure traceability, as understood in this study, was challenging. The examples found (e.g., Green et al., 2017; Stranieri et al., 2017; Whitaker et al., 2007; Zelbst et al., 2010) inform about specific aspects of traceability seen as a quasi-synonym for tracking-and-tracing systems (i.e., depth, breadth and precision of the information traced) or refer to its technical side (i.e., RFID adoption). However, they fall short in terms of informing about the ability to 'identify and control the trajectory and conditions of each component, material, process and human resources related to its products, from its initial conception until the end of its lifecycle' (Garcia-Torres et al., 2022, p. 352) Thus, the scale used to measure traceability in this work stems from the typology used in the EU Regulation on food security and traceability (a sector that constitutes, together with pharma, the most advanced industry in terms of traceability regulations). Such typology divides this tracking and tracing between the products' 'initial conception until the end of the lifecycle' into three phases: production, processing and distribution. For the sake of clarity for survey respondents, we translated this to 'external upstream' and 'internal' and external downstream' during the survey-building triangulations (see Table 1).

The data collected through these scales would naturally provide the traceability information at the SC level.

3.2.3 | SC transparency

Bernstein (2017, p. 229) highlighted the difficulty of measuring transparency in a meaningful way, 'meaningful defined as correlated with actual behaviour and performance'. Thus, the items used in this survey stem from the transparency definition supported in this study (Gold & Heikkurinen, 2018) and complemented by the one defined by Egels-Zandén et al. (2015) for the disclosure side. We reformulated these items for clarity during the survey-validation process. This allowed us to gather perceptual information about the fashion-apparel suppliers and their own suppliers upstream, with consequences/inferences at the SC level, based on the understanding that an SC is as transparent as the less transparent of its actors/tiers. Particularly, our questionnaire enquired about the companies' own behaviours and disclosure policies and those of their suppliers. Although aware that companies' measurement of their 'own transparent behaviour' (TRANSP6) might be debatable and, ideally, should be contrasted with how the others perceive that transparent behaviour, we decided to

keep the item in the model to not lose one of the core components of SC traceability for the scope of this study. We later explicitly report this as one of the limitations of our study.

Each of the items of these constructs—Stakeholder collaboration, SC traceability and SC transparency—are the intra- and interorganisational activities, practices, routines and behaviours to which the SCPV lens refers.

3.2.4 | TBL performance

Regarding TBL performance, we chose to measure the three sustainability elements with the same single, perceptual item that assesses performance in relative terms compared to other competitors (Yang et al., 2011). Despite acknowledging its drawbacks and after evaluating alternative options that also included objective performance measures available from the SABI Database, we determined that this approach was the most appropriate for our understanding of TBL performance, integrating three items into the same construct (Dyllick & Hockerts, 2002; Henry et al., 2019). This ensured that the survey instrument's length was manageable and prevented high nonresponse rates (Boyer et al., 1997).

In this case, as mentioned above, we were aware of the challenges of gathering information about TBL performance for other actors in the chain and thus kept this variable monodic to measure performance at the company (i.e., supplier) level.

In all cases, the constructs emerged from the indicators used to represent them. Consequently, indicators do not need to be highly correlated. When this occurs, a composite measurement model applies (Henseler, 2017) in which latent variable scores are calculated as linear combinations of the indicators making up each construct. The weights of the indicators can be determined as bivariate correlations between each indicator and their respective constructs (mode 'A') or based on ordinary least squares regression (mode 'B'). For this research, we chose mode 'A' since it performs better when R^2 values are small to medium (Sarstedt et al., 2016), as in this study.

3.3 | Data collection

We collected data from January 2019 and January 2020 by telephone, email, personal interviews or directly online with the support of 'SociSurvey' and 'Acrobat Forms'. Key textile associations/clusters in both countries collaborated to recruit respondents by sending the survey to their members. We also organised two workshops for association members to inform them about the project and encourage their participation. Two fashion brand companies and one specialised fashion-business media were also involved in sharing the questionnaire. One of the authors also visited international trade fairs in Portugal (Modtissimo: <https://modtissimo.com/en/>) and Spain (ITMA: <https://itma.com/>), where additional companies meeting NACE code requirements were invited to take part in the study. A total of 7761 companies were contacted.

There were a total of 139 valid responses for the analysis. In order to avoid the potential bias associated to inferences to the company (i.e., respondent) from individuals' responses (i.e., informants), we made an effort to carefully select the key informants within the surveyed companies per their knowledge regarding the surveyed topics. Additionally, this allowed us to adequately satisfy reliability and validity requirements when using perceptual scales, as it has been demonstrated that perceptual data from senior managers tend to strongly correlate with objective data (Ketokivi & Schroeder, 2004; Venkatraman & Ramanujam, 1987). Tables 2 and 3 below provide details on the sample structure and informant profiles.

TABLE 2 Sample composition—Respondents.

| Number of employees | % |
|-------------------------------|--------|
| 0–25 | 64.44% |
| 25–50 | 14.07% |
| 51–100 | 9.63% |
| 101–250 | 8.15% |
| >250 | 3.70% |
| Annual turnover (thousands €) | % |
| 0–500 | 28.47% |
| >500–1000 | 7.30% |
| >1000–5000 | 34.31% |
| >5000–10,000 | 10.95% |
| >10,000 | 18.98% |
| Position in the SC | % |
| Tier 1 | 68.35% |
| Tier 2 or + | 31.65% |
| Manufacturing | % |
| Manufacturing companies | 72.66% |
| Non-manufacturing companies | 27.34% |
| Company country | % |
| Spain | 48.20% |
| Portugal | 51.80% |

TABLE 3 Sample composition—Informants.

| Informants | % |
|---|----|
| CEO | 63 |
| Multi-department | 9 |
| Buying/sourcing | 17 |
| Sales/marketing | 14 |
| Sustainability/corporate social responsibility department | 10 |
| Administrative area | 8 |
| Quality | 6 |
| Finance/accounting department | 4 |
| Production/operations/SC | 4 |
| R & D | 3 |
| Design department | 1 |

3.4 | Statistical analysis

We analysed the gathered data using Partial Least Squares Structural Equation Modelling (PLS-SEM), a technique that combines principal component analysis for construct measurement (measurement model) and regressions to determine the relationships amongst constructs (structural model) (Hair et al., 2016). PLS-SEM is the only option when working with composites (Henseler, 2017) and can be used for exploratory and explanatory purposes, as is the case in this study: testing an early-stage explanatory theory in which exploratory goals are very present (Hair et al., 2016). Therefore, the focus is on finding significant path coefficients linking the predictors and the dependent variable(s) and explaining the latter's variance (Hair et al., 2016). We used SmartPLS 3 v.3.3.3 (<http://www.smartpls.com>) statistical software to analyse the research model and the sample indicator means and standard deviations.

We carried out a two-stage PLS-SEM in which we tested the measurement model during the first stage (i.e., the validity and reliability of the indicators) to then assess the structural model (i.e., the postulated hypotheses regarding patterns amongst variables and the variance explained). Prior to that, however, we carried out two additional verifications: ensuring sufficient sample size to analyse the posed model and statistical control to detect potential common-method bias (on top of the measures taken during the design and data collection phases).

Sample size depends—in addition to the statistical power and the significance level—on the model's most complex regression (in the case of this study, TBL performance, with nine predictors) and the expected R^2 (in this case, >25% for TBL performance, >20% for transparency and <10% for traceability) (Cohen, 1992). Considering nine predictors, sample size should not be lower than 84 for $R^2 > 25%$ at 5% and no lower than 143 for $R^2 < 10%$, which is close to the 139 observations included in our study. Thus, our study's sample, although limited, can be considered sufficient for a statistical power of 80%, with a significance level of 5% for TBL performance and transparency and 10% for traceability (Cohen, 1992).

To discard the presence of common-method bias potentially leading to erroneous conclusions regarding the relationships, we applied a full collinearity test specially conceived for PLS-SEM (Kock, 2015), which includes both vertical (predictor–predictor) and lateral (predictor–criterion) collinearity analyses. According to Kock (2015), if all the variance inflation factors (VIFs) resulting from a full collinearity test are equal to or lower than 3.3, the model can be considered free of common-method bias, as is the case with our model in which all VIFs are well below the 3.3 threshold as can be observed in Table 4 below.

4 | RESULTS

4.1 | Findings from the descriptive analysis at the item level

The descriptive data—mean and standard deviations (see Table 5 below)—for the different indicators already provide relevant contextual information as they represent the intra- and interorganisational activities, practices, routines and behaviours forming stakeholder collaboration, SC traceability and transparency and TBL performance at the dimension level.

Regarding stakeholder collaboration, the highest collaborative relationship mean refers to collaboration with clients (4.258 out of 5), followed by collaboration with suppliers (4.031). The mean for collaboration with NGOs or other stakeholders is almost half that (2.306), followed closely by collaboration with competitors (2.299). These last two types also have the highest standard deviations. Concerning the number of associations that respondent companies belong to, the mean is below 1 (0.763), with a standard deviation of 1.381.

With regard to SC traceability, the most developed 'phase' corresponds to the 'internal one' (mean = 4.617 out of 5), followed by 'external upstream' (mean = 3.7) and, in last place, external downstream traceability (mean = 3.513, with the highest standard deviation = 1.288).

TABLE 4 Predictor–predictor and predictor–criterion VIF values.

| | 01TBLPF | 02TRACE | 03TRANSP | 04COLL | 05ASSOC | 06SIZE | 07COUNTRY | 08DIRECT/ INDIRECT | 09MANUF |
|-----------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------------------|--------------|
| 01TBLPF | 1.355 | −0.005 | −0.361 | −0.328 | −0.106 | 0.028 | 0.006 | 0.322 | −0.236 |
| 02TRACE | −0.005 | 1.124 | −0.239 | −0.091 | −0.141 | −0.043 | −0.093 | 0.088 | 0.142 |
| 03TRANSP | −0.361 | −0.239 | 1.410 | −0.338 | −0.040 | 0.005 | 0.210 | −0.240 | 0.226 |
| 04COLL | −0.328 | −0.091 | −0.338 | 1.350 | −0.142 | −0.008 | 0.163 | −0.207 | −0.087 |
| 05ASSOC | −0.106 | −0.141 | −0.040 | −0.142 | 1.241 | −0.394 | −0.052 | 0.120 | −0.105 |
| 06SIZE | 0.028 | −0.043 | 0.005 | −0.008 | −0.394 | 1.176 | −0.123 | −0.046 | −0.130 |
| 07COUNTRY | 0.006 | −0.093 | 0.210 | 0.163 | −0.052 | −0.123 | 1.107 | −0.146 | 0.063 |
| 08DIRECT/ INDIRECT | 0.322 | 0.088 | −0.240 | −0.207 | 0.120 | −0.046 | −0.146 | 1.144 | −0.032 |
| 09MANUF | −0.236 | 0.142 | 0.226 | −0.087 | −0.105 | −0.130 | 0.063 | −0.032 | 1.128 |

Note: VIF values are detailed in the diagonal.

TABLE 5 Survey instrument and measurement model evaluation.

| Constructs and measures | Item wording | N | Mean | STDEV | VIF | Weights | Loadings |
|---|--|-----|-------|-------|-------|-----------------------|----------------------|
| Collaborative relationships (COLLRP) | Rate the extent (1 = not at all; 5 = completely) to which: (5-point Likert scale) | | | | | | |
| Mode 'A' | | | | | | | |
| COLLRP1 | Your company collaborates with its suppliers | 139 | 4.031 | 1.161 | 2.279 | 0.349*** | 0.794*** |
| COLLRP2 | Your company collaborates with its clients | 139 | 4.258 | 1.091 | 2.214 | 0.271*** | 0.760*** |
| COLLRP3 | Your company collaborates with its peers/competitors | 139 | 2.299 | 1.263 | 1.505 | 0.321*** | 0.741*** |
| COLLRP4 | Your company collaborates with NGOs or other stakeholders without contractual relationships | 139 | 2.306 | 1.341 | 1.47 | 0.371*** | 0.751*** |
| No. of associations (ASOCC) | | | | | | | |
| ASSOC1 | Please state the number of associations your company belongs to: | 139 | 0.763 | 1.381 | 1.000 | 1.000 | 1.000 |
| SC traceability (TRACE) | Rate the extent (1 = not at all; 5 = completely) to which your company: (5-point Likert scale) | | | | | | |
| Mode 'A' | | | | | | | |
| TRACE1 | Traces the origin of the product upstream outside your company | 139 | 3.7 | 1.141 | 1.197 | 0.571*** | 0.798*** |
| TRACE2 | Tracks and traces the destination and origin of the product within the boundaries of your company | 139 | 4.617 | 0.802 | 1.172 | 0.648*** | 0.853*** |
| TRACE3 | Tracks the destination of the product downstream outside your company | 139 | 3.513 | 1.288 | 1.039 | -0.102 ^{not} | 0.081 ^{not} |
| SC transparency (TRANSP) | Rate the extent (1 = not at all; 5 = completely) to which: (5-point Likert scale) | | | | | | |
| Mode 'A' | | | | | | | |
| TRANSP1 | The supplier acts in a way that enables others to perceive and understand what the company does | 138 | 3.910 | 0.924 | 1.356 | 0.121*** | 0.455*** |
| TRANSP2 | The supplier discloses its suppliers' names | 138 | 3.06 | 1.48 | 1.934 | 0.132*** | 0.708*** |
| TRANSP3 | The supplier discloses its suppliers' sustainability conditions | 137 | 3.133 | 1.334 | 5.098 | 0.136*** | 0.857*** |
| TRANSP4 | The supplier discloses its internal sustainability conditions | 138 | 3.226 | 1.379 | 4.997 | 0.16*** | 0.868*** |
| TRANSP5 | The supplier discloses its own codes of conduct and internal policies (including buying practices) | 138 | 3.031 | 1.415 | 3.791 | 0.161*** | 0.829*** |
| TRANSP6 | Your company acts in a way that enables others to perceive and understand what it does | 139 | 4.39 | 0.782 | 1.364 | 0.125*** | 0.545*** |
| TRANSP7 | Your company discloses its suppliers' names | 139 | 3.234 | 1.527 | 1.733 | 0.097*** | 0.573*** |
| TRANSP8 | Your company discloses its suppliers' sustainability conditions | 139 | 3.424 | 1.424 | 2.944 | 0.139*** | 0.74*** |
| TRANSP9 | Your company discloses internal sustainability conditions | 139 | 3.626 | 1.337 | 2.993 | 0.153*** | 0.782*** |
| TRANSP10 | Your company discloses its own codes of conduct and internal policies (including buying practices) | 139 | 3.318 | 1.485 | 2.928 | 0.149*** | 0.786*** |
| TBL performance (TBLPF) | Rate the performance of your company compared to its competitors (1 = much worse than competitors; 5 = much better than competitors) in regards to: (5-point Likert scale) | | | | | | |
| Mode 'A' | | | | | | | |
| ENVPF | Environmental performance | 134 | 3.664 | 0.917 | 2.343 | 0.474*** | 0.904*** |

TABLE 5 (Continued)

| Constructs and measures | Item wording | N | Mean | STDEV | VIF | Weights | Loadings |
|--------------------------|--|-----|-------|-------|-------|----------|----------|
| SOCPF | Social performance | 134 | 3.604 | 0.901 | 2.492 | 0.464*** | 0.921*** |
| ECPF | Economic performance | 134 | 3.451 | 0.785 | 1.183 | 0.248*** | 0.580*** |
| Control variables | | | | | | | |
| SIZE | Natural logarithm of total assets. | 137 | 7.168 | 1.925 | 1.000 | 1.000 | 1.000 |
| COUNTRY | 1 = Spain; 0 = Portugal | 139 | 0.518 | 0.501 | 1.000 | 1.000 | 1.000 |
| POSITION IN SC | 1 = direct suppliers; 0 = indirect suppliers | 139 | 0.683 | 0.467 | 1.000 | 1.000 | 1.000 |
| MANUFACTURING | 1 = yes; 0 = no | 139 | 0.727 | 0.447 | 1.000 | 1.000 | 1.000 |

Note: not = not statistically significant. TRANSP3, TRANSP4 and TRANSP5 (in bold) are kept in the model despite showing values higher than 3 because, given the composite nature of the construct, dropping one of the indicators would mean losing information regarding one of their dimensions.

* $p < .10$, ** $p < .05$, and *** $p < .01$, one-tailed test.

Turning to SC transparency, the items informing about the respondents' own companies were ranked higher than those centred on their suppliers. In both cases, the behavioural items (i.e., actions that enable others to perceive and understand what the company does) surpass the disclosure-related ones. For these behavioural items, respondent companies earned a mean of 4.39 (out of 5) and the suppliers, 3.91. Amongst the items informing about disclosure, the highest means were obtained in both cases from 'disclosing internal sustainability conditions' (3.626 for respondent companies; 3.226 in the case of their suppliers). For respondent companies, the lowest mean value corresponded to 'disclosing suppliers' names' (3.234) and, in the case of their suppliers, to 'disclosing own codes of conduct and internal policies (including buying practices)' (3.031), followed very closely by 'disclosing suppliers' names' (3.060).

Finally, regarding TBL performance, although the three means achieved similar values, the economic dimension ranked lowest (3.451), followed by the social (3.604) and, very closely, the environmental (3.664) ones.

4.2 | Measurement model evaluation

To test the quality of the measurement model when dealing with mode 'A' composites, the convergent validity and the significance of the weights and loadings should be analysed (Hair et al., 2019).

Regarding convergent validity, the survey-building process described above guarantees it (Petter et al., 2007). In terms of the weights and loadings, we assessed these by applying bootstrapping techniques, using 5000 samples with replacement. All these were significant at the 1% significance level except for TRACE3, which we decided to keep in the model to not lose one of the three SC traceability dimensions. Regardless, since we calculated indicator weights in mode 'A' through simple correlations between the indicators and their constructs, they do not show the relative relevance of the indicators in maximising the amount of variance explained. Table 5 above summarises these results.

4.3 | Structural model evaluation

The starting point to assess the structural model is confirming the lack of collinearity amongst the constructs to discard bias in the regression results (Hair et al., 2019), assessed by analysing the inner model's VIFs. Since all VIF values are well below 3 (see Table 6 below), no collinearity issues are expected.

Next, we analysed the model's quality, which provides insights regarding how much it contributes to answering the posited RQs, beyond merely supporting or rejecting the hypotheses. This implied examining the amount of explained variance (R^2) amongst the dependent variables. R^2 also represents a measure of the model's (in-sample) explanatory power. Its expected magnitude depends on the phenomenon studied and the research stage (exploratory first-stage research should expect much lower R^2 than confirmatory ones). Hair et al.

TABLE 6 Inner VIF values.

| | 01TBLPF | 02TRACE | 03TRANSP |
|-------------------|---------|---------|----------|
| 02TRACE | 1.124 | | 1.080 |
| 03TRANSP | 1.314 | | |
| 04COLL | 1.271 | 1.106 | 1.133 |
| 05ASSOC | 1.233 | 1.207 | 1.229 |
| 06SIZE | 1.175 | 1.174 | 1.175 |
| 07COUNTRY | 1.107 | 1.070 | 1.073 |
| 08DIRECT/INDIRECT | 1.067 | 1.046 | 1.049 |
| 09MANUF | 1.086 | 1.039 | 1.066 |

(2019) suggest using a guideline that considers 0.75, 0.50 and 0.25 values to be substantial, moderate and weak R^2 , respectively, though considering that, depending on the context and discipline, 'an R^2 value as low as 0.10 is considered satisfactory' (Hair et al., 2019, p. 11). Our analysis returned an R^2 of 26.2%, 7.4% and 23.9% for TBL performance, SC traceability and SC transparency, respectively. Especially for the first and third values, this can be considered acceptable given that the state-of-the art has, thus far, shown inconsistencies and even contradictory views.

We then tested the strength and statistical significance of the relationships between the variables to determine (or not) support for the posed hypotheses responding to the RQs. For this, we assessed the path coefficients and their statistical significance (at the .1 and .05 level) by means of bootstrapping techniques (one-tailed bias-corrected and accelerated [BCa] bootstrap), using 5000 samples, with replacement (Hair et al., 2019). Table 7 below summarises the results of the structural model analysis, whilst Figure 2 below depicts the supported and unsupported hypotheses that we discuss next.

4.4 | Hypothesis testing

Regarding the direct effects (the direct-path relationships described in the hypotheses), we found that collaborative relationships have a positive and significant effect on the three dependent variables: SC traceability (significant at 10%), SC transparency and TBL performance. Thus, hypotheses H1a, H5a and H6a are supported. Similarly, the number of associations positively and significantly affected SC traceability (the higher the number of associations companies belong to, the greater the traceability developed). However, neither SC transparency's nor TBL performance's effects, although positive, have statistical significance. Therefore, hypothesis H1b is supported, whilst H5b and H6b are not. With regard to SC traceability, its (very weak) effect on TBL showed no statistical significance, but a positive and significant effect on SC transparency was confirmed. Thus, whilst hypothesis H4 was supported, hypothesis H2 was not. Finally, the positive relationship between SC transparency and TBL performance was found to be statistically significant, thus supporting H3.

As a result of the mediating variables (SC traceability and transparency), this research reveals additional positive and significant

indirect and total effects. Specifically, our study confirmed both the indirect effect of collaborative relationships on TBL performance via SC transparency and SC traceability's effect on TBL performance via transparency. Despite the latter, SC traceability's total effect on TBL performance still shows no significance.

In terms of control variables, size showed no significant effect on any of the variables, whilst country had significant effects on SC transparency. Portuguese companies achieved statistically significant higher values for transparency than their Spanish peers. The respondent companies' position (tier) also showed a positive effect (significant at 10%) on transparency. The statistically significant (negative) impact on TBL performance implies that, the lower the tier (=direct suppliers), the lower the TBL performance. Finally, manufacturing activity showed a statistically significant impact on all three variables. TBL performance was significantly higher for manufacturers versus traders or designing companies, but the opposite was true for SC traceability and transparency (traders and designing companies achieved higher values than manufacturing companies).

We further discuss the significant total effects, summarised in Table 8 and in Figure 3 below.

5 | DISCUSSION AND IMPLICATIONS

Our study's findings, built on SCPV postulates, allow for an exploratory TTfS model vis-à-vis stakeholder collaboration, with relevant theoretical and practical implications for both PBV and SCPV literatures and the SSCM field.

5.1 | Theoretical implications

This study identifies and empirically tests stakeholder collaboration, traceability and transparency (broken down into their activities, routines and behaviours) as three interorganisational practices whose (interrelated) implementation is associated to SC sustainability (measured as positive TBL performance). These findings thus provide empirical support for SCPV tenets and guide SSCM research towards *imitable* practices for improved sustainability (Brömer et al., 2019; Carter et al., 2017), as opposed to traditional SCM that aims to achieve and maintain competitive advantages focusing on the research (and protection) of *inimitable* practices and/or resources (Barney, 1991; Carter & Rogers, 2008; Seuring & Müller, 2008). In fact, without undervaluing the importance of the stated theoretical advancements, our study's most compelling contribution comes from the empirical endorsement of SCPV tenets applied to SSCM, further developing the idea that *imitable* practices that are not (necessarily or only) 'rocket science' underpin sustainable SCs. Our findings support a path towards sustainability in complex SCs through the deployment and use of a constellation of activities, routines and daily practices, most (though not all) modest and not necessarily *inimitable*, rather than complex, unachievable or unaffordable ones. However, since they are interorganisational, they loop back into the relationships between

TABLE 7 Structural model evaluation.

| | Effects | STDEV | t statistics | p values | 5% | 95% |
|--|-----------------------|--------------|--------------|--------------|---------------|---------------|
| Direct effects on TBL performance ($R^2 = 26.2\%$) | | | | | | |
| SCTRACE | 0.003 ^{not} | 0.089 | 0.039 | 0.485 | -0.139 | 0.152 |
| SCTRANSP | 0.266 | 0.097 | 2.756 | 0.003 | 0.101 | 0.420 |
| SCCOLL | 0.242 | 0.075 | 3.241 | 0.001 | 0.124 | 0.368 |
| NASSOC | 0.078 ^{not} | 0.09 | 0.871 | 0.192 | -0.075 | 0.223 |
| SIZE | -0.021 ^{not} | 0.087 | 0.236 | 0.407 | -0.166 | 0.121 |
| COUNTRY | -0.005 ^{not} | 0.082 | 0.056 | 0.477 | -0.137 | 0.131 |
| POSITION IN SC | -0.238 | 0.079 | 2.991 | 0.001 | -0.361 | -0.100 |
| MANUFACTURING ACTIVITY | 0.174 | 0.080 | 2.192 | 0.014 | 0.042 | 0.303 |
| Direct effects on SC traceability ($R^2 = 7.4\%$) | | | | | | |
| SCCOLL | <u>0.157</u> | <u>0.107</u> | <u>1.475</u> | <u>0.07</u> | <u>-0.014</u> | <u>0.331</u> |
| NASSOC | <u>0.143</u> | <u>0.104</u> | <u>1.377</u> | <u>0.084</u> | <u>-0.039</u> | <u>0.289</u> |
| SIZE | 0.037 ^{not} | 0.097 | 0.385 | 0.35 | -0.125 | 0.192 |
| COUNTRY | 0.051 ^{not} | 0.101 | 0.501 | 0.308 | -0.13 | 0.203 |
| POSITION IN SC | -0.056 ^{not} | 0.117 | 0.482 | 0.315 | -0.231 | 0.153 |
| MANUFACTURING ACTIVITY | -0.159 | 0.089 | 1.792 | 0.037 | -0.285 | -0.004 |
| Direct effects on SC transparency ($R^2 = 23.9\%$) | | | | | | |
| SCTRACE | 0.183 | 0.084 | 2.179 | 0.015 | 0.033 | 0.310 |
| SCCOLL | 0.324 | 0.097 | 3.336 | 0.000 | 0.186 | 0.507 |
| NASSOC | 0.052 ^{not} | 0.077 | 0.680 | 0.248 | -0.075 | 0.175 |
| SIZE | -0.010 ^{not} | 0.086 | 0.113 | 0.455 | -0.147 | 0.138 |
| COUNTRY | -0.161 | 0.087 | 1.859 | 0.032 | -0.294 | -0.010 |
| POSITION IN SC | <u>0.117</u> | <u>0.075</u> | <u>1.555</u> | <u>0.060</u> | <u>-0.015</u> | <u>0.232</u> |
| MANUFACTURING ACTIVITY | <u>-0.124</u> | <u>0.085</u> | <u>1.462</u> | <u>0.072</u> | <u>-0.260</u> | <u>0.020</u> |
| Indirect and total effects of collaborative relationships on SC transparency | | | | | | |
| Indirect effect via SCTRACE | 0.029 ^{not} | 0.031 | 0.023 | 1.239 | 0.108 | -0.003 |
| Total effect (direct + indirect) | 0.353 | 0.371 | 0.097 | 3.629 | 0.000 | 0.213 |
| Indirect and total effects of number of associations on SC transparency | | | | | | |
| Indirect effect via SCTRACE | 0.026 ^{not} | 0.025 | 0.021 | 1.225 | 0.110 | -0.007 |
| Total effect (direct + indirect) | 0.078 ^{not} | 0.076 | 0.076 | 1.027 | 0.152 | -0.049 |
| Indirect and total effects of collaborative relationships on TBL performance | | | | | | |
| Indirect effect via SCTRACE (1) | 0.001 ^{not} | 0.017 | 0.033 | 0.487 | -0.030 | 0.025 |
| Indirect effect via SCTRANSP (2) | 0.086 | 0.041 | 2.093 | 0.018 | 0.030 | 0.162 |
| Total indirect effect (1 + 2) | 0.095 | 0.043 | 2.176 | 0.015 | 0.031 | 0.172 |
| Total effect (direct + indirect) | 0.337 | 0.072 | 4.670 | 0.000 | 0.228 | 0.462 |
| Indirect and total effects of number of associations on TBL performance | | | | | | |
| Indirect effect via SCTRACE (1) | 0.007 ^{not} | 0.007 | 1.055 | 0.146 | -0.002 | 0.019 |
| Indirect effect via SCTRANSP (2) | 0.014 ^{not} | 0.023 | 0.616 | 0.269 | -0.019 | 0.054 |
| Total indirect effect (1 + 2) | 0.021 ^{not} | 0.028 | 0.773 | 0.220 | -0.018 | 0.072 |
| Total effect (direct + indirect) | 0.100 ^{not} | 0.091 | 1.095 | 0.173 | -0.053 | 0.246 |
| Indirect and total effects of SC traceability on TBL performance | | | | | | |
| Indirect effect via SCTRANSP | 0.049 | 0.029 | 1.695 | 0.045 | 0.005 | 0.098 |
| Total effect (direct + indirect) | 0.052 ^{not} | 0.090 | 0.581 | 0.281 | -0.096 | 0.199 |

Note: For data in bold, effects significant at $p < .05$; for underlined data, effects significant at $p < .10$; ^{not} refers to not statistically significant effects.

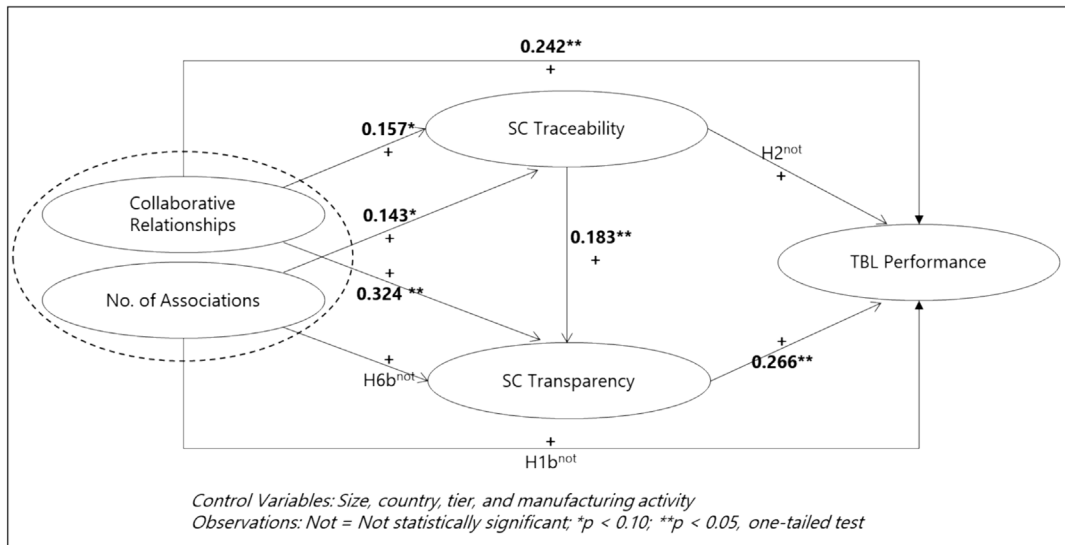


FIGURE 2 Hypothesis testing.

TABLE 8 Statistically significant total effects.

| | Effects | STDEV | t statistics | p values | 5% | 95% |
|---|--------------|--------------|--------------|--------------|--------|--------|
| Total effects on SC traceability (R ² = 7.4%) | | | | | | |
| SCCOLL | <u>0.157</u> | <u>0.107</u> | <u>1.475</u> | <u>0.07</u> | -0.014 | 0.331 |
| NASSOC | <u>0.143</u> | <u>0.104</u> | <u>1.377</u> | <u>0.084</u> | -0.039 | 0.289 |
| MANUFACTURING ACTIVITY | -0.159 | 0.089 | 1.792 | 0.037 | -0.285 | -0.004 |
| Total effects on SC transparency (R ² = 23.9%) | | | | | | |
| SCTRANS | 0.183 | 0.084 | 2.179 | 0.015 | 0.033 | 0.31 |
| SCCOLL | 0.353 | 0.097 | 3.629 | 0 | 0.213 | 0.532 |
| COUNTRY | -0.152 | 0.087 | 1.752 | 0.04 | -0.288 | -0.001 |
| POSITION IN SC | <u>0.107</u> | <u>0.077</u> | <u>1.395</u> | <u>0.082</u> | -0.023 | 0.227 |
| MANUFACTURING ACTIVITY | -0.153 | 0.081 | 1.892 | 0.029 | -0.282 | -0.018 |
| Total effects on TBL performance (R ² = 26.2%) | | | | | | |
| SCTRANS | 0.266 | 0.097 | 2.756 | 0.003 | 0.101 | 0.42 |
| SCCOLL | 0.337 | 0.072 | 4.67 | 0 | 0.228 | 0.462 |
| POSITION IN SC | -0.209 | 0.079 | 2.664 | 0.004 | -0.337 | -0.077 |
| MANUFACTURING ACTIVITY | 0.133 | 0.078 | 1.712 | 0.043 | 0.005 | 0.261 |

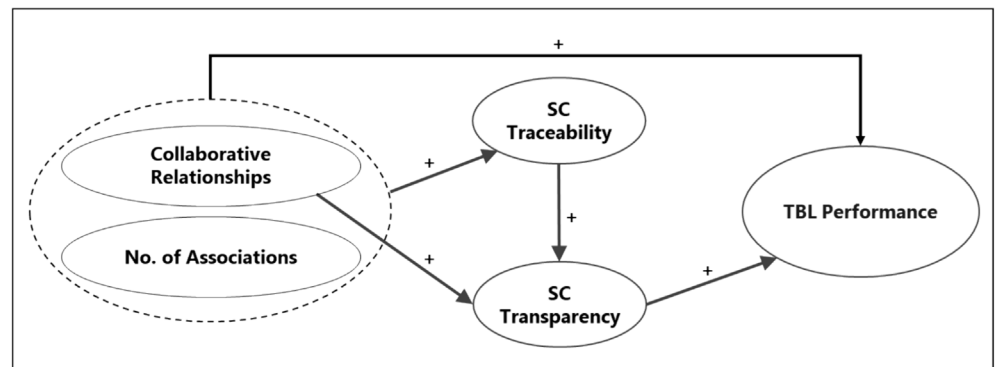
Note: For data in bold, effects significant at p < .05; for underlined data, effects significant at p < .10; ^{not} refers to not statistically significant effects.

participants in the entire SC and end up shaping the SC's (out)performance (and, ultimately, the industry's and society's). This is the case with associations membership, disclosing suppliers' names, internal traceability and so on, which are easy to access (through memoranda of intentions, collaboration agreements, membership fees, etc.) and generally easily imitable or not necessarily inimitable. An example of a difficult-to-imitate element can be end-to-end traceability, as it involves almost all SC actors and may also extend beyond interorganizational practices to include technological capabilities that are (temporarily at least) difficult to imitate. Thus, these results also contribute to SCPV with a portfolio of key perceptions and publicly available and modest practices (the survey instrument items, detailed in Table 5).

Delving into the proposed explanatory TTfS model, we can extract new insights regarding the relationships amongst stakeholder collaboration and SC traceability and transparency and how all of them impact TBL performance.

5.1.1 | Stakeholder collaboration and SC traceability and transparency

The fact that not only collaborative relationships with stakeholders but, also, the number of associations in which companies take part significantly affect traceability provides a new perspective to unravel

FIGURE 3 Explanatory TTfS model.

the rather contradictory assumptions that traceability is associated to high costs (Cheng & Simmons, 1994; Malik et al., 2021; Stranieri et al., 2017) and value destruction (Malik et al., 2021) or that it is a source of outperformance through flexibility, inventory performance and operational agility (Alfaro & Rábade, 2009; Kamann et al., 2019; Marconi et al., 2017; Roth et al., 2008; Skilton & Robinson, 2009). Thus, given our findings, we argue that volume (portfolio size) is a relevant/contingent variable to (cost-)effectively achieve traceability.

With respect to transparency, however, the informative result is that the degree of associationism (number of associations) does not significantly affect transparency. This reinforces its 'internal' and 'behavioural' aspects (Gold & Heikkurinen, 2018) and its development through relationships (Lamming et al., 2004). The descriptive analysis further strengthens this argument, showing higher values for behavioural items than for disclosure-related ones, with the lowest mean for 'disclosing suppliers' names.' This provides additional support to critiques that transparency is the mere unilateral publication of irrelevant information, potentially leading to greenwashing (Gupta et al., 2020; Lamming et al., 2004; Stohl et al., 2016) and takes sides with behavioural streams in transparency literature (Gold & Heikkurinen, 2018; Gupta, 2010).

5.1.2 | SC traceability and transparency

This study also contributes to provide some clarity to the endless debate regarding traceability and transparency and which comes first: at least when TBL performance is the final aim, traceability precedes transparency although leaving, as mentioned, the door open for bidirectional relationships and interaction effects (Malik et al., 2021). This result supports Egels-Zandén et al. (2015) and Stranieri et al. (2017) who argue that traceability is necessary to guarantee SC transparency and propose non-conventional dialogic technologies as its crucial enablers in the form of technologically assisted dialogue and information-sharing across the SC (McGrath et al., 2021).

5.1.3 | TBL performance: Integrating the three sustainability dimensions and advancing the 'how to'

Another relevant contribution of our work is the empirical evidence about the 'how to' of sustainability, using TBL performance as a proxy

that integrates three dimensions in one construct. This approach is still rare in the published literature (Henry et al., 2019).

With respect to stakeholder collaboration's impact on TBL performance, both collaborative relationships and associationism have a positive effect, although only the former (both for direct and indirect effects) is found to be statistically significant. This reflects the downside of collaboration and, especially, of associationism, where conflicting objectives sometimes coexist, giving rise to different levels of paradoxes and challenging governance and long-term existence (Rey-Garcia et al., 2020).

Regarding the relationship between SC transparency and TBL performance, this study clarifies the previously unclear and contradictory findings regarding SC transparency's effect on TBL performance (Gardner et al., 2019; Mol, 2015; Wognum et al., 2011), demonstrating a positive association. The difference from earlier inconclusive findings may be due to the behavioural aspects of transparency and limited disclosure, which prevent the 'transparency paradox' (i.e., opacity from excessive but irrelevant information) (Lamming et al., 2004; Stohl et al., 2016). Advancing transparency through collaboration and traceability significantly enhances TBL performance (Mol, 2015; Wognum et al., 2011). These findings support Gupta et al.'s call (Gupta, 2010; Gupta et al., 2020) to move beyond mere data collection to unlock transparency's transformative potential, as well as the importance of dialogic technologies to prevent the decreasing cost-effectiveness of collecting increasing volumes of data from suppliers (McGrath et al., 2021). Our study adds collaboration to the traceability and transparency tandem for sustainability (Fraser et al., 2020; Garcia-Torres, & L., Rey-Garcia, M., and Seuring, S., 2019), providing quantitative empirical evidence of its positive impact on TBL performance.

In terms of SC traceability, the fact that direct and total effects do not have statistical significance could be explained by the inner tensions amongst the TBL dimensions. This includes SC traceability's potential negative association to the economic sustainability component, given the high organisational and monetary costs related to traceability technologies (or tracking-and-tracing tools) (Cheng & Simmons, 1994; Macchion et al., 2015; Wognum et al., 2011). However, as mentioned above, these results shed some light on how it can drive improved TBL performance despite the high costs (Alfaro & Rábade, 2009). This is due to the indirect effect stemming from its role as an SC transparency antecedent.

Finally, we can also extract interesting findings from the research model's control variables. Firstly, Portuguese companies achieved statistically significant higher values for SC transparency than their Spanish counterparts. This may be due to cultural differences between the two countries and potentially reinforces the importance of company culture (as part of the corporate mission, vision, values and cultural factors) that previous literature has mentioned as a key transparency driver (Garcia-Torres et al., 2022). In addition, the significant impact of company tier on TBL performance (the lower the tier [=direct suppliers], the lower the TBL performance) may be explained by prior findings that point to sustainability surveillance being delegated upstream to first-tier suppliers (Wilhelm et al., 2016). Next, manufacturing activity also has a statistically significant impact on the three dependent variables (SC transparency, SC traceability and TBL performance). Whilst TBL performance is shown to be significantly higher for manufacturers versus traders or designing companies, the opposite is true for SC traceability and transparency (traders and designing companies achieved higher values here than manufacturing firms). This result is counterintuitive to this study's underlying hypothesis, contesting the premise regarding SC traceability and transparency as TBL enablers. One explanation may be related to unauthorised subcontracting that is still a frequent practice amongst textile manufacturers (Malik et al., 2021). All in all, our analysis of the control variables supports the moderating role that organisational history and context may play in shaping practices (Bromiley & Rau, 2014).

5.2 | Practical implications

Several implications for managers and regulators can be derived from this research, starting with the catalogue of *publicly-available* practices that are provided to managers and regulators as guidelines to TBL performance (Bromiley & Rau, 2014). Our results show that the combination of stakeholder collaboration, SC traceability and SC transparency (as well as all the associated activities, behaviours and routines) results in positive TBL performance. Beyond that, it should be a question of managers and policymakers' will and efforts (and/or future research) to ensure that the most difficult (or temporary) activities and practices that are difficult to imitate can also extend beyond interorganisational boundaries and become publicly available for others who want to support sustainability at the firm, SC, industry and societal levels.

In terms of descriptive results, our study highlights collaboration-related elements (peer-to-peer collaboration and collaboration with non-traditional actors) that are less developed in the literature, as well as the number of associations the respondent companies belong to which, on average, is below one. This finding encourages a first and urgent call to managers to rely on and develop collaborative efforts with stakeholders other than their clients to facilitate the (necessary) path towards sustainable models (Rinaldi et al., 2022). European regulators are fostering this transition with circularity-based mandates that oblige member states to implement high-quality recycling systems and

instil extended producer responsibility (ERP). In this regard, in terms of the textile industry specifically, the January 2025 deadline to establish the separate collection of textile waste is already triggering cross-sector collaboration, uniting global multinational competitors to achieve the common goal of creating a collective ERP system (<https://apparelresources.com/business-news/sustainability/leading-brands-join-tackle-textile-waste-spain/>). Along these lines, the fact that separate textile waste collection has historically involved NGOs or social enterprises can be viewed as an opportunity to further develop cross-sector collaboration for TBL performance, an initiative worth exploring and transferring to other industries (Bouzada-Novoa et al., 2022).

We can interpret the low values obtained by SC transparency's disclosure versus behavioural items as a need for governments and institutions to respond to demands for global standards and supervision. This could take the shape of a public agency that substitutes non-governmental systems and avoids audit fatigue and the public disclosure of rather useless information, also acting as an information arbitrator to provide transparency whilst protecting secrecy as needed. This is especially relevant since, in line with the literature and reports alerting about opacity beyond the first and second tiers, the lowest mean value in our study corresponded to 'disclosing suppliers' names' (3.234), evidencing that not much has been done since Egels-Zandén et al. (2015) alerted about this issue.

Also stemming from the descriptive analysis, improving external downstream traceability is direly needed if aiming to move towards a circular, closed-loop model (Rinaldi et al., 2022). For this, companies must be ready to embrace disruptive changes in how they operate and equip themselves with the capabilities, practices and processes needed to facilitate this desired circularity (Kache & Seuring, 2017).

On the institutional side, some initiatives are already in place such as the EU strategy for sustainable and circular textiles, the European Commission's [Circular Economy Action Plan](#), or, again with a focus on the textile industry, the above mentioned ERP and high-quality recycling deadline (Rinaldi et al., 2022).

Regarding the tested model, on the one hand, it sheds light on collective relationships' and associations' contributions in deploying traceability, transparency and sustainability across SCs. Our findings prove that stakeholder collaboration is directly and positively associated to SC traceability and TBL performance, whilst industry associations enable SC traceability, and, even though not statistically significant (possibly due to the limited sample size), they have a positive relation with TBL performance. These results support collaboration with other SC actors (in addition to suppliers and customers), thus leveraging collaboration's potential to favour the transition towards sustainable models. Relevant business associations are called to articulate member responsibilities in this regard, as well as to arbitrate in the transparency/competitiveness dilemma to avoid undesirable outcomes such as innovation disincentives or unfair competition (Rey-Garcia et al., 2020). Our results indicate that adding collaboration to the SC traceability and transparency tandem stimulates positive TBL performance. Specifically, SC traceability fosters SC transparency and thus has an indirect effect on TBL performance that needs to be added to transparency's direct effects. Collaborating is costly, difficult

and involves the risk of information and reputation exchange (Govindan et al., 2023). However, our study empirically demonstrates that this cost is worth it.

Again, and specifically for the fashion-apparel industry, this study's most relevant contribution may come from contravening the (well-established) idea that big retail brands, under pressure from regulators, investors and markets, are the driving force behind sustainability in SCs. In the scenario that this research proposes, the behaviours, routines, perceptions and practices underlying ordinary relationships between SC actors are responsible for introducing sustainability in order for it to flourish, not only in the SCs but also at the industry and societal levels. This serves to empower suppliers and other SC actors and can serve to push sustainability further.

6 | LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Whilst this study contributes valuable insights, it is important to acknowledge its limitations that, at the same time, present opportunities for further research and refinement. Firstly, the reliance on perceptual measures instead of on objective data, albeit taking the pertinent measures to avoid potential respondents' discretions and biases (Ketokivi & Schroeder, 2004), needs to be noted. Furthermore, the decision to use a single item to measure each TBL performance dimension for the sake of simplicity, although pragmatic and deemed valid to capture complex constructs (Yang et al., 2011), may not fully capture the complexity of sustainability dimensions. Additionally, the focus on data collection at the company (supplier) level may restrict the breadth of its application at the SC level and limit generalisability. Finally, the study's industry-specific focus on the fashion-apparel sector may limit extrapolation to other industries. These limitations highlight avenues for future research to explore alternative measurement approaches, broaden data collection methods and examine diverse industry contexts, thereby enriching our understanding of sustainability practices within SCs.

These limitations could also serve as the basis for future research that, based on SCPV principles, refines the measurement of performance in the posed model. Specifically, future research could complement these subjective measures with objective data and incorporate insights from multiple informants within companies and, ideally, add the dyadic or SC levels (Carter et al., 2017). Regarding SC transparency, it may benefit from more granular research, breaking it down to the actor/tier level instead of aggregated into one construct. Also, the fact that the 'own transparent behaviour' (TRANSP6) measurement is the most debatable one calls for further research in which SC members' perception of transparent behaviour can be contrasted with that of other traditional and non-traditional SC actors as well as research that further develops its behavioural and relational dimensions. Regarding TBL performance, future studies could break down the construct into its three constituent dimensions and further develop them: for example, the economic dimension could encompass operational, market and financial performance, whilst environmental and social dimensions could be measured with the most relevant items for

the context/industry of the study. Welcoming paradox theory to guide future research would also help bring research closer to understanding TBL performance not only as the integrated results in the three sustainability dimensions but the 'simultaneous non-negative' outcomes. The analysis of the sustainability dimension at the disaggregate level and/or carrying out additional research on the different activities and routines amongst manufacturers and traders or design companies might shed light not only on what to do to achieve TBL (out)performance but also what not to do to avoid negative TBL outcomes.

Our findings also encourage research and practice aimed at developing transparency's behavioural and relational dimensions to counteract the abovementioned drawbacks of its disclosure side (Gupta et al., 2020; Lamming et al., 2004; Stohl et al., 2016).

Seeing stakeholder collaboration as a key enabler of SC sustainability (measured here through TBL performance), our results reinforce the call for the appropriate governance of alliances or collaborative efforts in line with previous research (Garcia-Torres, & L., Rey-Garcia, M., and Seuring, S., 2019) to transform existing tensions into positive outcomes for the different traditional and non-traditional SC actors (Rey-Garcia et al., 2020). In this way, our study reiterates the need to consider the tensions and paradoxes in sustainability and stakeholder management, insisting on deeper analyses of how to prevent and/or properly manage these tensions.

Finally, research on configurations and contexts (for example, possibly applying Qualitative Comparative Analysis techniques) is urgently needed (Kosmol et al., 2019) to provide SC actors with concrete guidance to build their portfolios of practices, activities, behaviours and routines and to help them to understand how these should be used and how they can interact with other activities, practices and routines. This is particularly pronounced in the textile industry, given the impending January 2025 deadline for separate waste collection and ERP implementation.

7 | CONCLUSIONS

Traceability and transparency are seen as pivotal preconditions for sustainable SCs (Guo et al., 2015; Malik et al., 2021). Along these lines, both the United Nations Economic Commission for Europe (UNECE) and the EU have identified transparency and traceability as key priorities to advance sustainability and the transition towards a circular economy (European Commission, 2017; UNECE, 2021). Likewise, the UN recognises the significant role traceability and transparency play in achieving its SDGs, particularly those related to inclusive and sustainable economic growth and decent work (SDG 8); resilient and sustainable infrastructures, industrialisation and innovation (SDG 9); and sustainable consumption and production patterns (SDG 12), amongst others (UN General Assembly, 2015). In this challenging process of implementing traceability and transparency to achieve sustainability, collaboration amongst all types of players (companies, industry associations, consumers, civil society organisations and policymakers) is crucial (Adhi Santharm & Ramanathan, 2022; Rinaldi et al., 2022).

Building on SCPV postulates and testing empirical data from a sample of suppliers in global fashion-apparel SCs by means of PLS-SEM, our study proposes a prospective model that empirically tests the claims of traceability and transparency as conducive to TBL performance (Fraser et al., 2020; Garcia-Torres et al., 2022). It also highlights collaboration's impact on their deployment, thus contributing to shed light on the combined role of traceability, transparency and collaboration when it comes to promoting sustainability and more sustainable behaviours. As shown in Figure 3 above, stakeholder collaboration precedes traceability, transparency and sustainability. Traceability is positively associated to transparency and only indirectly to sustainability—through transparency. Finally, our results demonstrate that transparency significantly and positively impacts sustainability.

By focusing on imitable practices that drive TBL performance (instead of on inimitable capabilities linked to competitive advantages), the results of our study should help spread sustainability across firms and SCs to ultimately impact society as a whole (Brömer et al., 2019).

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