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Green supply chain practices in the plastics industry in Portugal. The moderating effects of traceability, ecocentricity, environmental culture, environmental uncertainty, competitive pressure, and social responsibility

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ABSTRACT

The proper use of resources in an industrial environment is crucial for the sustainability of the industry and the planet. As the supply chain is important for improving companies' environmental performance, this article measures the impact of green supply chain management (GSCM) practices on the environmental performance of companies in the plastics industry in Portugal. Environmental culture, environmental uncertainty, competitive pressure, ecocentricity, social responsibility in procurement and value chain traceability were used to moderate the relationship between GSCM and environmental performance. Using seven regression models via partial least squares structural equation modeling, it was possible to test the six moderators referred to above. The results demonstrate that GSCM practices have a positive impact on companies' environmental performance; however, the moderating effects tested proved not to be statistically significant. The immediate consequences for firms are clear: it is mandatory for them to implement an environmental, ecocentric culture if they want to manage the socio-environmental challenges of procurement and the traceability of the supply chain; only then will they be able to deal with both environmental uncertainty and the competitive pressures of supply chain sustainability. The biggest current challenges lie in the rational use of plastic resources and their reuse, either by the industry or by the end user, in terms of conscientious consumption and correct routing for their reuse. According to the natural resource-based theory, it is possible to claim that firms have capabilities but lack the resources to cope with environmental challenges they are facing to properly internalize the changes and to implement them across the supply chain.

1. Introduction

Environmental concerns and resource limitations have turned environmental pollution and the use of sustainable resources into global issues (Tseng et al., 2019). This has come about as a result of the 2030 Agenda established by the United Nations, which addresses several dimensions of sustainable development (social, environmental and economic), consisting of 17 Sustainable Development Goals (SDGs). The preservation of the environment has become a variable of great importance in industrial activity and the notion that it is necessary to adopt sustainable measures is increasingly common and pressing (Ahi & Searcy, 2013; Carter & Rogers, 2008; Hassini et al., 2012). Generally speaking, companies take one of two paths: they can adopt a reactive strategy—complying and reacting only to legislation—or, alternatively, they can opt for a proactive strategy—focusing on reducing their environmental impact. A large part of environmental degradation comes from companies' supply chains, where there is great potential for improving environmental performance (Dubey et al., 2015; Nureen et al., 2022; Seman et al., 2019). Therefore, the supply chain should be a focal point in combating environmental degradation, and there is increasing pressure on companies to find ways to improve their performance at this level (González-Benito & González-Benito, 2007; Tseng et al., 2019; Tumpa et al., 2019).

While initially sustainability was interpreted as a philosophical position, currently it is a multidimensional term used in business management. Green supply chain management (GSCM) can be defined as the

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management of information, materials, and capital, as well as cooperation between companies along the supply chain, dynamically integrating objectives related to the three dimensions of sustainable development—the social, environmental, and economic—that derive from the demands of customers and stakeholders (Ahi & Searcy, 2013). Sustainability is a relevant topic in the context of supply chain management (Ahi & Searcy, 2013; Carter & Rogers, 2008; Cousins et al., 2019; Huma et al., 2022; Pagell & Wu, 2009; Qiao et al., 2022; Seuring & Müller, 2008; Soleimani et al., 2022) and although early approaches to sustainability focused mostly on environmental issues with hardly any differences between sustainable and green supply chain management (Ahi & Searcy, 2013), in this study we adopt the term green supply chain management.

For firms, the concern with the environment and the urgency to take measures to reduce the environmental footprint has led to the sudden growth of interest in a sustainable, green supply chain (Cousins et al., 2019; Duan et al., 2021; Nureen et al., 2022; Padilla-Lozano & Collazzo, 2022). There is research on the importance of management practices for supply chain traceability and ecocentricity (Agyabeng-Mensah et al., 2021; Bataineh, 2021) in manufacturing industries (Agyabeng-Mensah et al., 2021; Cousins et al., 2019; Habib et al., 2022; Huma et al., 2022; Seman et al., 2019; Padilla-Lozano & Collazzo, 2022), in the garment industry (Habib et al., 2022), in the hotel industry (Yeşiltaş et al., 2022), in developing countries (Agyabeng-Mensah et al., 2021; Phruksaphanrat & Kamolkittiwong, 2022; Seman et al., 2019), in supplier involvement (Qiao et al., 2022) and in companies' culture and corporate social responsibility (CSR) policies (Padilla-Lozano & Collazzo, 2022; Silva et al., 2022). Moreover, studies of small and medium-sized firms (SMEs), in particular, have not been disclosed as the samples include a large proportion of large firms: 46% of SMEs (Seman et al., 2019), 48% SMEs (Cousins et al., 2019), less than 4% with less than 500 employees (Habib et al., 2022), with only two studies involving samples composed of more than 80% of SMEs (Agyabeng-Mensah et al., 2021; Huma et al., 2022). Moreover, although all industries are more or less are harmful for the environment, no single study analyzes the plastics industry, which is one of the most polluting industries.

The growing concerns about climate change, the excessive use of fossil fuels (Shao et al., 2021), air pollution and CO_2 emissions (Razzaq et al., 2020) are generally firms' growing concerns regarding GSCM activities to minimize pollution and energy consumption and to improve sustainability (Nureen et al., 2022). In order to protect the environment, governments across the world are introducing restrictions, regulations and standards (Bag et al., 2020; Chu et al., 2017; Wang et al., 2018; Żywiołek et al., 2022), which require top management to introduce supplier involvement activities to deal with green logistics, corporate social procurement and more competitive pressures (Adebayo et al., 2022; Kumar et al., 2019). Most SMEs need to deal with these but, perhaps, cannot easily internalize them, as those changes not only affect and demand firms' resources, but also are altered over time.

The plastics industry has become one of the most polluting industries, mainly due to misconduct regarding waste, both on the part of the end consumer and lack of sustainable practices among industrial firms. The paths plastics take after their daily or industrial use harm the planet more than the material itself. Furthermore, GSCM has been identified as one of the key areas of success for improving the effectiveness and sustainability of SMEs in a polluting industry such as the plastics industry (Deshmukh & Borade, 2019). The actions integrated throughout the supply chain to reduce emissions, pollution and energy consumption, and the diffusion of the introduction restrictions, regulations and standards at interorganizational level play a key role in GSCM activities. As such, this paper seeks to complement previous literature by analyzing how GSCM practices among firms in general, and SMEs in particular, impact companies' environmental performance in a polluting industry like that of plastics. Moreover, it will also address how environmental culture, competitive pressure, environmental uncertainty, ecocentricity, CSR in procurement and value chain traceability moderate the relationship between GSCM practices and environmental performance. The main novelty of this study is that it uses moderation effects (Baron & Kenny, 1986) between those variables and between GSCM practices and environmental performance.

With the aim of filling a gap in the literature when addressing the topic of GSCM, this study is unique in that its intention is to focus on companies which are part of the plastics industry, as it is the target industry for environmentally sustainable trends. Thus, this study aims to answer the following research questions:

- What is the impact of sustainable supply chain management on company performance?
- To what extent do environmental culture, environmental uncertainty, competitive pressure, ecocentricity, social responsibility in procurement and value chain traceability influence the relationship between GSCM and environmental performance?

In order to address those questions, we used the natural resource-based view (NRBV) theory as a theoretical lens using data obtained from 93 companies, 88 of them small and medium-sized firms (SMEs), operating in the plastics industry in Portugal. By analyzing the direct and moderating effect of environmental culture, competitive pressure, environmental uncertainty, ecocentricity, traceability and CSR in procurement, we seek to complement previous literature (Agyabeng-Mensah et al., 2021; Cousins et al., 2019; Govindan & Hasanagic, 2018; Nureen et al., 2022; Qiao et al., 2022; Tseng et al., 2019; Tumpa et al., 2019) involving mainly SMEs in a polluting industry. In this alternative approach, seven hypotheses were analyzed leading to the conclusion that despite the important direct effects, firms lack the resources to implement and achieve a green-based strategy throughout the supply chain.

This paper is divided into six sections. After this introduction, the literature review covers the topics relevant to this study and the proposed model is presented. Section 3 contextualizes the plastics industry and addresses and justifies the methodology used. In section 4, the results of the statistical analysis are presented, while section 5 discusses the results obtained. Finally, the final section includes the main conclusions and implications for management, as well as the main limitations of the study and some suggestions for future research.

2. Literature review

This section is composed of four subsections that lead to the proposed model. The first subsection proposes the natural resource-based view (NRBV) theory as the grounding theory that supports firms' competitive actions. The second subsection addresses the concept of GSCM and environmental performance, which is central to the model tested. The third subsection presents the concepts of ecocentricity and supply chain traceability and their relationships as moderating variables supporting hypotheses H2 and H3, presented in the subsection. The fourth subsection presents the concepts of environmental culture and corporate social responsibility in procurement and their relationships as moderating variables supporting hypotheses H4 and H5. The fifth subsection presents the concepts of environmental uncertainty and competitive pressure and their relationships as moderating variables supporting hypotheses H6 and H7. Finally, the model tested is presented at the end of the section.

2.1. The natural resource-based view of the firm

The resource-based view (RBV) theory proposes that firms deploy their valuable, rare and inimitable tangible and intangible resources to achieve a sustainable competitive advantage (Barney, 1991). Hart (1995) claims that the RVB theory places too much emphasis on internal resources and does not properly consider the contextual environment. Hart (1995) argues that what is important is the level of fitness between

firms' internal resources and the external environment and proposes the use of the natural resource-based view (NRBV). NRBV theory seeks to highlight environmental practices and intangible resources that are difficult to imitate or obtain as a result of capability and institutional constraints (Hart, 1995; Hart & Dowell, 2011). As such, NRBV contends that firms are constrained by both their internal and their external resources in such a way that the use of environmentally related strategies can provide firms with sustainable competitive advantages (Hart & Dowell, 2011). In this study, ecocentricity, value chain traceability, corporate social responsibility in procurement, environmental uncertainty and competitive pressure will be considered the result of external pressures that influence green-based environmental strategies, supporting NRBV theory. Environmental culture of the firm is going to be considered as supported by the RBV of the firm.

2.2. Sustainable supply chain management and environmental performance

The constantly changing global trends in consumer requirements and preferences, product design, and materials used require flexible intermediaries in the relationship between the consumer/end users and manufacturers. Therefore, producers, suppliers and customers are always interconnected and depend on this multiparty harmonious connection to influence the environment around them and the variety of resources needed (Min & Zhou, 2002; Ribau et al., 2019a, Ribau et al., 2019b; Wathne & Heide, 2004). The group of stakeholders across the supply chain facilitates access to knowledge, information flow, motivation, productivity, and innovation, helping firms acquire strategic competitive advantages (Ribau et al., 2019b).

Global awareness about environmental protection has been increasing, with consequences for all players in the supply chain (Dube & Gawande, 2016). It is often found that the unplanned and 'irresponsible' actions of companies, in all industries, but especially in polluting industries, pose potential threats to environmental sustainability. Consequently, establishing sustainable industries is one of the main goals of contemporary organizations. It is essential for companies to consider the external environment in order to achieve sustainable goals. The supply chain is an extremely important branch of operations management and has a very significant impact on the environment. This includes emissions, pollution, community health risks, and more (Tseng et al., 2019).

Some organizations have been trying to minimize their environmental impact by integrating environmental practices into their supply chain, which is referred to as 'green supply chain management' (Tseng et al., 2019). GSCM requires the integration and coordination of different business areas within the company and the alignment with the organization's overall strategy with the supply chain stakeholders to minimize the occurrence of environmental problems throughout the supply chain. Companies need to collaborate with suppliers, clients and other logistics service providers to share information and knowledge to improve environmental performance (Carter & Rogers, 2008; Dube & Gawande, 2016; Seman et al., 2019; Tseng et al., 2019; Tumpa et al., 2019). GSCM is also defined as the integration of environmental thinking into all processes of supply chain management, including production, sourcing and selection of materials, the manufacturing process, and delivery of the final product to consumers, as well as the end-of-life management of the product after its useful life (Pinto, 2020).

Seman et al. (2019) argue that GSCM significantly affects the environmental impact of supply chain procedures, which can improve the environmental performance of organizations. Essentially, GSCM includes green purchasing, reverse logistics, and the process cycle (involving suppliers, producers, and customers). In addition to environmental benefits, GSCM offers benefits from a business perspective since companies can respond to external pressure, for example, from regulation, government, or even the surrounding community at large. GSCM is seen not only as an enabler of environmental improvement (reducing the use of chemicals and toxic materials, energy consumption, waste generation, air pollution, etc.) but can also improve economic performance and competitive advantage (Tumpa et al., 2019). The introduction of GSCM practices in different segments of the business process results in a coordinated sustainable/green supply chain. GSCM practices enhance the improvement of overall business performance, helping to generate green innovation (Seman et al., 2019; Tseng et al., 2019).

Motivated by the growing concern for the environmental sustainability and by the pressure associated with competition, globalization, and public opinion, organizations have made increasing efforts to improve their environmental performance, including making environmental awareness an integral part of the overall company culture and restructuring their strategy by choosing to adopt GSCM practices (Shamsuddin et al., 2020). Investigating the outcomes of GSCM at different levels, considering both developed and developing countries, Shamsuddin et al. (2020) reiterate that GSCM can impact the economic performance of some organizations. For them, GSCM practices are mostly adopted due to external pressures from governments, customers, and the growing environmental awareness of the community at large. They also argue that the main result expected from the implementation of GSCM is the protection of the environment, through the reduction of pollution generated by the industry.

Jabbour and De Sousa Jabbour (2016) argue that internal management should be the first step towards the adoption of GSCM practices, by raising the team's awareness of environmental concerns, increasing the organizational culture, making the team more sustainable and encouraging it to consider aspects such as pollution prevention and resource optimization, among others. Companies also face external pressures, namely from government regulations and demands from customers and suppliers (Ma et al., 2021; Shamsuddin et al., 2020). Another cause often found to improve not only environmental performance, but also overall company performance is the sustainability-oriented internal organizational culture (Liu et al., 2020), which can have repercussions throughout the supply chain (Padilla-Lozano & Collazzo, 2022; Phruksaphanrat & Kamolkittiwong, 2022; Yeşiltaş et al., 2022).

According to Pinto (2020), GSCM practices are a set of techniques, policies, and procedures implemented by companies in order to reduce or eliminate waste, pollution, and hazardous materials. Environmental practices include distribution activities, green procurement, and internal environmental management, among others. In addition to internal practices, environmental practices should also cover inter-organizational activities, through collaboration with the company's environment, such as suppliers and customers, enhancing the sharing of information and an alignment of objectives of all in relation to sustainability. GSCM practices are diverse and there is no clear and commonly accepted recipe of available practices (Nureen et al., 2022; Pinto, 2020; Tseng et al., 2019).

Successful implementation of GSCM depends on integration and collaboration with stakeholders (Ghosh, 2019). Their participation will be crucial in improving the company's performance at economic, environmental, and innovation levels (Dube & Gawande, 2016; Tseng et al., 2019). GSCM practices promote efficiency and synergy among stakeholders and help minimize waste and improve environmental performance (Rao & Holt, 2005). Also, Seman et al. (2019) argue that the implementation of GSCM practices influences organizational environmental performance.

Cousins et al. (2019) highlight the importance of managers valuing and making efforts to improve monitoring and collaboration in supply chains to gain benefits from actions for sustainability. Realizing the value of sustainability-related activities in supply chains represents a significant challenge for most companies. Organizations must select and monitor their suppliers in order to obtain green, sustainable products and services, minimizing the negative environmental impact during production processes. In addition, companies must have performance standards to meet customer demands for sustainable products (Cousins

et al., 2019; Habib et al., 2022; Sharma et al., 2017).

Based on the analysis of mimetic, normative, and coercive pressures exercised on manufacturing firms, GSCM practices were found to be positively related to firms' environmental, operational and economic performances (Samad et al., 2021). As such, collaborative practices across the whole supply chain are advised in order to improve environmental performance. Based on a qualitative methodology, Viale et al. (2022) claim that environmental performance increases with the propensity of organizations to eco-innovate. For that to take place, purchasing agents need to work closely with their suppliers to achieve the ecological transition of the supply chain. To prioritize companies' environmental performance, logistics activities play a key role in improving sustainability (Yontar, 2022) as they improve the environmental impact, waste management, resource usage, transportation and warehouse management of the firms involved in the supply chain. As such, GSCM activities are expected to improve companies' environmental performance.

As companies are increasingly interested in adopting green practices in their supply chains, it is important to understand the real link between these practices and companies' environmental performance. There are different views about the adoption of these practices. On the one hand, there is literature suggesting that GSCM practices have a positive effect on firms' performance at various levels (Carter et al., 2000; Cousins et al., 2019; Geng et al., 2017). On the other hand, others suggest that companies have some difficulty in deriving benefits from adopting GSCM practices (Nureen et al., 2022; Schmidt et al., 2017), which may be a result of some existing barriers to implementing these types of practices (Dube & Gawande, 2016; Tseng et al., 2019; Tumpa et al., 2019). As such, based on the importance of GSCM practices for firms in the plastics industry, the following hypothesis was put forward:

H1—GSCM practices are positively linked to firms' environmental performance.

2.3. Ecocentricity and supply chain traceability

There is a growing interest from both academia and businesses in addressing issues related to sustainability and ecocentricity. Sustainability is not just a matter of monitoring and controlling the environmental impact of organizational practices, processes and products. Far beyond this, it is about protecting the environment and resources and not destroying them with their use in order to make them last longer (Allen et al., 2019).

According to Purser et al. (1995), eco-centrism offers an alternative to the technocentric orientation, arguing that humans are not the only value and calling for a change in the anthropocentric attitude toward the environment. The theory of eco-centrism is supported by a principle of wholeness—humans are seen as part of a network in harmony with the ecosystems of the environment (Allen et al., 2019; Purser et al., 1995). According to Cousins et al. (2019), ecocentricity can be defined as a company's propensity to collaborate and learn from stakeholders to achieve sustainability goals. Because it has a proven positive effect on economic performance through good internal organizational and stakeholder management, ecocentricity can be considered a strategic resource to minimize costs (Bataineh, 2021).

The importance of ecocentricity is grounded in NRBV theory as external stakeholders play a crucial role in advancing social, environmental and economic GSCM goals, activities and practices (Hart, 1995; Agyabeng-Mensah et al., 2021). To apply ecocentricity, it is important for firms to get involved with their counterparts throughout the supply chain to learn, engage, operate and enhance GSCM innovative practices that may lead to: reducing environmental pollution; gaining new insights about sustainable approaches; adopting changes in products and processes; and changing logistics and transportation practices (Agyabeng-Mensah et al., 2021; Cousins et al., 2019).

Regarding supply chain traceability, Cousins et al. (2019) define it as the way to assess the company's level of knowledge throughout its products and processes, from the origin to the end customer. It consists of the ability to trace aspects such as the location and origin of raw materials and products and the type of processes used by suppliers. The lack of traceability hinders firms' capacity to trace and track activities through the supply chain, inhibiting firms from eradicating certain environmental, socially adverse or idle practices and reducing the risk of non-compliance with standards by ensuring that the entire process is known in detail (Agyabeng-Mensah et al., 2021; Cousins et al., 2019). Supply chain traceability also enables firms to measure and trace the material flows, parts, components and products from the suppliers to end customers, providing firms with information on transportation (Dabbene et al., 2014).

Ecocentricity and supply chain traceability play an important role in the relationship between GSCM practices and the environmental and economic performance of companies. Through supply chain traceability, it will be possible, for example, to understand which specific areas of the processes need intervention (Agyabeng-Mensah et al., 2021; Bataineh, 2021; Cousins et al., 2019).

Based on Agyabeng-Mensah et al. (2021) and Cousins et al. (2019), it is expected that the higher the level of ecocentricity and traceability levels, the stronger the relationship is between GSCM activities and environmental performance. As such, the following hypotheses were formulated regarding the impact of ecocentricity and traceability as moderating variables of the relationship between GSCM practices and environmental performance:

H2—Ecocentricity positively moderates the relationship between GSCM practices and firms' environmental performance.

H3—Supply chain traceability positively moderates the relationship between GSCM practices and firms' environmental performance.

2.4. Environmental culture and corporate social responsibility in procurement

Culture is understood as a pattern of assumptions and behaviors that mold human behaviors within organizations (Schein, 1990). Organizational culture helps individuals to deal with how external changes are internalized or dealt with within the organization (El Baz & Iddik, 2022). Organizational culture plays a very important role in the process of making the supply chain more sustainable. Organizational culture refers to the content shared by the members of an organization, including the environmental practices of companies (Kumar et al., 2019).

The importance of culture is reflected in human practices. However, culture has not been extensively used to analyze how organizational green culture influences employee behavior. For example, in the hotel industry, Yeşiltaş et al. (2022) conclude that although organizational green culture has an impact on green human resource practices, environmental culture has no impact on green environmental behavior. Furthermore, the results differ between green and non-green hotels. The passive, throw-away culture of most consumers is also an important external factor that influences organizational culture as it encourages a resistance to change to more sustainable, greener solutions within organizations, which jeopardizes closed-loop supply chain initiatives (Tumpa et al., 2019; Govindan & Hasanagic, 2018).

A social responsibility culture is defined as the set of shared meanings of the concept of sustainable development, which gives an organization its own behaviors of ethics, fairness, and transparency in social groups and the environment. It allows members of the organization to reach a consensus on assumptions, values and beliefs that the company believes in. Social responsibility, like other aspects already discussed, can be influenced by factors such as government pressure, competitive pressure, and pressure from customers (Phillips et al., 2019; Rizzi et al., 2018).

Stakeholders play an important role in pressing firms to embrace CSR principles and standards. As such, firms' CSR monitoring policies are important for achieving supply chain transparency. Duan et al. (2021)

claim that the more information disclosed about suppliers, the better for firms' CSR, both for the firm and for their suppliers' social and environmental activities. In an analysis of the food industry involving SMEs, proactive CSR policies are better perceived by consumers when compared to passive environmental CSR policies, which reveals that firms using proactive CSR policies can be more transparent and achieve a better consumer response (Kim & Bhalla, 2022). CSR is related to environmental practices, which refers to an organization's voluntary consideration of social and environmental issues, especially in their interactions with their stakeholders (Liu et al., 2020). Social responsibility generally involves economic, social, and environmental dimensions (Carter & Rogers, 2008).

Top management plays an important role in creating and supporting social responsibility. The level of environmental culture and social responsibility varies and is dependent on several factors. For example, companies with a high level of environmental culture and social responsibility, and which have a higher level of defined assumptions, values and beliefs, may better understand the core of the social responsibility and thus obtain greater awareness, motivation, and understanding of the importance of adopting environmental practices from all members of the organization (Liu et al., 2020). Salam (2009) argues that there are several reasons for leaders to invest in social responsibility, from competitive positioning, to globalization, regulation, and sustainable development.

Sustainable purchasing activities include the management systems of recycling, reusing and reducing the negative environmental effects of all involved in the supply chain (Huma et al., 2022). As such, in order to implement social and environmental practices in the supply chain, manufacturers need to pursue and implement them in this process so that suppliers of components and raw materials actively participate in GSCM practices (Nureen et al., 2022; Phruksaphanrat & Kamolkittiwong, 2022). Previous studies show that for effective GSCM practices to be effective, top management support and supplier involvement are necessary (Habib et al., 2022; Nureen et al., 2022); the environmental certification of suppliers are important mechanisms to align the suppliers and the clients (Ma et al., 2021); and the supplier environmental commitment is of key importance for suppliers to be committed to collaborating in achieving environmental results (Habib et al., 2022; Qiao et al., 2022). Finally, the importance of CSR to performance is present when this relationship is mediated by job satisfaction and organizational trust (Silva et al., 2022). To this end, firms need a solid environmental culture to be social and environmentally responsible.

Liu et al. (2020) emphasize the importance of environmental culture in GSCM processes. Moreover, in order to overcome organizational resistance and involve other stakeholders across the supply chain, the firm's environmental culture is expected to play an important role in influencing GSCM practices (Tumpa et al., 2019; Govindan & Hasanagic, 2018). Thus, the following hypothesis was formulated for this study:

H4—Firms' environmental culture positively moderates the relationship between GSCM practices and firms' environmental performance.

Following Salam (2009), the importance of social responsibility in procurement is emphasized as is the involvement of suppliers and other stakeholders throughout the supply chain (Habib et al., 2022; Qiao et al., 2022; Tumpa et al., 2019). As such, the following hypothesis was formulated:

H5—Social responsibility in procurement moderates the relationship between GSCM practices and firms' environmental performance.

2.5. Environmental uncertainty and competitive pressure

In recent decades, economic and environmental uncertainty has been considered strongly linked to various business activities and relevant to both the business and academic worlds. Environmental uncertainty is defined as the inability, at various levels, to establish the probability of future events and to accurately predict the consequences of decisions (Zimmermann et al., 2020). As referred before, environmental and climate changes being about growing concerns about GSCM activities, energy consumption, environmental restrictions, regulations and standards (Bag et al., 2020; Chu et al., 2017) that are changing the competitive landscape many firms to adequately compete in the markets with consequences in green activities throughout the supply chain (Adebayo et al., 2022; Kumar et al., 2019).

The competitive pressure to improve supply chain management has been growing in recent years. Business environments have come to be characterized by increasing levels of uncertainty and unpredictability. Thus, organizations feel the constant need to gain competitive advantage to match the pressures from their competitors, betting on strategies that guide them to this goal (Braunscheidel & Suresh, 2009). Competitive pressure is often a strong reason for companies to make decisions related to supply chain improvement at the environmental level (Dai et al., 2015). In order to boost competitive pressure, firms need to introduce green innovation within the company and across the supply chain (Padilla-Lozano & Collazzo, 2022; Seman et al., 2019). According to Gosh (2019), competitive pressure is a strong driver for adopting CSCM.

Based on the study of Zimmermann et al. (2020) and Kumar et al. (2019) about environmental uncertainty in the supply chain, firms are expected to invest their resources to adapt and adopt those environmental changes to cope with institutional challenges. As such, the following hypothesis was formulated, as it is expected that the higher the environmental uncertainty, the more firms invest their resources to improve the relationship between GSCM and environmental performance:

H6—Environmental uncertainty positively moderates the relationship between GSCM practices and firms' environmental performance.

For Ghosh (2019), competitive pressure has some relevance as a moderating variable of GSCM practices. Moreover, it is also expected that the higher the competitive pressure, the more firms invest their resources to improve the relationship between GSCM and environmental performance (Padilla-Lozano & Collazzo, 2022; Seman et al., 2019). Thus, the following hypothesis was formulated:

H7—Competitive pressure positively moderates the relationship between GSCM practices and firms' environmental performance.

In order to achieve the main objective—to assess the impact of GSCM practices on company performance—a conceptual model was created (Fig. 1). This model was developed based on the literature and hypotheses presented above. The model assumes that there is a positive relationship between GSCM practices and firm performance. This relationship is influenced by six moderating variables: ecocentricity, traceability, environmental culture, competitive pressure, environmental uncertainty, and social responsibility in procurement.

3. Method

3.1. The plastics industry

Due to their characteristics, the plastics industry feeds different industries, such as packaging, footwear, construction, transportation, electricity and electronics, agriculture, design, and sports and leisure, among others (Almeida et al., 2019; Ribau et al., 2019a). The plastics industry is not only present in the daily life of society, but also plays a vital role in the European economy. Together, more than 55,000 companies—mostly SMEs, the producers of plastic raw materials, plastics processors and recyclers, and machinery manufacturers—account for around 1.5 million jobs in Europe. In 2019, these companies created a turnover of more than 350 billion euros and contributed more than 30 billion euros to European public finances (Plastics Europe, 2020). The supply chain of the plastics industry is complex and is composed of very differentiated players that encompass raw material suppliers, large plastic compounders, and waste management companies (Plastics Europe, 2020; Ribau et al., 2019b).

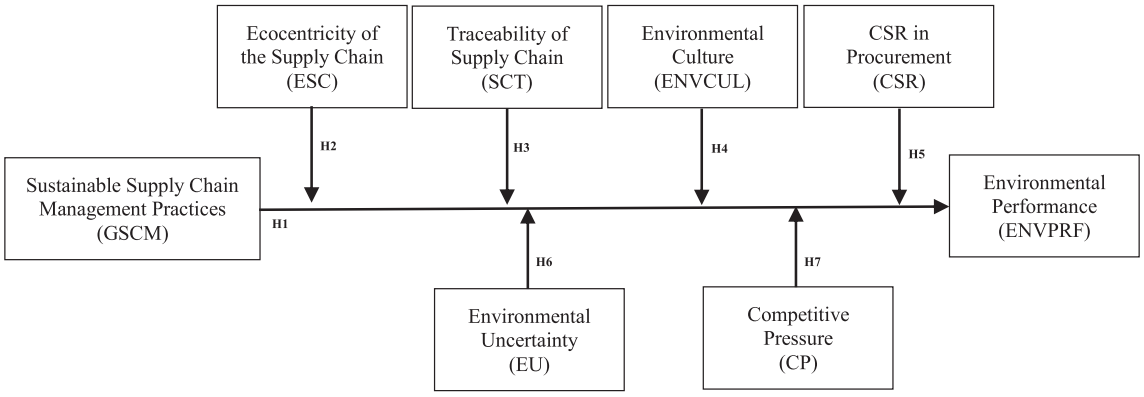

Fig. 1. Conceptual model. Source: Own elaboration.

In recent years, the Portuguese plastics industry has played a significant role in the growth of the Portuguese economy. In 2017 it generated a gross value added of 0.70% of GDP, which corresponds to more than 1,300 million euros. In comparison, in 2010, the weight of the plastics industry in GDP represented only 0.52%. In 2019, the manufacturing of rubber and plastic articles industry ranked seventh in the national manufacturing industry ranking, positively influencing economic activity (Instituto Nacional de Estatística, 2019).

As sustainability has become a major global concern, the plastics industry is one of the core concerns of environmental protection. The adoption of environmentally led practices is fundamental and imperative in a modern society that is governed by a new environmental paradigm that gives primacy to the relationship of the human being with the environment. For firms in this industry, and especially for SMEs, it represents a major challenge because the changes needed throughout the supply chain involve SMEs, which are characterized by their lack of resources (Plastics Europe, 2020).

3.2. Questionnaire development and pre-testing

In this study, a quantitative methodology was used, based on a questionnaire created through a review of existing literature about different variables that GSCM covers and that influence environmental performance. The data collection strategy was based on the application of a survey research questionnaire, which was generated based on previously tested, validated and published scales. The constructs and the items of each construct are presented in a table in the appendix.

The questionnaire was divided into four sections: the first introduces the purpose of the questionnaire and the research. The second part addresses questions related to GSCM practices, competitive environmental uncertainty, ecocentricity, traceability, environmental culture and social responsibility of purchasing; the third part of the questionnaire contains questions related to environmental performance; finally, the fourth and last section of the questionnaire contains questions related to company and respondent data, such as the year the company was founded, number of employees, sales volume and export percentage, as well as the respondent's role. Green supply chain management, the ecocentricity of the supply chain and supply chain traceability were measured using seven, four and five items, respectively, based on Cousins et al. (2019). Competitive environmental uncertainty was based on Zimmermann et al. (2020), with three items. Environmental culture was measured using five items from Liu et al. (2020), Competitive pressure was based on four items from Ghosh (2019). Social corporate responsibility in procurement was measured based on Salam (2019). Finally, environmental performance was based on seven items from Cousins et al. (2019). All questions were asked using a Likert scale from 1 to 7, which provides insight into the extent to which the respondent agrees or disagrees, as well as the intensity of agreement (1 = Strongly disagree; 7 = Strongly agree). To avoid misunderstandings when translating the questionnaire from English into Portuguese and back translating it to English, we followed Brislin's (1971) recommendations, comparing both questionnaires.

3.3. Sample and data

In order to collect the desired data about the selected universe, a questionnaire was created through the LimeSurvey platform, which allows online data collection and subsequent download for data analysis. Before starting to disseminate the questionnaire, a pre-test was run with seven individuals in similar positions (purchasing and business management) in order to identify minor errors and make the questionnaire as intuitive as possible. Minor changes were made after the pre-test.

The survey questionnaire was applied via e-mail and complemented by a phone call to companies belonging to the Portuguese plastics industry. The questionnaire allows us to understand the extent to which companies consider that GSCM practices contribute positively or negatively to their performance. The questionnaire was active for approximately-two months, and 93 valid answers were obtained.

This research is grounded on the information provided regarding the Portuguese plastics industry, with a universe of 650 companies (Instituto Nacional de Estatística, 2020). 519 companies were contacted, having excluded companies in the process of insolvency or with no formal email contact for sending the questionnaire. A sample of 93 companies willing to participate and respond to the questionnaire was obtained, leading to a response rate of 18%. Although the sample is somewhat small, the sample size is considered suitable for data analysis using partial least squares structural equation modeling (PLS-SEM) (Hair et al., 2016). Moreover, other studies have also used samples with less than 100 responses (Silva et al., 2018). Finally, PLS-SEM can be used as long as the 10-times rule for PLS-SEM is fulfilled, which indicates that the sample size needs be at least equal or larger to 10 times the largest number of structural paths indicated in a particular construct of the structural model (Hair et al., 2016).

The Statistical Package for the Social Sciences (SPSS) software version 27.0 was used for data analysis, as well as partial least squares structural equation modeling (PLS-SEM). Structural equation modeling (SEM) includes one or more linear regression equations to explain the linear causal relationship between dependent and independent constructs. The main goal of this type of analysis is to measure the link between constructs.

The first step of the analysis was to check the consistency of the conceptual model, so the following methods were used: reliability analysis, in order to validate the scales; and exploratory factor analysis (EFA). Before the hypotheses were tested, the data underwent a validation process through a basic descriptive statistical analysis (mean, standard deviation, skewness, and kurtosis). According to Curran, West, and Finch (1996), skewness values should be below 2.0 in absolute value, while kurtosis values should be below 7.0 in absolute value, in

order to reject the non-normality of the sample.

To analyze the reliability using Cronbach's alpha, the values referred to in the study of Pestana and Gageiro (2014) were used as reference values. Tests of reliability, convergent validity and discriminant validity were carried out. SmartPLS software was used to measure the relations between the variables, as to test the moderation effects of each of the six moderators used to test the relationship between GSCM and environmental performance. For each moderator, a 'model' was used to test the hypotheses formulated.

4. Results

The main characteristics of the sample of the 93 companies analyzed are represented in Table 1, in which it is possible to witness that the large firms only represent 5% of the sample analyzed. The year of founding varies between 1929 and 2011, with the number of employees ranging from two to 700. Moreover, micro and small firms represent slightly over 75% of the sample, with sales volumes and percentages of exports lower than the average of the sample analyzed.

The skewness and kurtosis values are below 2.0 and 7.0, respectively, as recommended by Curran et al. (1996). Moreover, we followed the recommendations of Hair et al. (2019) and Hair et al. (2016) for presenting the results of the analysis of the relations. The loadings and cross-loadings of all items studied were analyzed and obtained by bootstrapping with 5000 iterations. All loadings are statistically significant at 1% ($|t\text{-values}| \geq 3.291$). Some of the items analyzed present loadings below the minimum recommended by Hair et al. (2019), 0.7. This is the case of items ENVPRF6 (0.665), EU2 (0.543), EU3 (0.668), and GSCM3 (0.668), which were removed for analytical purposes without compromising the reliability of the analysis as they are higher than 0.4, Hair et al. (2019). The remaining items show values above the reference value suggested by the authors mentioned above, with ESC1 being the item with the lowest loading (0.700). The results support the convergent validity of the constructs.

Table 2 shows the Cronbach's alpha values, average variance extracted (AVE), composite reliability (CR) and correlations between each variable. All values for composite reliability (CR) are above the recommended minimum of 0.6 (Hair et al., 2019), ranging from 0.811 (CP) to 0.930 (CSR), which indicates that the constructs have adequate internal consistency. With regard to the AVE, it is also above the minimum recommended by Hair et al. (2019)—0.5, ranging from 0.592 (CP) to 0.743 (STP), which confirms their convergent validity.

Discriminant validity was measured both through the Fornell-Larcker and heterotrait-monotrait (HTMT) criteria, the results of which can be seen in Table 2. Henseler et al. (2015) claim that the HTMT criterion performs better, as it is more rigorous and has the ability to achieve higher rates of specificity and higher sensitivity when compared to the Fornell-Larcker criterion. Using the HTMT criterion implies comparing it to a predefined threshold that ranges from 0.85 (Kline, 2011) to 0.9 (Gold et al., 2001), so if the result is higher than this threshold, it can be concluded that there is a lack of discriminant validity (Henseler et al., 2015). The Fornell-Larcker method compares the square root of the AVE with the correlation of latent constructs (Hair et al., 2016). It seeks to demonstrate that a latent construct explains the variance of its own indicator better than the variance of other latent constructs. Table 2 shows the results for Cronbach's alpha, AVE, CR, and the results of the discriminant analysis using the HTMT and the Fornell-Larcker criteria. All constructs present HTMT scores with values lower than 0.9, and the square root of each construct is larger than the correlation of each construct vis-à-vis other constructs. Thus, the discriminant validity of the constructs can be confirmed.

Table 1
Characterization of the sample.

	Number of firms	% of firms	Number of Employees*	Sales Volume (€)*	Age of the firm (years)*
Micro firms	34	36.5	7.23	563 140	23.64
Small firms	36	38.7	25.62	3 026 780	28.24
Medium-sized firms	18	19.4	85.18	8 088 986	43.27
Large firms	5	5.4	378.25	88 368 500	39.75
Overall sample average	–	–	54.26	8 938 005	30.09

Note: * denotes average number per firm. The European definition of SMEs in terms of head count was used for characterizing the firms: micro firms: less than10 employees; Small firms: less than50 employees; and Medium-sized firms: less than250 employees.

Before embarking on the analysis of the various hypotheses presented in Fig. 1, sales volume (in €), number of employees and size of the firm (0 for micro firms, 1 for small firms, 2 for medium firms, and 3 for large firms), were tested as control variables. The results are shown in Table 3. As such it is possible to conclude that there are no statistically significant differences for the variables analyzed.

The regression models presented in Table 4 were first evaluated via the sign, magnitude, and statistical significance of the parameters of the relationships between the variables, and next via the explained variance (R^2) of the dependent variables, as suggested by Hair et al. (2019). Overall, seven models were tested, each testing the hypothesis formulated in the literature review. As shown in Table 4, Model 1 tests the direct relationship between GSCM and environmental performance. Model 2 tests the direct effect of the antecedents of of ecocentricity and GSCM as well as the moderating effect of ecocentricity on the relationship between GSCM and environmental performance. Finally, Model 7 tests the direct effect of the antecedents of competitive pressure and GSCM as well as the moderating effect of competitive pressure on the relationship between GSCM and environmental performance.

Table 4 presents the results for the whole sample (93 firms). The results are very similar for the subset of SMEs (88 firms), which were not presented. As shown in Table 4, the cut-off values of standardized root mean squared residual (SRMR) are below 0.100 demanded for samples with 100 respondents for all the models tested. As such, model fit is assured (Cho et al., 2022) as we have less than 100 respondents. Based on a statistical significance level of 5%, all direct effects of independent variables (ESC, SCT, ENVCULT, SCR, EU, CP) have positive statistically significant coefficients on GSCM. However, when testing the moderating effects, not all variables have parameters compatible with the expected sign, as traceability and environmental culture have negative signs. Moreover, none of the moderating effects were statistically significant.

When analyzing Model 1 present in Table 4, it can be observed that the relationship between GSCM practices and environmental performance is significant ($\beta = 0.419$; p-value = 0.004). Thus, hypothesis H1 is confirmed. Taking into consideration what is shown in Model 2 in Table 4, despite ecocentricity having an important direct effect on GSCM ($\beta = 0.217$; p-value = 0.015), H2 is rejected since, as a moderator variable of the relationship between GSCM practices and environmental performance, contrary to what was expected, it is not statistically significant ($\beta = 0.238$; p-value = 0.409). According to Model 3 (Table 4), supply chain traceability has a positive direct effect on GSCM ($\beta = 0.298$; p-value < 0.001); however, with a $\beta = -0.028$ and not statistically significant, supply chain traceability shows no moderating effects on the relationship between GSCM practices and environmental performance; thus, hypothesis H3 is rejected.

Environmental culture ($\beta = 0.261$; p-value = 0.001) and social responsibility in procurement ($\beta = 0.226$; p-value = 0.001) have a positive influence on environmental performance; however, as a moderating variable of the relationship between GSCM practices and environmental performance (Model 4), environmental culture has a slight negative effect and no statistical significance ($\beta = -0.019$; p-value = 0.842). Through Model 5 it can be concluded that although social responsibility

Table 2
Reliability and discriminant validity (HTMT).

	Cronbach's alpha	CR	AVE	1	2	3	4	5	6	7	8
1. ENVCUL	0.866	0.903	0.650	**0.806**	*0.400*	*0.576*	*0.465*	*0.294*	*0.609*	*0.449*	*0.451*
2. ENVPRF	0.879	0.909	0.625	0.374	**0.791**	*0.323*	*0.486*	*0.477*	*0.475*	*0.329*	*0.345*
3. ESC	0.833	0.887	0.664	0.499	0.291	**0.815**	*0.479*	*0.432*	*0.441*	*0.166*	*0.447*
4. GSCM	0.691	0.827	0.617	0.360	0.383	0.380	**0.786**	*0.106*	*0.662*	*0.154*	*0.245*
5. EU	0.701	0.840	0.644	0.228	0.360	0.340	0.034	**0.802**	*0.308*	*0.217*	*0.502*
6. CP	0.658	0.811	0.592	0.498	0.367	0.329	0.471	0.180	**0.769**	*0.286*	*0.364*
7. SCT	0.829	0.897	0.743	0.393	0.300	0.148	0.109	0.170	0.229	**0.862**	*0.503*
8. CSR	0.905	0.930	0.726	0.415	0.331	0.395	0.190	0.388	0.286	0.448	**0.852**

Note: the square root of AVEs is presented along the diagonal; the correlations between the variables are presented below the diagonal. They are used to assess the Fornell-Lacker criteria; HTMT scores are presented above the diagonal.

Table 3
Analysis of control variables.

Paths	Regression coefficients (β)	pvalues
Sales Volume → ENVPRF	−0.141	0.675
Size → ENVPRF	0.253	0.140
Number of employees → ENVPRF	0.080	0.819

in procurement shows a positive impact on the relationship between GSCM practices and environmental performance (β = 0.115; p-value = 0.272), it is not statistically significant. Thus, hypotheses H4 and H5 are rejected.

Both environmental uncertainty and competitive pressure positively influence GSCM (β = 0.350 and β = 0.281). Despite having a positive impact on the relationship between GSCM practices and environmental performance (β = 0.011; p-value = 0.386), environmental uncertainty did not prove to be statistically significant (Model 6). Although competitive pressure has a positive moderating effect on the relationship between GSCM practices and environmental performance, it is not statistically significant (β = 0.223; p-value = 0.386) (Model 7). Thus, hypotheses H6 and H7 are rejected. The explained variance (R^2) for the direct effects for the whole sample ranged from 17.6% to 29.4%, as presented in Table 4. Table 5 presents the validation of the tested hypotheses.

5. Discussion

As confirmed by previous studies, GSCM practices do indeed have a positive impact on companies' environmental performance (Carter &

Table 5
Hypotheses validation.

Paths	Hypotheses	Validated
GSCM → ENVPRF	H1	Yes
ESC× (GSCM → ENVPRF)	H2	No
SCT× (GSCM → ENVPRF)	H3	No
ENVCUL× (GSCM → ENVPRF)	H4	No
CP× (GSCM → ENVPRF)	H5	No
EU× (GSCM → ENVPRF)	H6	No
CSR× (GSCM → ENVPRF)	H7	No

Table 4
Direct and moderating effects regarding environmental performance.

Variables	Model1	Model2	Model3	Model4	Model5	Model6	Model7
GSCM → ENVPRF	0.419 (0.000)	0.267 (0.005)	0.392 (0.000)	0.326 (0.001)	0.354 (0.000)	0.388 (0.000)	0.229 (0.028)
ESC → ENVPRF		0.217 (0.015)					
ESC×(GSCM → ENVPRF)		0.238 (0.409)					
SCT → ENVPRF			0.298 (0.000)				
SCT×(GSCM → ENVPRF)			−0.028 (0.729)				
ENVCULT → ENVPRF				0.261 (0.005)			
ENVCULT×(GSCM → ENVPRF)				−0.019 (0.842)			
CSR → ENVPRF					0.226 (0.001)		
CSR×(GSCM → ENVPRF)					0.155 (0.272)		
EU → ENVPRF						0.350 (0.000)	
EU×(GSCM → ENVPRF)						0.011 (0.900)	
CP → ENVPRF							0.281 (0.002)
CP×(GSCM → ENVPRF)							0.233 (0.386)
R^2	0.176	0.257	0.263	0.238	0.249	0.294	0.270
R^2 Adjusted	0.167	0.232	0.238	0.212	0.224	0.270	0.246
SRMR	0.088	0.084	0.089	0.094	0.099	0.097	0.089

Note: values testing the relationships between variables are beta coefficients; p-values of those relationships are between parentheses; R^2 represent determination coefficients; SRMR are standardized root mean squared residual.

Rogers, 2008; Cousins et al., 2019; Dube & Gawande, 2016; Geng et al., 2017; Tseng et al., 2019). In this study, the positive influence of GSCM practices on firms' environmental performance was proven (H1), which supports the theory that the adoption of these practices is important for industry. This indicates that companies in the plastics industry are implementing GSCM measures and have already seen the effort of these measures reflected in their environmental performance. The results show that firms in general, and SMEs in particular, have managed to deploy an integrated strategy, involving various aspects of supply chain management (including production, sourcing and selection of materials, the manufacturing process, and delivery of the final product to consumers), as well as incorporating ecocentricity, traceability, end-of-life management of the product after its useful life, logistics, and the process cycle that lead to environmental improvements (reducing the use of chemicals and toxic materials, energy consumption, waste generation, air pollution, etc.).

The positive benefits of ecocentricity on GSCM confirm previous studies (Agyabeng-Mensah et al., 2021; Bataineh, 2021; Cousins et al., 2019); however, contrary to expectations, the results of this study did not reveal a relevant moderating effect on the relationship between GSCM practices and environmental performance. Given that ecocentricity focuses mainly on companies' collaboration and learning with stakeholders to achieve sustainability goals, a possible explanation for the lack of moderating effects may be that firms in the plastics industry have managed to internalize external feedback and worked with other stakeholders of the supply chain but as this process is quite labor intensive, given the need for increased skills, flexible organizational culture, and top management involvement in it, SMEs are having difficulty keeping up with the profusion of environmental changes they are facing.

With regard to traceability (Agyabeng-Mensah et al., 2021; Bataineh, 2021; Cousins et al., 2019), from which a moderating role in the relationship between GSCM practices and environmental performance was expected, the results confirm that no moderating effect on this relationship was drawn. Taking into consideration that value chain traceability involves many resources to track the company's knowledge regarding the sustainability of its products, processes, raw materials and suppliers, from the origin to the final customer, in accordance with the literature (Agyabeng-Mensah et al., 2021; Bataineh, 2021; Cousins et al., 2019), SMEs may have serious difficulties in this monitorization. Moreover, ecocentricity forces companies to reorient themselves by environmental-based principles that require profound organizational and interorganizational changes and a broad interrelationship with stakeholders. If it is clear that SMEs of the plastics industry have managed to improve their direct influence on GSCM activities, more resources are needed so that companies can refocus themselves towards ecocentrism, which brings new business perspectives to life in keeping with environmental ecosystems. Following NRBV theory, it is possible to argue that firms follow pollution preventative strategies, seek to reduce cost of raw materials and disposal and deal with external stakeholders to incorporate external insights about environmental practices. However, despite their efforts, their internal resources are in short supply to cope with the environmental changes they are facing.

In addition to ecocentricity and traceability, environmental culture was also analyzed as a direct and moderating variable of the relationship between GSCM practices and environmental performance. We confirmed the direct effect of environmental culture in previous studies (Liu et al., 2020; Yeşiltaş et al., 2022), although it did not prove relevant as a moderator. These findings reflect the importance of management in corporate culture. It is urgent to work on the environmental culture in order for companies to be environmentally reborn and to for them to internalize the urgent need for a paradigm shift. This environmental culture is important to attune employees to a greater social and environmental responsibility that aligns the interests of companies with sustainability and ecocentricity, in order to make them more competitive and closer to the goals of sustainable development, which is sustained in the literature (e.g. Kumar et al., 2019; Liu et al., 2020; Duan et al., 2021; Kim & Bhalla, 2022). As the moderating effect is not statistically significant, one thing is clear: SMEs need to invest and deploy more resources to improve their environmental acculturation, internalize external values and work with their stakeholders across the supply chain to achieve a greener supply chain perspective.

Social responsibility in procurement, which is slightly related to traceability and ecocentricity, showed a strong direct effect on environmental performance. This result is in line with that obtained by Ghosh (2019) in procurement activities. This means that, as argued by Tumpa et al. (2019), social responsibility in procurement helps support operational improvement and better quality, which are tuned to working with other players in the supply chain, supporting environmental performance (Huma et al., 2022; Qiao et al., 2022). Nevertheless, a statistically significant interaction with the relationship between GSCM practices and environmental performance was not found, confirming the results of Nureen et al. (2022). Social responsibility is intrinsically linked to the outward perspective of the company and an environmental culture in tune with social and environmental responsible practices. This means that institutional and environmental factors, though important to make firms finetune their strategies towards more environmental goals and greener practices across the supply chain, may have limited resources to deploy behavioral-oriented practices in the implementation of ethical conduct, equity, and transparency within and across the firms in the supply chain.

Competitive pressure was found to affect positively environmental performance confirming previous studies (Braunscheidel & Suresh, 2009; Dai et al., 2015; Ghosh, 2019; Padilla-Lozano & Collazzo, 2022). However, the moderating effect between environmental performance and GSCM practices was not confirmed in the plastics industry addressed in this study. If competitive pressure is important for companies to implement solutions that meet the new environmental needs of the market, what we see is that competitive pressure, though positive and has increased the environmental performance of companies, the moderating effect on the relationship between GSCM practices and environmental performance has not benefited. This can be justified by the limitation of resources of SMEs, which prevents the increase of environmental products in line with what the market demands, or the inability of companies to keep up with the products offered by their competitors, which is in line with the NRBV theory as SMEs may struggle to cope with environmental and institutional changes and the deployment of internal resources to compete in broader markets.

Finally, and like the other variables tested, environmental uncertainty does not moderate the relationship between GSCM practices and environmental performance as found by Zimmermann et al. (2020). The absence of a statistically significant moderating effect may be related to the limited capabilities of SMEs to cope with the major environmental changes that are shifting the business landscape—concerns about climate change, restrictions, regulations and standards, deployment of internal environmental culture, supplier involvement activities, green logistics, corporate social procurement and so on—and are draining the limited resources firms have available (Kumar et al., 2019; Nureen et al., 2022; Żywiołek et al., 2022).

6. Conclusions and limitations

Several conclusions can be drawn. First, it shows that SMEs, in particular, and firms, in general, are implementing green practices and solutions across the value chain. Although ecocentricity, traceability, environmental culture, corporate social responsibilities, competitive pressure and environmental uncertainties are being dealt with by Portuguese SMEs of the plastics industry—and improving their environmental performance—, according to the NRBV theory, many sustainability practices and solutions are still not being adequately implemented or valued as SMEs may have resource limitations to deal with the abundant changes they have to implement internally—ever

changing regulations, standards, restrictions, environmental culture, among others—and externally—green supplier involvement, green logistics, socially responsible procurement activities. As such, it is possible to conclude that companies of the plastics industry in Portugal, although using their GSCM practices to increase environmental performance, still need more resources to clearly define an organizational culture focused on a green, eco-centric and sustainable strategy to cope with environmental and competitive uncertainty of the whole supply chain.

Second, this study has contrasting results as the direct effects of the variables analyzed had a positive effect on environmental performance. However, the moderating effects show two different perspectives. On one hand, ecocentricity, corporate social responsibility in procurement and competitive pressure, show positive moderating effects, though not statistically significant. This means that there are some interactions between these variables and the relationship between GSCM and environmental performance. On the other hand, environmental culture, traceability and environmental uncertainty show almost a null moderating effect. This clearly means the firms of the plastics industry, most of them SMEs, still need resources to take full advantage a strong environmental change that is taking place to deploy supply chain traceability and to deal with environmental uncertainty.

Third, this study expands literature analyzing SMEs in Portugal from the plastics industry perspective. Although there is literature exploring the direct linear effects using some of the variables we used, we contribute with the moderating effects, broadening the scope of GSCM studies as no single study has analyzed those variables as moderators involving SMEs. As such, this study contributes with a different understanding of the moderating effects and the importance of some variables—ecocentricity, traceability, corporate social responsibility in procurement, environmental uncertainty, environmental culture, and competitive pressure—*vis-à-vis* other variables— GSCM and environmental performance. The results provided above also provide further avenues for further research that can be conducted in other countries/industries.

This study offers some important practical contributions to managers and public policy. First, despite all resources used, the need for more resources seems to indicate that firms' investment seems to be directed to short-term solutions that seek immediate profitability and not to more sustainable, long-term solutions. Consequently, firms need to invest in a powerful green, environmentally-led culture to support CSR in procurement and to revive the ecocentricity and traceability of the supply chain in order not to jeopardize the proper implementation of GSCM practices and to cope with the intricacies of competitive pressure and environmental uncertainty.

In order to complement the need for more resources most SMEs have, it is important to rethink how public policy can be adapted, although not analyzed in this paper, and what support SMEs with scarce resources really need to face the paradigm of environmental change that lays ahead, based on environmental sustainability of a new circular economy. This public support is important as GSCM deals with the strategic alignment of the company and all its stakeholders with the surrounding environment facilitating a systemic view of the supply chain, involving suppliers' suppliers to the final customer, based on eco-centric circular economy and knowledge sharing, which only brings advantages, both for companies and for the environment.

Given the scarcity of other studies on this area of knowledge applied to the Portuguese plastics industry, this work fills a gap in the literature and adds knowledge, showing the position of the industry in relation to green, sustainable practices at the moment, which is the typical position of many resource-scarce SMEs around the globe. The future challenge seems to be clear: they need to adapt or perish!

This study uses data from the plastics industry in Portugal, which may not be generalizable to other situations. Future studies could accommodate the environmental orientation of managers as well as the participation in environmental support public policy programs to assess how important those variables are. It is expected that those companies with proactive environmental orientation could have better supply chain practices than those companies that do not have an environmental orientation or do not participate in environmental support programs. Another aspect that deserves further study is the analysis of suppliers' environmental commitment to improve the sustainability of the supply chain. An interindustry perspective could also give a different outlook on how environmentally intense different industries are.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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