

How to align logistics environmental sustainability with corporate strategy? An Italian perspective

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ABSTRACT

Logistics environmental sustainability is a priority for practitioners and policymakers, but companies lack clarity about how to align it with strategic purposes. As this prevents them from coherently turning sustainability into action, this paper focuses on how companies can align logistics environmental sustainability with corporate strategies. We conducted multiple embedded case research involving logistics service providers (LSPs) and shippers operating in the Italian context. We selected 13 companies (6 LSPs and 7 shippers) and conducted semi-structured interviews to contextualise and elaborate the extant theory. Results highlight that companies seem more motivated by the need to comply with regulations or to protect their environmental reputation than by a genuine understanding of the actual need for sustainability. A framework is proposed to foster the alignment of logistics environmental sustainability with corporate strategy, underpinned by five main dimensions: degree of awareness, degree of formalisation, measurement systems, governance and accountability, and budget allocation.

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Introduction

Supply chain activities have a considerable impact on the environment (McKinnon 2018), and companies are called on to quickly reduce their supply chains' environmental impact, which is often related to greenhouse gas (GHG) emissions (Abbasi and Nilsson 2016). Rising GHG emissions are accelerating global warming making the planet no longer stable (Rockström 2020). Urgent action is called for to address this phenomenon (Wieland 2021), which could potentially lead to a 10-meter increase in sea level due to ice sheet melting in Greenland and West Antarctic (IPCC 2022). In this context, logistics is a key sector for global warming mitigation, as it accounts for 13% of the overall GHG emissions worldwide (Perotti, Prativiera, and Melacini 2022), a relevance which is further exacerbated by the steady growth of the demand for eCommerce services in the last few years (Creazza, Ellram, and Colicchia 2023). Addressing logistics environmental sustainability is thus a huge concern (Füchtenhans et al. 2023), and research has shown that this is at the top of the

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agenda of practitioners and policymakers (Huge-Brodin, Sweeney, and Evangelista 2020; Osman et al. 2022).

Logistics environmental sustainability is also referred to as ‘green logistics’ (Jazairy 2020), and aims to mitigate the environmental externalities of logistics functions (Dekker, Bloemhof, and Mal-lidis 2012). Principles of logistics environmental sustainability have been formalised (Abbasi and Nilsson 2016), and environmentally sustainable logistics practices (or green logistics practices – GLPs) have been developed to mitigate the impact on the natural environment (Evangelista, Colicchia, and Creazza 2017). Seminal research works (e.g. Etzion 2007) as well as more recent endeavours (Cavaleri and Shabana 2018) suggest that the effectiveness of sustainability practices can be enhanced by aligning them with corporate strategies, both for large corporations and SMEs (Del Baldo 2010). Aligning logistics environmental sustainability with corporate strategies can strengthen GLPs adoption (Evangelista, Colicchia, and Creazza 2017), improving organisations’ sustainability and leading to better firm performance both from a general corporate perspective (Golcic and Smith 2013) and with reference to logistics environmental sustainability (Seroka-Stolka 2014). It can also lead to enhanced sustainable competitive advantage and long-term business development of firms – as shown by an early study by Schrettle et al. (2014) which was later confirmed by van Zanten and van Tulder (2021) in terms of compliance with the UN’s Sustainable Development Goals and by Le (2022) in terms of inclusion of green innovation processes.

Although corporate strategies need to include sustainability items in their decision-making (Labuschagne, Brent, and Van Erck 2005) and logistics environmental sustainability is acknowledged as an important strategic contributor (Martinsen and Bjorklund 2012), companies still struggle to align it with corporate strategies (Kazancoglu et al. 2021). Environmental sustainability is characterised by an ‘understanding into action conundrum’ (Sweeney, Grant, and Mangan 2018), as ‘there is a clear understanding of what should be done and why but less clarity in terms of how to go about it’ (Huge-Brodin, Sweeney, and Evangelista 2020, 599). Companies need to develop innovative approaches that contribute to coherently turning sustainability into practice (Abbasi and Nilsson 2016), but they lack clarity about how to align logistics environmental sustainability with their strategic purposes (Laari, Töyli, and Ojala 2018). To address this research gap, we formulated the following RQ:

How do companies align logistics environmental sustainability with corporate strategy to foster the adoption of GLPs?

To empirically address this RQ and contribute to the extant knowledge, we conducted multiple embedded case studies, as recommended by Yin (2014). We examined companies that acknowledged logistics environmental sustainability as a current strategic priority or a key prospect for the immediate future (Evangelista, Colicchia, and Creazza 2017). Previous studies mainly investigated it by considering logistics service providers (LSPs) (e.g. Abbasi and Nilsson 2016), also small-medium size ones (Evangelista, Colicchia, and Creazza 2017). However, logistics environmental sustainability can also be developed by shippers (typically retailers and manufacturers, i.e. the customers of LSPs) whose strategic purposes could be different to those of LSPs (Jazairy, von Haartman, and Björklund 2021). Therefore, we involved both LSPs and shippers, and focused our investigation on the Italian context. Italy is one of the European countries with the highest traffic volumes and forecasts suggest a further increase in logistics activities in the next few years (Prataviera et al. 2021), showing the importance of improving its logistics environmental sustainability. Previous literature highlighted that a limited number of Italian companies acknowledge sustainability as a strategic priority (Evangelista, Colicchia, and Creazza 2017). The Italian landscape has recently been evolving, however, and companies have started looking at sustainability as a non-negotiable item to be incorporated into their company strategy (Perotti et al. 2012).

This study reviews previous contributions and contextualises empirical insights to elaborate extant knowledge and improve our understanding about how to align environmental sustainability

with corporate strategies in the logistics industry, which is a significant contribution. A framework is also proposed to describe this alignment, underpinned by five main dimensions: degree of awareness, degree of formalisation, measurement systems, governance and accountability, and budget allocation. In a context where environmental sustainability is urgently needed but where companies seem held back by insurmountable inertia, this study formalises those dimensions which could pragmatically be developed to align logistics environmental sustainability with corporate strategy and action change. Different stages of alignment are also identified, providing practitioners with insights into how they could foster the alignment between corporate targets and pragmatic actions and thus support the adoption of logistics environmental sustainability principles and practices.

The paper proceeds as follows. The literature review is presented first, followed by illustration of the methodology and description of the findings. Results are then discussed, and conclusions are drawn along with suggestions for future research avenues.

Literature review

Green supply chain management

Green supply chain management encompasses the explicit consideration of the ecological dimensions in the management of supply chain operations, resources, information, and capital to enhance the competitive advantage of a supply chain (Carter and Rogers 2008). Green supply chain management aims not only to reduce the negative impact generated by traditional supply chain activities but also to introduce pollution -decreasing initiatives into each supply chain stage. This was initially investigated by Abukhader and Jönson (2004) who set the scene on the topic, further developed by Fahimnia, Sarkis, and Davarzani (2015) in their extensive review and investigated according to the importance of leveraging relationships in the supply chain by Li and Huang 2017. Scholars focused on heterogeneous problems like the impact of purchasing activities on focal companies' environmental performance (Giunipero, Hooker, and Denslow 2012), waste management (Martensson and Westerberg 2016), and more recently compliance with government regulations (Negri et al. 2021).

Even though environmental awareness is regarded as highly relevant, the main obstacle for successful adoption of green supply chain management is the perception of incompatibility between efficiency and sustainable initiatives (Kazancoglu et al. 2021). The issue of cost is predominant for companies; this was explored in an early study by Abbasi and Nilsson (2012) and seems not to have changed a decade later (Shaw, Grant, and Mangan 2021). One key aspect is that customers are not always willing to purchase green products and services if they drive prices up. This was initially shown by the work of Colicchia et al. (2013) and confirmed years later from the corporate perspective by Huge-Brodin, Sweeney, and Evangelista (2020) and in the light of institutional pressures by Del Baldo (2010). A key challenge, therefore, is determining the 'right' investment (Seuring and Müller 2008). Although many companies have been working on quick wins and light-touch interventions, future actions require major investment commitments, increasing the pressure for companies to adopt practices that can both enhance the environmental performance and at the same time improve the economic bottom line (Shaw, Grant, and Mangan 2021).

Environmentally sustainable logistics practices (Green logistics practices – GLPs)

If green supply chain management is the integration of environmental concerns within supply chain management (Fahimnia, Sarkis, and Davarzani 2015), a significant proportion of supply chain environmental impact is generated from logistics operations (Kazancoglu et al. 2021). Logistics environmental sustainability concerns the study of the environmental effects of all the activities involved in the transport, storage, and handling of physical products as they move through supply chains in both forward and reverse directions (McKinnon et al. 2015). Therefore, logistics

environmental sustainability aims to reduce CO₂ emissions, noise, and waste (Centobelli, Cerchione, and Esposito 2017; Dekker, Bloemhof, and Mallidis 2012).

Previous studies formalised the principles of logistics environmental sustainability (Abbasi and Nilsson 2016) and the term GLPs describes a variety of logistics-related initiatives implemented by organisations to reduce their impact on the natural environment (Evangelista, Colicchia, and Creazza 2017). Thanks to the increasing importance attributed to logistics when pursuing environmental sustainability, many GLPs have been adopted in recent years to reduce supply chains' carbon footprint (Huge-Brodin, Sweeney, and Evangelista 2020). To provide an organic overview of GLPs and consolidate existing practices, scholars have often categorised them into taxonomies (e.g. Perotti, Coslovich, and Granata 2023). Key areas of GLPs include transport planning and execution (Lieb and Lieb 2010), fuel decarbonisation (Osman et al. 2022), green warehousing (Füchtenhans et al. 2023), reverse logistics (Bottani et al. 2018), eco-design and packaging management (Colicchia et al. 2013), internal management (Evangelista, Colicchia, and Creazza 2017), and collaboration with customers, suppliers, and external stakeholders (Centobelli, Cerchione, and Esposito 2017). These practices also include modal shift (McKinnon 2018) and intermodal solutions (Laguir, Stekelorum, and El Baz 2021), network re-design (Aronsson and Huge-Brodin 2006; Jazairy, von Haartman, and Björklund 2021), shipment and freight consolidation (Colicchia et al. 2013), and the use of tools to improve carbon footprint assessment (Piecyk and Björklund 2015). However, it appears that the actual adoption of these practices is taking place at a relatively slow pace (Huge-Brodin, Sweeney, and Evangelista 2020).

Although GLPs adoption is mostly left to LSPs (Evangelista, Santoro, and Thomas 2018), different actors are needed and can be deemed accountable for GLPs development (Jazairy, von Haartman, and Björklund 2021). LSPs can arrange complex solutions for door-to-door shipments, optimising the route travelled and selecting the most suitable transport mode (or combination of means), and warehousing solutions (Pratavieria et al. 2021). However, LSPs' implementation of GLPs is to a large extent dependent on the relationships formed with, and the actions made by, shippers (i.e. buyers of logistics services) (Huge-Brodin, Sweeney, and Evangelista 2020). Shippers do not usually own the physical logistics assets (necessary for transport or storage) and rely on LPSs or freight forwarders for logistics planning and execution (Rajahonka and Bask 2016; Jazairy 2020). As illustrated by Jazairy and von Haartman (2019), both LSPs and shippers are subject to institutional pressures to adopt green supply chain management practices, which could drive shippers to purchase logistics environmental sustainability services from LSPs, and LSPs to provide them. Shippers are then usually distinguished between manufacturers and retailers. Manufacturers are the producers of physical products to be distributed to final consumers directly or via intermediaries, like retailers, who buy from upstream players in the chain and serve final consumers (Jazairy, von Haartman, and Björklund 2021).

GLP adoption

The adoption of GLPs can be influenced by multiple factors, which may accelerate or jeopardise GLP implementation (Marchet, Melacini, and Perotti 2014). Organisational factors are important elements that concern companies' culture and internal management, and directly affect human resources and their willingness and capability to develop green initiatives (Abbasi and Nilsson 2016). First, management and employees must be engaged with green development (Abbasi and Nilsson 2012), as this determines internal resistance or support to changes (Forslund, Björklund, and Svensson Ülgen 2021). Engagement fosters the effective management of new projects and reduces the time needed for their implementation (Rossi et al. 2013). In its absence, management, and employees prioritise other goals and put environmental sustainability initiatives at the bottom of their agenda (Evangelista, Colicchia, and Creazza 2017).

However, complexity of the decision-making processes can play a key role (Seuring and Muller 2008). Some multinational companies need a lot of approval steps to even start discussing new

projects and investments (Laari, Töyli, and Ojala 2018). They need to be revised by different functions, and the different debated modifications could extend the time needed for approval to years. This is critical when breakthrough technologies are discussed, as those technologies are often subject to frequent updates (Centobelli, Cerchione, and Esposito 2017). If this process is too long, once the initiative is approved it might already be obsolete (Abbasi and Nilsson 2016), thus companies should design efficient and as-expedite-as-possible decisional processes (Centobelli, Cerchione, and Esposito 2020). Moreover, once a GLP had been approved by the management, a feasibility study would be needed and specific competences would be required (Evangelista, Colicchia, and Creazza 2017). If they are already inside the company, developing the practice is smoother. Conversely, if the management needs to organise employees' training or hire new workforce to supply the necessary skills and knowledge, organisational inertia slows down the GLP adoption (Centobelli, Cerchione, and Esposito 2017; Giunipero, Hooker, and Denslow 2012).

Finally, difficulties can arise when monitoring the developed initiatives (Perotti, Coslovich, and Granata 2023). It is fundamental to periodically control GLP performance, comparing results achieved against the expected ones (Laguir, Stekelorum, and El Baz 2021). However, some companies could suffer difficulties in measuring environmental performance. This can be a strong deterrent behind GLP adoption. If companies cannot measure their improvements, they can hardly understand and evaluate the related benefits (Marchet, Melacini, and Perotti 2014). Owning effective monitoring instruments and processes strongly encourages companies to develop GLPs thanks to increasing awareness of the potential gains (Perotti, Prataviera, and Melacini 2022).

Aligning logistics environmental sustainability with corporate strategy

Logistics operations are strategically crucial to achieving environmental sustainability as they influence the entire supply chain (Giufrida and Mangiaracina 2020), and companies are progressively aligning environmental management practices with their business strategies (Laari, Töyli, and Ojala 2018). Having green initiatives that are fragmented and disconnected from corporate strategy generates loss of productivity, efficiency and effectiveness and eventually yields poor results in terms of environmental outputs (Kazancoglu et al. 2021). However, there is uncertainty about how to align logistics environmental sustainability with the overall corporate strategy (Laari, Töyli, and Ojala 2018; Perotti, Prataviera, and Melacini 2022), as this requires structural changes and time, and we lack a common and homogeneous approach (Evangelista, Colicchia, and Creazza 2017). The strategic alignment of corporate strategy, sustainability objectives, and governance mechanisms should be applied at tactical and operational levels, and this represents a step change (Formentini and Taticchi 2016).

Some companies first introduce sustainability goals into their mission, then develop financial reports to include specific sections that demonstrate their efforts to improve environmental performance and share positive results (Carbone, Moatti, and Esposito Vinzi 2012; Isaksson et al. 2017). These results might be expected to satisfy customers, to stay ahead of more stringent regulations, or to react to pressures from banks and investors (Cucari, Esposito de Falco, and Orlando 2018). For example, investors are increasingly embracing capital-allocation strategies that take environmental, social, and governance (ESG) issues into account (Garcia and Orsato 2020; Widayawati 2020).

Sustainability and business success goals can go hand in hand, as a positive link exists between ESG and financial performance (McKinsey 2021). However, companies and investors have often thought of ESG reporting as a form of greenwashing, an issue more relevant for marketing and communications, rather than an actual financial issue (Uyar, Karaman, and Kilic 2020).

Therefore, companies also need a change in the existing operational practices (Jazairy, von Haartman, and Björklund 2021). Logistics environmental sustainability is developed gradually from informal actions to formalised plans and approaches (Evangelista, Colicchia, and Creazza 2017); i.e. some companies first develop low-level GLPs that simultaneously improve their green

image and spread the green culture needed to foster the definition of a formal sustainability strategy (Carter and Rogers 2008). These kinds of GLP mainly concern ‘pollution prevention’ and ‘compliance adherence’, and often receive special funding for their development (Bahr and Sweeney 2019). The former includes GLPs aimed at reducing CO₂ emissions, while the latter encompasses actions aimed at complying with defined standards. For example, ISO 14001 has become a leading reference within organisations, influencing also top management commitment and leadership (Curkovic and Sroufe 2011). Nevertheless, advancements on logistics environmental sustainability are threatened by the inadequacy of sustainable performance assessment systems (Oberhofer and Dieplinger 2014). No shared context-based metrics exist (Ahi and Searcy 2015) and companies find it rather difficult to develop good measurement systems that can help in assessing and steering the strategic alignment of governance mechanisms, sustainability objectives and corporate strategy (Shaw, Grant, and Mangan 2021). Internationalisation is then a further challenge, as individual countries have developed their own assessment of GHG emissions (Colicchia et al. 2013). The creation of internationally shared measurements and standards might enable environmental protection by providing clear and transparent information to all the actors involved (Perotti, Pratavia, and Melacini 2022).

In addition, it is important not only to establish formal programs but also to appoint specific individuals or groups to lead specific initiatives (Evangelista, Colicchia, and Creazza 2017). They can be accountable for the ownership of the process and for setting objectives, but also for the execution and reporting on environmental initiatives (Oberhofer and Dieplinger 2014; Rossi et al. 2013). Organisational support, especially from top management, is essential to advance GLPs, as it gives employees motivation and resources to successfully implement environmental actions (Evangelista, Colicchia, and Creazza 2017). Whether GLPs are developed with a bottom-up (i.e. promoted by employees) or a top-down (i.e. pushed by management) approach, embracing logistics environmental sustainability requires a shift in firm culture towards a more holistic consideration of sustainability within the firm (Perotti, Coslovich, and Granata 2023). This can contribute to raising awareness within the firm and across the supply chain (Colicchia et al. 2013). Overall success is determined by the importance attributed to environmental sustainability, the presence of an explicit environmental strategy, its incorporation into the corporate strategy, and clear accountability for environmental issues within companies (Rossi et al. 2013). The role of the organisation’s governance, in this sense, is essential for the successful implementation of GLPs (Formentini and Taticchi 2016).

Research framework

Within the broader realm of green supply chain management, the paper aims to explore the adoption of environmentally sustainable practices in logistics (GLPs) and gain greater understanding about how to foster the alignment of logistics environmental sustainability and corporate strategies. GLP adoption relies on a set of literature-based key pillars, i.e. workers’ awareness (Abbasi and Nilsson 2016) and engagement (Rossi et al. 2013), available skills and knowledge (Centobelli, Cerchione, and Esposito 2017), decision-making processes design (Seuring and Muller 2008), and monitoring and control procedures (Perotti, Pratavia, and Melacini 2022).

Moreover, previous scholars have suggested that aligning logistics environmental sustainability with corporate strategies fosters GLP adoption (Evangelista, Colicchia, and Creazza 2017). Logistics environmental sustainability could be aligned with corporate strategies by properly formalising environmentally oriented practices (Laari, Töyli, and Ojala 2018), by defining an opportune governance (Formentini and Taticchi 2016), and by clearly acknowledging accountability within the organisation (Oberhofer and Dieplinger 2014). However, companies struggle with aligning logistics environmental sustainability with corporate strategies and need enhanced understanding to coherently turn environmental sustainability into practice (Kazancoglu et al. 2021). We aim at elaborating the extant knowledge on the topic by addressing the RQ ‘How do companies align logistics

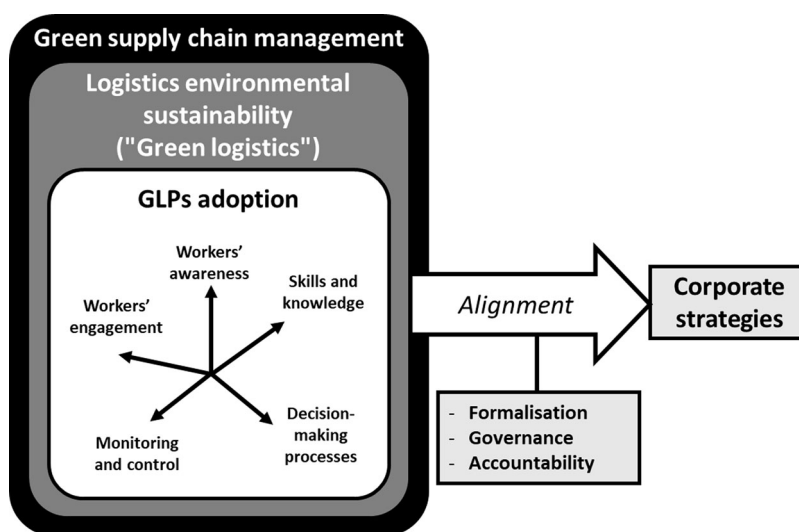


Figure 1. Research framework.

environmental sustainability with corporate strategy to foster the adoption of GLPs?'. [Figure 1](#) illustrates the research framework derived from, and supported by, the extant literature.

Methodology

Research design and sample selection

To address the identified RQ we conducted qualitative case research, as it improves understanding about how notional arguments are inflected in the empirical world and creates opportunities for pushing forward theory through the collection of rich empirical data (Eisenhardt 1989; Yin 2014). The research methodology is presented in [Figure 2](#).

We first reviewed academic contributions to gain an initial portrait of the available academic knowledge. Relevant articles were collected after having defined keywords within the scope of the study. 'Logistics' and 'supply chain' were chosen to identify the context, 'green' and 'sustainability' to define boundaries, 'strategy' and 'alignment' to limit the scope. Different keyword combinations were tested, combining them by using different Boolean operators (AND/OR) to explore the potential variety of the results. Moreover, logistics environmental sustainability is far from being a purely academic problem and instead deeply concerns practitioners and policymakers (Abbasi and Nilsson 2016; Huge-Brodin, Sweeney, and Evangelista 2020). We thus consulted a wide range of grey literature sources including industry and government reports, discussion papers, and other public documents. According to Stentoft and Rajkumar (2018), this was instrumental in order to properly analyse the available practical knowledge and increase the study's practical relevance.

We then chose a multiple case approach and designed an embedded study (Yin 2014), choosing 'logistics environmental sustainability strategies and practices' as embedded sub-units of analysis within larger units of analysis represented by broader 'corporate strategies'. We focused on the Italian logistics industry, which is one of the largest in Europe with an overall market value higher than €80billion (Prataviera et al. 2021). Despite the many claims and public announcements, a limited number of companies prioritise sustainability (Evangelista, Colicchia, and Creazza 2017). However, environmental issues are increasingly perceived as crucial by logistics and transport companies (Colicchia et al. 2013).

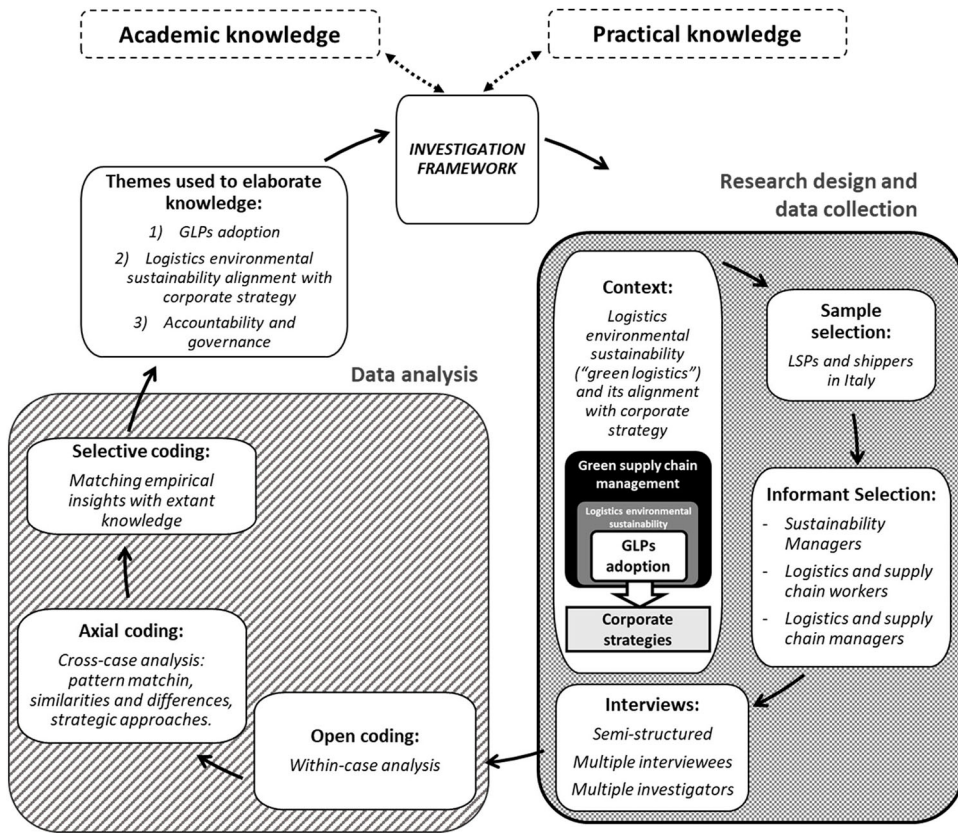


Figure 2. Research methodology and data analysis procedures.

The selection of cases and informants aimed at maximising conceptual insights and understanding (Eisenhardt 1989). We adopted a purposeful sampling approach (Patton 1990), choosing companies which considered environmental sustainability as a priority. We only targeted large companies as they are usually more prone to formalise and develop logistics environmental sustainability. This was deemed necessary to contextualise how companies could align logistics environmental sustainability with strategic purposes and to identify potential best practices. As appropriate cases we considered both LSPs and shippers, in line with similar recent contributions (e.g. Jazairy, von Haartman, and Björklund 2021). Organisations were then clustered according to their nature of logistics service providers (LSP.No.) and shippers (SH.No.). In total, 13 firms (six LSPs and seven shippers) took part in the study (Table 1).

Data collection

We designed a semi-structured interview questionnaire (provided in Appendix A) to collect data rigorously while allowing interviewees to follow any line of inquiry which they deemed relevant for the study's purposes (Voss, Tsikriktsis, and Frohlich 2002). The widely adopted and accepted format of the funnel model was used, sharing the interview questionnaire in advance to allow interviewees to prepare. This also allowed companies to involve people who were the best possible informants for our study and ensured that interviewees were aware of their companies' green actions. Two interviews were conducted for each case, and multiple investigators were involved to mitigate observer bias as suggested by Yin (2014). Interviews involved different types of workers and managers, engaging with logistics and supply chain functions as well as sustainability managers or

Table 1. Cases overview.

Case	Revenues (2020)	Interviewee 1 role	Interviewee 2 role	Interviewee 3 role
LSP.1	€ 200–300 M	Logistics Manager	Warehouse Manager	
LSP.2	€ 500–600 M	Marketing Manager	Quality Manager	Environmental Manager
LSP.3	€ 200–300 M	Marketing Manager	External Relations Manager	Sustainability Manager
LSP.4	€ 800–900 M	Logistics Manager	Sustainability Manager	Marketing Director
LSP.5	€ 600–700 M	Sustainability Manager	Brand Manager	Operations Manager
LSP.6	€ 300–400 M	Innovation Manager	Supply Chain Manager	
SH.1	€ 1.4–1.5 B	Supply chain Manager	Transport Manager	
SH.2	€ 100–200 M	Plant Director	Supply Chain Manager	
SH.3	€ 5.5–5.6 B	Leather Logistics Director	Supply Chain Manager	
SH.4	€ 800–900 M	Logistics Manager	Logistics Specialist	Sustainability Manager
SH.5	€ 800–900 M	Supply Chain Manager	Sustainability Manager	Plant Director
SH.6	€ 15.5–15.6 B	Supply Chain Director	Regional Manager	Customer Service Manager
SH.7	€ 300–400 M	Europe Head of Logistics	Supply Chain Manager	

employees. This provided different viewpoints from different functional domains within firms. At least two interviewees were involved for each of the thirteen cases. While it was not always possible to interview the same number and type of workers and managers in every company (because of different organisational structures, implying in some instances that sustainability matters fell under the remit of different functions – as in the case of Shipper 1 as opposed to the case of LSP 3), the selection of the informants allowed for a complementary view on the joint themes of logistics and sustainability regardless of the job title of the interviewees. In other words, when selecting the informants, we first took account of how the organisational structure of each company was arranged, what kind of competences and responsibilities the various managers had, and then we involved as informants those professionals that could offer appropriate insights on the themes investigated in this research. In this way we worked towards ensuring the complementarity of the informants, and the information provided by the interviewees in each sample company offered a well-rounded view, thus contributing together to the different explored research themes.

In total, 26 interviews were conducted online between February 2021 and July 2021, using Microsoft Teams because of the ongoing pandemic and the related travel restrictions. Each interview lasted approximately 120 min, and instruments (recorder and written notes) were used to consolidate the collected information and later transcribe data. Once the data were collected, the draft of notes and the final documentation for each case were sent back to the interviewees for final approval and to improve the study's construct validity (Yin 2014). An integrated case study database was also developed and regularly updated during the research, increasing the study's reliability as recommended by Voss, Tsikriktsis, and Frohlich (2002). Downstream of each interview, data were homogeneously collected in pre-structured case outlines through MS Excel spreadsheets (Voss, Tsikriktsis, and Frohlich 2002). The adoption of a standard format made it easier to position data related to a particular subject within cases and simplified the cross-case analyses (Yin 2014).

Data analysis

The first step in the analysis was coding the collected data. A provisional initial list of coding categories was created leveraging constructs taken from the available literature (as proposed in the research framework – Figure 1), such as the degree of formalisation of environmental sustainability targets and their measurement (e.g. Evangelista, Colicchia, and Creazza 2017), or the organisational accountability for environmental sustainability (e.g. Rossi et al. 2013). Categories were refined after each interview, iteratively comparing the information collected from the different cases and reformulating it whenever more meaningful insights emerged, as suggested by Yin (2014). Both within-case and cross-case analyses were performed to identify important similarities and differences, as recommended by Eisenhardt (1989). Ellram's (1996) recommendation related to open coding was adopted, and empirical data were first broken down, examined, and compared to strengthen

existing constructs and develop new categories. We analysed the targets (if any) for each case, as well as the measurement systems in place. Other important constructs were the centralisation of environmentally oriented decision-making and the creation of a proper governance system. Open coding paved the way for axial coding, to make connections between categories and look at their interactions (Yin 2014). Initial codes were refined according to the themes that emerged from the data and grouped into higher-level categories, also suggested by Ellram (1996). Specifically, the answers to the semi-structured interview questionnaire were elaborated and organised around attributes which also linked back to the literature (e.g. targets formalisation and measurement were clearly separated; see Table 3). New categories were also developed, such as the relevance of budgeting and how it is considered across the sample. We also explicitly linked governance to the organisational footprint of the interviewed companies. To adopt suggestions from Eisenhardt (1989) and Yin (2014), findings from single cases were then compared in a cross-case analysis for matching patterns, and multiple dimensions that characterise environmental sustainability alignment with corporate strategy were developed. We then analysed differences and common patterns to identify different stages of alignment (early, medium, and advanced) which were detailed for each of the identified dimensions (Table 4). Table 2 summarises the action we took to ensure the study's quality and trustworthiness for each research phase, following Yin's (2014) approach and its construct validity, internal validity, external validity, and reliability dimensions.

Findings

Findings and insights from the examined cases are described, giving first a within-case perspective for LSPs and shippers and then the related cross-case analysis.

LSPs

LSP.1 offers integrated transport and storage solutions, with strong expertise in the FMCG industry and specific assets to satisfy customers' temperature requirements. LSP.1 exemplifies how logistics environmental sustainability is not yet a concept which has completely permeated companies' strategy, even for LSPs. Its logistics manager observed that 'even if there is a growing interest in sustainability as a topic, which is increasingly discussed when planning the long-term future of operations, it still does not represent a priority when tendering and contracting with business partners'. Pressures from customers (i.e. shippers) made LSP.1 increase its GLPs including the release in 2020 of its first sustainability report. Because of the insufficient internal knowledge on sustainable performance measurement, the report was developed by an external consultancy company. Nevertheless, there is no specific measurement in place and the report mainly concerns general guidelines and communications. As a general approach, any GLP is first discussed by the board of directors and, if approved, a budget is allocated. However, LSP.1 does not have any specific budget for environmental sustainability, nor has it created any department accountable for environmental sustainability practices.

LSP.2 is a multinational express courier company, operating in Europe, US, and Canada. The Italian branch has 147 facilities and 13 distribution centres. Its mission includes operational excellence, without mentioning sustainability. However, sustainability targets are defined centrally at a corporate level (beyond the Italian branch) and spread downstream. This has led to the company obtaining several certifications and it recently achieved the Silver Ecovadis certification. The company aims at becoming carbon neutral by 2022 through compensation initiatives, and carbon free by 2045. Measurement takes place in an aggregated way, including both operational business units (e.g. last-mile delivery, line-haul transport) and staff functions (e.g. marketing and sales). The company has been publishing an annual sustainability report at corporate level since 2018. The company created a corporate unit accountable for environmental sustainability and appointed an

Table 3. Summary of case findings. Columns are directly linked to the questions presented in the semi-structured interview questionnaire (Appendix A).

Case	Defining logistics environmental sustainability	Targets to measure logistics environmental sustainability	Organisational footprint to pursue logistics environmental sustainability	Individuals/groups accountable for logistics environmental sustainability	Budget for logistics environmental sustainability initiatives
LSP.1	No formal sustainable strategy defined, but a 'growing interest in the subject' due to the pressure of the shippers.	No measurement is performed, only generic communication	No	No	No
LSP.2	Environmental strategy is defined at a corporate (multinational) level in a quantitative way, spreading over national branches	Measurement of environmental performance at corporate level	A centralised unit at corporate level	Environmental managers appointed for each branch	No
LSP.3	Strategy defined through strategic pillars for logistics at corporate level	Benefit Impact Assessment measured yearly	Creation of a cross-functional team along with an impact team	Sustainability manager for each business unit plus the cross-functional team	No
LSP.4	Strategy defined via a strict corporate plan for logistics	Specific targets to be achieved between 2020 and 2025	Creation of a cross-functional team	Cross-functional team	No, but there is increasing interest
LSP.5	Strategy defined at corporate level for logistics operations	Targets defined at corporate and business unit level	Creation of a cross-functional sustainability function	Sustainability managers for each business unit plus the sustainability function	There is a budget for each business unit from 2021
LSP.6	Strategy is formalised at corporate level for logistics	Targets are defined but their measurement is critical and not in place yet	No	A person responsible for sustainability in each business unit	No
SH.1	Strategy defined at corporate level, considering logistics in limited way	Targets about carbon neutrality by 2030	No	No	No
SH.2	Sustainability is not a strategic priority, and does not include logistics	Development of ad-hoc targets for individual initiatives	No	No	No
SH.3	Strategy defined at corporate level; sustainability is meant to be supportive for the overall strategy, but logistics is considered in limited way	Qualitative targets, but no measurement system	Creation of a CSR department	CSR manager	No
SH.4	Strategy defined at corporate level, detailed at national level, including logistics operations	Targets are defined coherently with United Nations SDGs to be reached by 2025 and 2050. KPIs are introduced for each target.	Creation of a CSR department	CSR manager	Yes, controlled by the top management
SH.5	Strategy defined at corporate level, detailed at business	Targets are defined quantitatively and	Appointment of a sustainability manager for each	Sustainability department	Budget is allocated to each business unit

(Continued)

Table 3. Continued.

Case	Defining logistics environmental sustainability	Targets to measure logistics environmental sustainability	Organisational footprint to pursue logistics environmental sustainability	Individuals/groups accountable for logistics environmental sustainability	Budget for logistics environmental sustainability initiatives
	unit level, including logistics operations	measured in real-time	business unit, and a cross-functional sustainability department		
SH.6	Strategy defined at corporate level, including logistics	Targets are mostly qualitative; new measurement systems to be introduced	Creation of a sustainability and CSR department	Sustainability and CSR department	Yes, with budget assigned to each business unit
SH.7	Strategy defined at corporate level, considering logistics in limited way	Targets mostly qualitative but with quantitative aspirations (i.e. carbon neutrality by 2030)	No	No	No

Table 4. Proposed framework to describe the alignment of logistics environmental sustainability with corporate strategy.

Dimension	Stage of alignment		
	Early stage of alignment	Medium stage of alignment	Advanced stage of alignment
Degree of awareness	Logistics environmental sustainability is not included in the corporate strategy	Logistics environmental sustainability is deemed supportive to the corporate strategy	Logistics environmental sustainability is core to the corporate strategy
Degree of formalisation	Targets are defined in a qualitative way	Targets are defined in a quantitative way	Targets are granularly defined in quantitative and qualitative way for each business unit.
Measurement systems	There are no measurement systems adopted	Measurement occurs at a high-level	Specific KPIs are developed to evaluate the target achievement
Governance and accountability	There is an individual adding accountability for environmental sustainability to normal work responsibilities	There is a cross-functional team that adds collective accountability for environmental sustainability to normal work	There is a cross-functional team that is fully committed to developing environmental sustainability
Budget allocation	There is no defined budget dedicated to environmental sustainability	There is a specific budget dedicated to environmental sustainability, which is shared across business units	Every business unit has its budget dedicated to environmental sustainability

environmental manager for each national branch in 2016 to develop initiatives oriented at achieving the expected targets.

LSP.3 is a leading provider with 54 sites in Italy (including 9 distribution centres) and 120 thousand delivery points. Their approach towards sustainability is defined at corporate level and then shared across business units through three pillars, namely ‘community’, ‘planet’, and ‘ecosystem’. The company drafts a consolidated sustainability report which includes corporate-level targets, progress, aligning plans and expected outcomes with the United Nations Sustainability Development Goals (SDGs). Their sustainability report includes a Benefit Impact Assessment (BIA), needed to become a certified B-Corp organisation. From an organisational viewpoint, communication, divulgation, and training activities take place to increase people’s awareness and commitment. Each business unit has a sustainability manager, and the company created an impact team to monitor environmental performance. It is a cross-functional team, with managers from different business units. However, no fixed budget is allocated to sustainability actions.

Table 2. Research quality and validity dimensions (based on Yin 2014).

	Research design	Data collection	Data analysis
Internal validity	<ul style="list-style-type: none"> Developed a literature-based research framework. Selected cases and subcases following a purposeful sampling approach. 	<ul style="list-style-type: none"> Involved multiple respondents (representing different internal functions) to compare responses. Notes and final documentation for each case were reviewed by informants. Data collected through interviews were analysed according to categories from the literature. 	<ul style="list-style-type: none"> Shared preliminary results and conclusions with informants to compare views and strengthen implications. Findings were compared against the available literature
Construct validity	<ul style="list-style-type: none"> Used grey literature sources to inform the research protocol and interview questionnaire. Triangulated data using multiple sources of evidence (interviews, internal presentations, industry reports, websites). Involved multiple respondents (representing different internal functions). 	<ul style="list-style-type: none"> Developed a semi-structure interview questionnaire. Triangulated data using multiple sources of evidence (interviews, internal presentations, industry reports, websites). Explained to respondents the academic terminology used prior to each interview to avoid misunderstandings. Conducted two interviews for each case. 	<ul style="list-style-type: none"> Based coding on a provisional list of categories from the extant academic literature. Conducted open and axial coding following well-established procedures. Illustrated the chain of evidence using tables and figures.
External validity	<ul style="list-style-type: none"> Designed a multiple case study with embedded sub-units of analysis. Described the criteria applied behind case and subcase selection to allow for analytical generalisation. 	<ul style="list-style-type: none"> Collected data and developed cases descriptions to highlight elements in common with other contexts. Used repetition logic for multiple cases. 	<ul style="list-style-type: none"> Conducted a cross-case analysis. Used repetition logic in multiple cases.
Reliability	<ul style="list-style-type: none"> Developed a standardised interview protocol for data collection across the cases. Developed a case study database (including interview transcriptions and notes). 	<ul style="list-style-type: none"> Involved multiple investigators during the interviews. Displayed data in tabular data forms to facilitate cross-case analysis and pattern matching. Continuously updated a case study database (including interview transcriptions, codes, and notes). 	<ul style="list-style-type: none"> Explained data analysis procedures. Displayed data in tabular data forms to facilitate cross-case analysis and pattern matching. Explained interrelations between key constructs (summarised in the research framework) to explore cross-case findings and elaborate knowledge.

LSP.4 is a multinational company mainly offering B2B integrated logistics solutions. It directly manages more than 3000 trucks, and indirectly approximately 2000 vehicles, which connect with more than 30 distribution centres in Italy and Europe. In terms of certifications, it achieved ISO 9001 for quality management and ISO 14001 for sustainability management. Sustainability initiatives are formalised into a corporate plan which defines objectives to be achieved between 2020 and 2025 (mainly concerning GHG emissions reduction). In terms of measurement, the company relies on an external consultancy firm that also drafts the company's sustainability report. A cross-functional team was created, leveraging heterogeneous skills and knowledge, to centrally manage sustainability actions. There is no budget assigned to sustainability, but after the release of the corporate plan, there is higher flexibility towards funding projects accepted by the top management. However, investment and operational costs are accounted to the business unit, which is mainly responsible for each project.

LSP.5 is also a multinational corporation, with 37 sites distributed across Europe and offering air, sea, and road freight logistics services. Their approach towards sustainability has been progressively formalised since 2018. Specific targets were defined for each business unit and in 2020 a sustainability function working laterally to the other business units was created to promote a huge cultural transformation. The company also appointed sustainability managers for each business unit and in 2021 released its first sustainability report. It included precise and quantitative assessment of the expected targets, collecting, and analysing historical data for the past three years. Such data ‘serves to guide the short and long terms objectives of the business’ (as highlighted by the LSP.5 sustainability manager). The aim is to identify the necessary competences and the impact of each GLP, including the portion of the fleet that the company does not directly manage. Until 2021, green initiatives were unstructured with a budget directly allocated to fleet management and the business development department. From 2021, a specific budget is allocated to each business unit and to the specific sustainability function.

LSP.6 is a multinational corporation which manages 29 sites across Europe but mainly operates in Italy with approximately 1500 trucks. The sustainability initiatives are aligned with the corporate strategy via the explicit consideration of the environmental sustainability urgency in the company’s mission and explicitly referring to United Nations SDGs. The company achieved the ISO 14001 certification but is still evaluating several tools to measure the environmental footprint. No specific organisational unit is dedicated to sustainability, and each business unit is individually accountable for developing environmental sustainability but without a specific budget. GLPs are mainly introduced via sharing the investment costs with the company’s customers. LSP.6 innovation and sustainability manager reported that ‘not all the customers agree, but the pressure from the final customers and governments is rising. Therefore, they are increasingly prone to share investments for sustainability’.

Shippers

SH.1 is an Italian multinational company active in the coffee industry, with 13 facilities in Europe and more than 90 worldwide. The company is strongly engaged in sustainable practices concerning the manufacturing processes, aiming at carbon neutrality by 2030. It is a high-level objective, which still needs to be operationalised properly. To speed up the formalisation of its sustainability programme, the company started publishing a sustainability report to show their commitment publicly. As distribution is increasingly becoming a concern for consumers, the company is now interested in developing GLPs. Despite efforts to improve their measurement systems, the company still struggles with understanding the required data accuracy level to assess their GLPs. Moreover, their sustainability report is limited to distribution centres and other logistics hubs because they outsource transport operations to an LSP and do not have visibility on the fuel consumed and emissions generated by their LSP. The company has neither budget nor specific function for logistics environmental sustainability.

SH.2 is an Italian clothing manufacturer specialised in women’s underwear. It owns 13 plants, of which 7 are in Italy, 2 in Serbia, and 4 in the U.S.A. The company is characterised by a strong vertical integration in manufacturing operations across their supply chain, from the yarn production to the clothes’ packaging processes. SH.2 has defined green targets but has not aligned them with their corporate strategy. Top management’s commitment to sustainability is low, and managers do not guide sustainable evolution. Green practices (rarely concerning logistics) usually emerge from employees suggesting improvements in a bottom-up approach. Sustainability projects have ad-hoc indicators to monitor their status, without a uniform and shared measurement system. The company has not set up any organisational unit accountable for sustainability, nor is any budget assigned to foster sustainability initiatives.

SH.3 is an Italian luxury fashion company with a wide product range including leather goods, shoes, accessories, apparel, jewellery, watches, make-up, perfumes, and a collection of home

furnishings and decorative accessories. The company is increasingly committed to environmental sustainability actions; as acknowledged by SH.3 supply chain manager, ‘we have to follow and chase the concerns from our customers, to keep the trendiness and innovativeness of our brand’. From an organisational viewpoint, the company has formalised a sustainability strategy which however relies only on qualitative claims. It releases a sustainability report, but no quantitative targets have been defined yet, nor is any specific measurement system used to assess the carbon footprint and environmental impact of their logistics operations. The company recently put a corporate social responsibility (CSR) and sustainability team in place and appointed a CSR manager, but they have not yet allocated a budget for environmental sustainability initiatives. Any time an initiative is proposed, top management approval must be obtained for budget allocation.

SH.4 is the Italian branch of a multinational company operating within the soft-drink industry. They acknowledge the importance and impact of logistics operations, to serve the myriad of customers spread across the country. They increasingly align sustainability with the corporate strategy, having formalised and quantified targets (aligned with United Nations Sustainability Development Goals) at a multinational and national level to be reached by 2025 and 2050 respectively. SH.4 has been releasing a sustainability report for a decade, which include success stories, future goals, and granular progress on KPIs. It also created several functions who are accountable for fostering sustainability, although most are coordinated by a higher-level CSR department which collects transversal and heterogeneous skills and knowledge. There is a budget for sustainability at corporate level that is, however, not managed by the CSR department but by top management at country level.

SH.5 is an Italian multinational company operating in the dairy industry, specialised in milk-derivative products. It operates 19 production facilities world-wide, 11 of which are in Italy and only 4 outside Europe. They consider their logistics operations as highly critical because of the products’ temperature and shelf-life requirements. Therefore, the company took a strategic orientation towards logistics environmental sustainability following the United Nations SDGs. The objectives within their environmental sustainability strategy are quantitatively defined for different business units, with measurement systems in place underpinned by access to real-time data. The company drafts an annual sustainability report to monitor performance, assess target achievement, and discuss target updates. All business units have sustainability team leaders, who are also members of a sustainability function aimed at project management and coordination. Each business unit also has a specific budget committed to environmental sustainability initiatives, including logistics.

SH.6 is one of the leading retailers in the Italian grocery industry, owning 52 logistics facilities in Italy and directly managing (i.e. not outsourcing to LSPs) its warehousing and handling operations. Improving the environmental footprint of logistics operations is acknowledged as a strategic objective, and the company releases an annual sustainability report. However, as the SH.6 supply chain director admitted, ‘the assessment of the performance only started in 2017 and mainly remains at a qualitative level’. Therefore, the company is introducing a measurement system to assess logistics emissions generated from suppliers and industrial distribution centres to retailers. In 2020, the company created a business department to foster sustainability projects and created a sustainability budget for each business unit. However, ‘currently there are rumours that the sustainability budget will be centralised into the sustainability and CSR department’ (SH.6 regional manager).

SH.7 is a UK multinational company active in the spirits industry, operating across Europe with several national branches (including Italy). It set its environmental strategy at a corporate level, and then extended it to all its business units. Concerning logistics, it mainly aims at optimising shipment utilisation rate to minimise costs (and consequently GHG emissions). The goal is to reduce logistics GHG emissions by 50% and achieve corporate carbon neutrality by 2030. They do not currently have an organisational unit accountable for environmental sustainability, and initiatives are left to individual business units. Whenever necessary, those business units can ask for money to develop environmentally oriented investments. There is no specific budget for sustainability, but the company’s approach is to give high priority to any environmentally sustainable initiative. However, as

SH.7 Europe Head of Logistics reported, 'We started to introduce a budget for sustainability, but is centralised and does not pertain specifically to logistics'.

Table 3 summarises the findings obtained from the cases, linking the attributes on the columns to the questions used during the semi-structured interviews.

Cross-case analysis

Elaborating within-case insights into a cross-case analysis led us to identify five main dimensions which describe and characterise the alignment of logistics environmental sustainability with corporate strategy: (i) degree of awareness; (ii) degree of formalisation; (iii) measurement systems; (iv) governance and accountability; (v) budget allocation.

Awareness of the ongoing climate crisis makes environmental sustainability a strategic priority for many LSPs (LSP.3, LSP.4, LSP.5, LSP.6), who arrange regular meetings to plan, discuss, and review future actions. Conversely, LSP.1 and LSP.2 considered becoming environmentally sustainable as an important target but less so than being cost-efficient or having high service levels. On the other hand, some shippers (SH.1, SH.3 and SH.4) highlighted how final customers usually perceive them as responsible for the environmental sustainability of the overall supply chain. Therefore, developing a green image is important to create and maintain competitive advantage. Nevertheless, logistics is often considered as a support activity outsourced to third parties, and its alignment with corporate strategies is limited. As SH.4 logistics manager said, 'logistics is often considered as an ancillary activity, and green marketing still plays a fundamental role'. This is confirmed also by SH.5 sustainability manager, who admitted that 'shippers mostly focus on packaging, as this directly affect consumers' perceptions'.

With regards to the degree of formalisation, both LSPs and shippers introduced targets related to reducing plastic usage and transport GHG emissions. However, shippers often develop corporate targets that aggregate manufacturing and logistics processes. Some firms (LSP.3, LSP.6, SH.4, SH.5) formalised 'pillars for sustainability' following the 17 Sustainable Development Goals (SDGs) developed by the United Nations. SH.4 further developed them by designing specific objectives for each SDG and KPIs for each business unit. On the other hand, SH.2 and SH.3 have qualitatively set the direction toward sustainability, without setting quantitative targets. Objectives are set at a corporate level and then shared across the different departments in a top-down approach. LSP.2, LSP.3, LSP.5, and LSP.6 introduced precise quantitative objectives to be achieved within a defined deadline. SH.1 and SH.7 formalised carbon targets to be achieved by 2030, but also highlighted the need to find more reliable ways to measure and monitor progress. Many companies start from introducing sustainability reports that help reflect upon the problem and set future directions. However, adopting appropriate measurement systems is acknowledged as a fundamental element to enhance environmental sustainability. Quantitative data can feed analyses aimed at evaluating the achievement of the goals included in corporate strategies (LSP.4, LSP.5). As LSP.4 sustainability manager reported, 'objectives are set at a corporate level and then shared across the different departments in a top-down approach'. Nevertheless, targets for sustainable improvements are heterogeneous within the industry and may be inconsistent, thus recommending the involvement of qualified external partners. LSP.1 and LSP.4 collaborated with third parties to develop increasingly precise and customised measurement systems, but collecting the right data is deemed highly critical (LSP.5, LSP.6).

From an organisational perspective, companies introduced different roles or functions that could be accountable for sustainability. LSPs have usually appointed environmental sustainability managers, who are responsible for short-term actions and other local initiatives. LSP.3, LSP.4, and LSP.5 built a team of people with cross-functional competences, who allocate part of their time to improving company's environmental performance, while LSP.2 also created a centralised sustainability department at a corporate level and LSP.3 established an 'impact team' to monitor performance and manage sustainability-oriented initiatives. Shippers also appointed managers to

coordinate sustainability actions across the different functions (SH.5) or established cross-functional teams (SH.6). In the words of SH.5 supply chain manager, ‘we built a team of people with cross-functional competences but also a centralised sustainability department at corporate level. This increased the alignment of logistics with the rest of the company’s operations’. However, shippers do not usually have specific figures assigned to managing logistics environmental sustainability, which is mostly embedded into corporate teams, who consider logistics alongside the other business functions (SH.3, SH.4, SH.6).

Lastly, the acknowledgement of the importance of logistics environmental sustainability is not reflected by the allocation of appropriate budgets. The interviewed case companies allocate resources to individual initiatives whenever the top management deem it opportune. However, LSP.5, SH.5, and SH.6 highlighted the recent introduction of a specific budget for sustainability, which can be centrally managed (SH.4) but in a few cases could soon be spread across different business units to bolster new initiatives (SH.3).

Discussion

Environmental sustainability can create a strategic opportunity for differentiation in logistics, but significant challenges can emerge (Kazancoglu et al. 2021). LSPs and shippers have so far introduced environmental concerns into corporate strategies in a limited way to develop robust environmental strategies (Giuffrida and Mangiaracina 2020). The findings (summarised in Table 3) obtained from the study include rich empirical evidence about how companies could pragmatically align their logistics environmental sustainability approaches with their corporate strategies. These findings led to the development of Table 4, which offers a framework that details different stages of alignment concerning the relevant dimensions that emerged across the empirical investigation.

First, the overall degree of awareness about the urgency and the importance of the problem seems to be rising and this major change in mindset can be driven by various factors. On the one hand, increasing pressures from a variety of stakeholders (e.g. investors and shareholders), are making sustainability one of the key drivers in logistics decision-making processes (Perotti, Pratavia, and Melacini 2022). On the other hand, more demanding regulatory pressures and growing recommendations are coming from national governments, as well as international organisations (Centobelli, Cerchione, and Esposito 2020). As such, companies have started reflecting on which roadmap to take (Perotti et al. 2012). Efforts towards the alignment of logistics environmental sustainability with corporate strategies are increasing, especially for LSPs and this is in line with a recent study by Isaksson et al. (2017). On the other hand, this study highlights that few shippers have included logistics environmental sustainability among strategic priorities, and this is in contrast with Bahr and Sweeney (2019), who pointed to a higher interest of shippers in environmental sustainability. LSPs increasingly consider environmental sustainability in logistics as a strategic priority directly related to their core business, while shippers’ awareness still seems generally driven by pressures from their customers and particularly final consumers.

LSPs and shippers are also characterised by different degrees of formalisation, and this also links back to their core business and how they deliver their value propositions to customers. Both LSPs and shippers formalise initiatives and targets for logistics environmental sustainability, but shippers often develop approaches which are not specifically focused on logistics, combining logistics and manufacturing operations in a single entity. Most of the participating LSPs introduced objectives to define a pathway for the future and leveraged United Nations SDGs to contextualise and design their actions. Some LSPs defined quantitative objectives to be achieved within a specific time horizon. In the case of shippers, they sometimes define only qualitative targets, which are nonetheless included within sustainability reports. Overall, most of the companies highlighted the importance of drafting sustainability reports to gain legitimacy in the eyes of society by raising awareness of their environmental performance, as acknowledged also by Kazancoglu et al. (2021). Evidence gathered from the case companies shows that releasing such instruments is often a first step which helps

define targets and identify appropriate measurement systems. Both LSPs and shippers can start from introducing CSR principles and use them to shape qualitative directions for the future. However, this study builds on previous theory by highlighting how companies urgently need to develop a precise measurement of corporate performance, to transform qualitative aspirations into quantitative statements (Centobelli, Cerchione, and Esposito 2020; Oberhofer and Dieplinger 2014). Developing specific KPIs to measure and monitor progress made on well-defined objectives is widely considered a powerful leverage to consider (Evangelista, Colicchia, and Creazza 2017), but collecting the accurate data can be critical. In this context, innovative technologies can represent an unprecedented opportunity to support companies to adopt measures able to reduce emissions and achieve their logistics environmental sustainability goals (Centobelli, Cerchione, and Esposito 2020).

Furthermore, Isaksson et al. (2017) stated that Italian companies (and particularly LSPs) usually lack specialised sustainability departments. However, our findings show that Italy-based companies have improved significantly in recent years in terms of governance and accountability. For example, the rising attention to sustainability concerns is often reflected in the increasing incorporation of ESG criteria into investment assessments. Moreover, companies have been appointing managers to deal with environmental issues and creating cross-functional teams with increasing commitment (Rossi et al. 2013). LSPs increasingly appoint logistics environmental sustainability managers, but shippers consider having a high degree of alignment between environmentally conscious logistics and corporate strategy fundamental to ensure progress on environmental sustainability. In this way, they can take advantage of corporate cross-functional teams who collect skills and knowledge from heterogeneous backgrounds (Laari, Töyli, and Ojala 2018). Unfortunately, even though the case companies have an increasing commitment to environmental sustainability, this is not reflected in an allocation of specific budgets to sustainability initiatives, which limits the progress that can be made on logistics operations. Companies often seem motivated more by the need to align with regulations or by the willingness to keep a 'green image', than by a sincere understanding of the problem, and this seems to confirm previous studies (Colicchia et al. 2013; Jazairy, von Haartman, and Björklund 2021). This myopic approach prevents supply chains from adequately facing the upcoming environmental crisis (Huge-Brodin, Sweeney, and Evangelista 2020).

Expanding the view from the individual dimensions, i.e. the rows in Table 4, it is possible to identify, define and describe early, medium, or advanced stages of alignment of logistics environmental sustainability with their corporate strategy – looking at the columns of Table 4. By embracing the different dimensions altogether in such a 'column-view' it is possible to isolate broader profiles of companies in relation to their stage of alignment of logistics environmental sustainability with corporate strategy.

These broad profiles could be linked to the literature discussing the strategic alignment of sustainability with corporate strategies, and adopting the viewpoint supporting the idea that better alignment can lead to better effectiveness of sustainability actions (Cavaleri and Shabana 2018; Le 2022). In an early stage of alignment, companies do not include logistics environmental sustainability in their corporate strategy and limit their efforts to define qualitative targets that are not precisely measured. They could also appoint an employee who is responsible for green initiatives, but the potential actions are quite limited as there is no budget for environmental sustainability. When companies progress to a medium stage of alignment, logistics environmental sustainability is explicitly acknowledged as supportive to the corporate strategy. This means that targets are quantitatively defined, with some kind of high-level measurement systems in place. With respect to the early stage, multiple employees become accountable for green actions as part of a dedicated cross-functional team. There is also a budget to develop initiatives, which is, however, shared across different business units thus limiting the logistics firepower.

Finally, when logistics environmental sustainability is core to the corporate strategy companies are characterised by an advanced stage of alignment. Targets are granularly defined in a quantitative and qualitative way, and specific KPIs are adopted to precisely evaluate target achievement. Companies create cross-functional teams with people fully committed to developing environmental sustainability, and every business unit (including the logistics function) can manage a budget for

environmental initiatives. According to the above-mentioned literature (e.g. Le 2022), this is deemed to be the stage of alignment leading to better effectiveness of sustainability actions and potentially to improved firm performance (Schrettle et al. 2014), which could deserve to be further investigated in future research into logistics environmental sustainability (and its potential relationship with firm's performance).

Conclusions

Logistics activities generate negative impacts on the environment, and companies are increasingly required to minimise such effects (Füchtenhans et al. 2023; Huge-Brodin, Sweeney, and Evangelista 2020). Logistics environmental sustainability is turning into a competitive advantage and becoming even a prerequisite for companies' survival (Singh and Trivedi 2016). The academic literature suggests that sustainability practices can be enhanced and made more effective by aligning them with corporate strategies (e.g. Etzion 2007). Previous studies acknowledge that an environmental sustainability culture should be spread throughout the entire organisation (Rossi et al. 2013), and companies need to develop original approaches to turn sustainability into practice (Evangelista, Colicchia, and Creazza 2017). However, companies often struggle to align logistics environmental sustainability with corporate strategies (Kazancoglu et al. 2021) and lack clarity about how to practically align it with strategic purposes in their day-by-day activities and processes (Laari, Töyli, and Ojala 2018).

To address this 'understanding into action conundrum' (Sweeney, Grant, and Mangan 2018), this research explored the alignment of logistics environmental sustainability with corporate strategy, based on multiple embedded case study research that includes expert views from 13 Italian LSPs and shippers. Literature-based insights were combined with empirical data to develop a framework that includes five main dimensions to describe alignment: degree of awareness, degree of formalisation, measurement systems, governance and accountability, and budget allocation. The framework highlights different stages of alignment (early, medium, and advanced) detailed for each of the identified dimensions.

From an academic perspective, this study is one of the first studies to provide an overview on how to align environmental sustainability with corporate strategies where logistics environmental sustainability is concerned, suggesting potential avenues for leveraging the concept of strategic alignment to improve the effectiveness of sustainability actions and firm performance. It highlights the importance of introducing precise targets and appropriate measurement systems to ensure sustainability programmes set by shippers and LSPs go from targets to actions. Also, it shows that clear accountability is crucial, along with the allocation of specific resources to sustainability projects. However, the paper also acknowledges that some companies seem motivated more by expected reputation benefits than by a sincere understanding of the problem, and this prevents them from adequately facing the upcoming environmental crisis. Therefore, the study intends to provide practitioners with insights that could support the operationalisation of logistics environmental sustainability, fostering the alignment between corporate targets and pragmatic actions.

Both perspectives of LSPs and shippers are illustrated and discussed, and it offers a framework that details different stages of alignment with respect to the identified dimensions. Findings could help companies in shaping logistics environmental strategies, offering a way ahead to managers willing to mitigate the negative environmental effects of logistics activities. This is expected to be relevant especially for those contexts where companies are characterised by an early stage of alignment, whereas the framework derived from this study could concretely help them understand better how to improve the alignment of logistics environmental sustainability with their corporate strategies.

Lastly, the limitations that characterise this paper could pave the way for promising research avenues in the future. First, the empirical investigation was limited to the Italian context, and investigating other countries could enhance findings' generalisability and strengthen the emerging

managerial implications. As we considered large companies, elaborating on the company size could offer further insights into this phenomenon. Moreover, a deeper investigation focused on specific industry sectors might be beneficial to highlight possible further interesting considerations. Lastly, we adopted a qualitative approach, while a quantitative survey could be conducted leveraging the available literature to test specific hypotheses concerning the operationalisation of logistics environmental sustainability. This could also regard the study of the relationships between the strategic alignment of sustainability strategies and firm performance – something that has been explored in the literature in more general terms but not yet with specific reference to logistics environmental sustainability.

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No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix A – Semi-structured interview questionnaire

- (1) Do you have any strategy concerning the development of logistics environmental sustainability in your organisation? If so, how granular is this strategy (at corporate level, at business unit level, at department level)?
- (2) Have you defined any specific target to measure your logistics environmental sustainability? If so, how do you measure these targets?
- (3) What is your organisational footprint to pursue logistics environmental sustainability? What organisational unit is responsible for making decisions about logistics environmental sustainability?
- (4) Is any individual/group accountable for promoting actions and achieving logistics environmental sustainability targets?
- (5) Do you allocate any specific budget to logistics environmental sustainability initiatives and approaches when defining the yearly budget? If so, how?