Why Scope 3 Data Systems Backfire: Tensions in Supply Chain CO_2 Reporting

A Multilevel Analysis of Scope 3 Emission Management in a Retailer's Supply Chain

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Abstract

The introduction of mandatory Scope 3 emissions reporting under the EU's Corporate Sustainability Reporting Directive (CSRD) and Corporate Sustainability Due Diligence Directive (CSDDD) requires large firms to account for greenhouse gas emissions across their entire value chain. Motivations for transparency extend beyond regulatory compliance. Large firms have already begun to experience resource constraints among their suppliers, highlighting emerging vulnerabilities within upstream networks. Consequently, their interest in enhancing resilience is not solely a response to the forthcoming directives, but reflects a strategic recognition that future supply markets will be more concentrated and resource-scarce. In anticipation of such structural shifts, firms seek greater visibility across their value chains to strengthen long-term resilience and adaptive capacity. Tracking such emissions in globally dispersed networks is challenging, yet existing research has largely focused on dyadic buyer-supplier disclosure, leaving the multi-actor coordination dynamics of Scope 3 data collection underexplored. This study aims to explore what sustainability tensions emerge when a retailer acquires a tailored CO_2 data platform, offers it free of charge to its supply chain, and mandates its actors to disclose granular data in it. The study also explores how these are managed and could be managed more effectively in the future. Drawing on these insights, the author seeks to inform large organizations' decisions on Scope 3 emission management and CSDDD-related actions, and to nudge them to address common sources of conflict in order to smooth their already resource-intensive climate transitions. The research gap is addressed through a multilevel qualitative case study of a Swedish beverage

retailer that has gone unusually far by acquiring a CO_2 data system for its entire supply chain, in which every upstream tier can self-report data, and by absorbing the project's training and quality-assurance costs. Under these conditions, many of the classical barriers to supplier disclosure are removed. What remains, the study argues, is better conceptualised as a set of persistent sustainability tensions. Industry experts at both corporate and project level at different levels of the supply chain have been interviewed to provide a multilevel analysis on supply chain tension and correlating management strategies, advancing earlier dual actor research and providing a more real world accurate understanding of challenges and opportunities of scope 3 emission management. The results show that the retailer's system causes multiple sustainability tensions that are complex in their nature. These are distributed almost evenly between intra- and inter-organisational dimensions. Intra-organisational tensions cluster around an inner triad and level dimensions while inter-organisational tensions are dominated by a change and context dimensions. Two recurring patterns escape the existing framework and prompt the study's principal theoretical contribution: a technical dimension and a meta dimension. The technical dimension is added as a backbone at the centre of the existing framework as it seems to amplify most of the sustainability tensions in this case study. The meta dimension is added as a separate bubble outside it, as these tensions are only perceived as real. Actors already deploy well established management strategies to cope with the identified tensions; acceptance, separation and synthesis, but a fourth, communication, could be more effective to solve meta tensions. The distribution of strategies across tiers is uneven, and their long-run sufficiency depends on whether the technical backbone can be resolved at the industry or EU level. The thesis closes with managerial implications for retailers and policy recommendations for EU-level standardisation of Scope 3 data infrastructure.

Keywords: *Scope 3 Emissions Management , Sustainable Supply Chain management* (SSCM)*, Sustainability Tensions, CO_2 data, EU sustainability regulation (CSDDD), Supply Chain*

Glossary

Term / abbreviation	Short explanation
2PP / 3PP	Second-party producer / third-party producer; suppliers further upstream that do not contract directly with the focal firm.
Activity data	Quantitative data on actual operational inputs (e.g. kilograms of grain, litres of fuel, kilometres of transport) used to calculate emissions, in contrast to default-factor estimates.
Boundary-spanning	Communication and coordination activities through which a firm interacts with external stakeholders across organisational boundaries.
Carbon dioxide equivalent (CO_2e)	A unit that converts the emissions of various greenhouse gases to the amount of CO_2 that would cause equivalent global warming.
Carbon Dioxide Removal (CDR)	Anthropogenic activities that remove CO_2 from the atmosphere and durably store it in geological, terrestrial, ocean or product reservoirs.
Carbon Disclosure Project (CDP)	Non-profit global platform through which thousands of companies disclose annual greenhouse-gas emissions on a standardised questionnaire.
Carbon sequestration	The capture and long-term storage of CO_2 from the atmosphere, for example by soil, vegetation or cover crops.
Corporate Sustainability Due Diligence Directive (CSDDD)	EU directive obliging large firms to identify, prevent and limit existing and potential negative sustainability impacts across their value chain.
Corporate Sustainability Reporting Directive (CSRD)	EU directive that introduces mandatory audited sustainability reporting for large and listed companies, including Scope 3 emissions.
Cradle-to-gate	Scope of emissions accounting that covers all activities from raw-material extraction up to the point at which a product leaves the producer, excluding downstream use and disposal.
Default factor (schablon)	An industry-average or generic emission multiplier used in place of primary activity data; in Swedish referred to as a schablon.
Emission factor	A coefficient that converts an activity (e.g. one kilogram of barley) into an associated quantity of CO_2e.
ESG (Environmental, Social, Governance)	An umbrella concept used to evaluate firms on non-financial dimensions; CO_2 disclosures sit under the environmental pillar.
Fast-Moving Consumer Goods (FMCG)	Industry segment characterised by high-volume, low-margin, short-shelf-life products; the Retailer in this case operates within FMCG.
General Data Protection Regulation (GDPR)	EU regulation governing the processing and protection of personal data; relevant in this study for data-handling concerns in shared CO_2 systems.

Greenhouse Gases (GHGs)	Gases that contribute to global warming, principally CO_2, methane (CH_4), nitrous oxide (N_2O) and hydrofluorocarbons (HFCs).
Interoperability	The ability of different data systems to exchange and use information without manual reformatting or recalculation.
Life Cycle Assessment (LCA)	A standardised method for evaluating the environmental impacts of a product across its life cycle, from raw materials through use to disposal.
Multi-tier supply chain	A supply chain in which the focal firm interacts not only with first-tier suppliers but also with their suppliers further upstream.
Net zero	A state in which residual greenhouse-gas emissions are balanced by equivalent removals from the atmosphere.
Primary data	Real, granular activity data measured directly by an actor in the supply chain, in contrast to industry-average proxies.
Primary Data Score (PDS)	The share of primary data versus default data in a given CO_2 reporting cycle; in this pilot, an average of 54 % was reached.
Procurement Sustainability Tensions (PSTs)	Systematic tensions identified by Fayezi, Zomorrodi and Bals (2018) between sustainability objectives and traditional procurement targets.
Product Carbon Footprint (PCF)	The total emissions associated with a single product across its accounted life cycle; the unit of analysis in the Retailer's system.
Returpack	Swedish national deposit-refund organisation for beverage packaging; one of the reporting bodies referenced by the Supplier.
Science Based Targets initiative (SBTi)	A global initiative that validates corporate climate targets against pathways consistent with limiting global warming.
Scope 1 emissions	Direct greenhouse-gas emissions from operations owned or controlled by the firm itself.
Scope 2 emissions	Indirect emissions from the generation of purchased electricity, heat or steam consumed by the firm.
Scope 3 emissions	All indirect greenhouse gas emissions that arise from activities across a company’s value chain, from sources that are not owned or directly controlled by the company. This includes both upstream (for example, extraction and production of purchased materials, goods and services, and their transport to the company) and downstream (for example, distribution, use and end-of-life treatment of sold products).
Stock Keeping Unit (SKU)	A distinct item-level product identifier; used by retailers to manage assortment at the product level.
Triple Bottom Line (TBL)	A framework conceptualising business performance in three dimensions: economic, environmental and social.
UNFCCC	United Nations Framework Convention on Climate Change; the principal international treaty on climate change.

UNEP	United Nations Environment Programme; publishes the annual Emissions Gap Report referenced in this study.

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1. Introduction

1.1 Background

Climate urgency and the rise in global emissions

Over the past two decades, environmental uncertainty has emerged as one of the most pressing long term concerns confronting societies and markets. In recent years, the global perception of climate risk has shifted from a future-oriented consideration to an acute issue, as climate-related extreme weather and pollution-related harms have made sustainability solutions increasingly urgent (World Economic Forum, 2025). The United Nations Framework Convention on Climate Change identifies pollution as the world's largest environmental risk, an antecedent to extreme weather, biodiversity loss, ecosystem collapse and critical change to Earth's systems. As well as to disease and premature death. The negative impact is unequally distributed: 92 % of pollution-related deaths occur in low- and middle-income countries (UNFCCC, 2024).

In spite of the danger, global emissions continue to rise. GHGs reached 57.7 $GtCO_2e$ in 2024, an annual increase of 2.3 %, which was four times higher than the 0.6 % average growth rate of the 2010s. The Emissions Gap Report 2025 indicates that global warming projections are well above the Paris Agreement's temperature ambition. Yet, limiting warming to 1.5 °C by 2100 remains technically feasible despite the temporary overshoot of the targeted emission pathway. However, The UNEP provides caution against placing excessive trust in carbon dioxide removal (CDR) methods, since these remain uncertain, risky and costly, and warns

that each year of postponed action makes the path to net zero more complex and expensive (UNEP, 2025a). Recent assessments indicate that the global economy already incurs pollution-related losses of approximately USD 4.6 trillion annually (UNEP, 2025b).

Industry impact and the rise of CO_2 reporting

While Sweden accounts for only 49 Mt CO_2e, a modest figure compared to other wealthy economies, high-income countries consume on average six times more material per capita than low-income economies (European Parliament, 2018). The structural rationale is that emissions from higher-tier suppliers, particularly those associated with the extraction and processing of raw materials, contribute approximately 60 % of all greenhouse-gas emissions and are typically concentrated in developing countries (UNEP, 2024).

Against this backdrop, carbon-dioxide reporting has become an emerging industry standard for large companies and groups, supported by the IFRS Sustainability Disclosure Standards (IFRS Foundation, 2023). Under the environmental pillar of ESG reporting, the volume of radiative-forcing agents required to operate the business is expressed as a CO_2 equivalent in order to inform stakeholders of the firm's climate impact. Since the majority of CO_2 emissions originate from higher-tier suppliers with limited resources for sustainable transformation, understanding which large actors drive their production has become a matter of strategic importance.

New EU Regulations: CSRD & CSDDD

For these reasons, the European Parliament has recently strengthened its sustainability-disclosure regime along two axes. The Corporate Sustainability Reporting Directive (CSRD) introduces mandatory audited reporting of Scope 1, 2 and 3 emissions for large and listed firms. The Corporate Sustainability Due Diligence Directive (Directive (EU) 2024/1760, CSDDD) obliges large companies to identify, prevent and limit existing and potential negative sustainability impacts in their value chains, both inside and outside Europe, thereby putting explicit pressure on them to address and reduce their Scope 3 emissions. The directive also requires the adoption of a climate-change mitigation plan aligned with the Paris Agreement's 2050 net-zero objective (European Parliament & Council, 2024). A new authority assembled by the Member States will enforce the directive through injunctive orders and penalties.

In its primary stage, the directive applies to companies with more than 1,000 employees or a net worldwide turnover above EUR 450 million annually; business groups and parent companies of franchise concepts that reach similar thresholds are also held accountable. To comply with the regulation, affected companies must account for CO2 emissions for their entire chain of activities, from upstream partners involved in design, extraction, sourcing, manufacturing, transport, storage and supply of goods or services, to downstream partners involved in distribution and storage (European Parliament & Council, 2024). The directive is expected to harmonise the legal framework across the EU, strengthen risk management and innovation incentives, and improve competitive standing among compilers. From a stakeholder perspective, compliance is connected to greater customer trust, higher employee commitment and increased financial support from sustainability-oriented investors and public procurers (European Commission, n.d.).

The operationalisation challenge

The central concern confronting firms is how these regulatory obligations can be operationalised in practice. Tracking scope 3 emissions across an entire supply chain is a complex challenge in contemporary market settings: with large firms and groups operating globally through spider-web structures, focal firms struggle to oversee all the business operations leading up to their sales. Accounting for these activities through granular CO_2e data is even harder, since Scope 3 emissions are generated by multiple tiers of suppliers and downstream partners, many of whom lack the resources, incentives or technical capacity to measure and report emissions in a consistent way. In a retail context, the Scope 1 and 2 emissions of all value chain actors constitutes the retailer's Scope 3 emissions, *see Figure 1*. Small firms, particularly those outside Europe, are often not directly subject to the CSRD and therefore have no legal obligation to report direct operational emissions. Consequently, large retailers must develop methods to estimate upstream tiers' emissions in order to calculate their own Scope 3 footprint. The underlying rationale of recent EU regulation is that resource-rich companies should support smaller partners in generating CO_2 data, thereby accelerating decarbonisation efforts across the value chain, even though only the largest firms are formally bound by the legal requirements (European Commission, n.d.). However, since the data is collected across different countries, legal systems and IT infrastructures, and are reported in incompatible formats, units or time periods, it makes aggregation and comparison highly difficult.

Faced with this complexity, a small number of resource rich organisations are developing in-house CO_2e tools by acquiring comprehensive data systems from third-party providers and tailoring them to collect scope 3 data for their specific supply chain. Others fully outsource the task to an emerging sector of environmental compliance and carbon-accounting firms, which aggregate suppliers' public data and apply emission factors to deliver ready-made Scope 3 estimates. While this offers a relatively quick compliance solution, it does little to deepen organisational understanding of value chain climate risks. Yet, many companies are waiting to observe which methods and tools prove robust, effectively learning from what in this context could be termed the innovator's mistake. It is this operationalisation challenge, and the tensions it generates across actors with very different positions in the chain, that motivates the present study.

Figure 1.

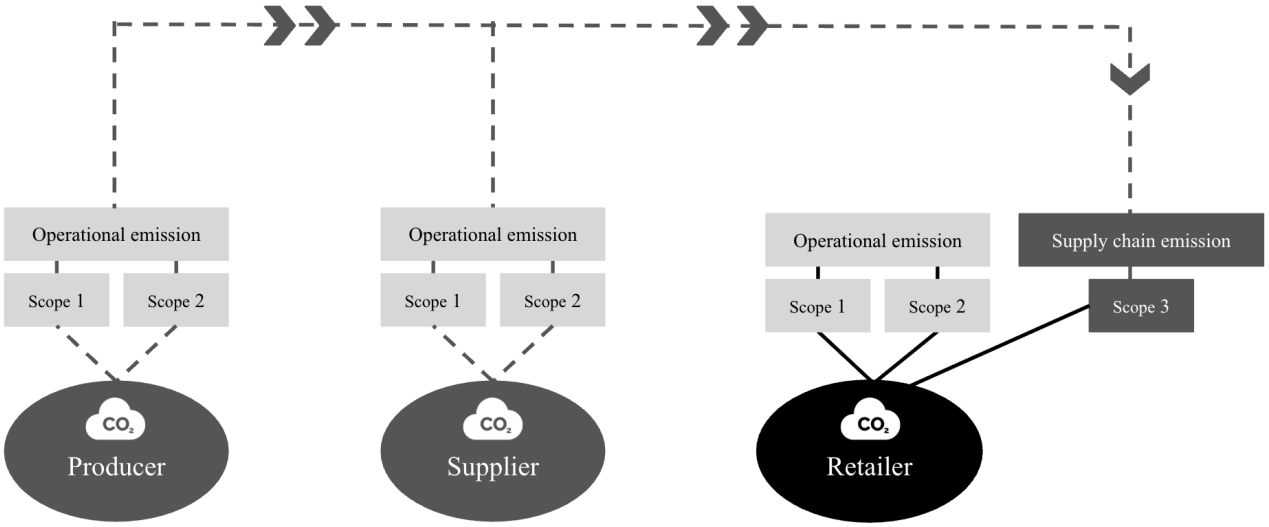


Fig. 1 Visualization of Scope 3 emissions from the retailer's perspective.

1.2 Research Gap

Scope 3 emission management has recently emerged as a distinct stream within the SSCM literature. Yet, much SSCM research remains fragmented, focusing primarily on firm-level perspectives rather than inter-organisational collaboration, and thereby neglecting the

complexities and operationalisation challenges of sustainability initiatives in uncertain decision environments that shape actual SSCM outcomes (Panigrahi et al., 2019). Against this backdrop, existing Scope 3 studies are largely confined to dyadic buyer - supplier relationships and technical accounting issues, underestimating the complexity of coordinating CO_2 data across interconnected supply chain actors. In practice, Scope 3 emissions represent a network-level sustainability issue that extends beyond bilateral governance solutions and requires multi-actor coordination and data integration across the broader supply network (Canal Vieira et al.).

The empirical setting also enables a conceptual shift in the Scope 3 literature. Existing work largely examines whether and why firms share emissions data, and which enablers and barriers affect data quality, typically from a retailer - supplier viewpoint (CDP, 2010; Depoers, Jeanjean, & Jérôme, 2016; Jira & Toffel, 2013; Liesen et al., 2015; Villena & Dhanorkar, 2020). In the focal case, many commonly cited SSCM barriers have been deliberately mitigated by the retailer through free access to an in-house Scope 3 reporting system, user training and ongoing adaptation of the tool to supplier needs (Seidel, Recker, Pimmer, & vom Brocke, 2010). Under these conditions, the remaining difficulties are more appropriately conceptualised as sustainability tensions. Stemming from conflicting interests, expectations and time horizons among actors, rather than as straightforward barriers or missing enablers (Hahn, Pinkse, Preuss, & Figge, 2015). This reveals a neglected gap: we know little about how such tensions emerge and are navigated in Scope 3 data management once classic barriers have been reduced. The present study addresses this gap by analysing the tensions triggered by a shared Scope 3 data system across the supply chain, and by exploring how these tensions can be managed in practice.

1.3 Purpose

The purpose of this thesis is to advance sustainable supply chain management (SSCM) by analysing how tensions shape the implementation of Scope 3 CO_2 data collection systems in retail supply chains, and how these tensions can be managed. As firms are increasingly legally obliged to account for and reduce their greenhouse gas emissions, and against the backdrop of rising emissions and accelerating global warming, they face growing pressure to expand climate accountability beyond their own operations. In light of increasing market

volatility, cost pressures and new regulatory demands such as the CSDDD, retailers are turning to more comprehensive Scope 3 accounting as a means to secure supply chain resilience and long-term competitiveness (Khodakarami et al., 2015; Panigrahi et al. 2019). However, existing Scope 3 research remains largely concentrated on retailer - supplier dyads, with a strong focus on technical accounting issues and enablers of data sharing, offering limited insight into the multi-level, inter-organisational tensions that arise when a shared CO_2 data system is rolled out across a wider network of suppliers. Using a unique case where a retailer provides free access to an in-house Scope 3 data tool throughout its supply chain, this study adopts a multilevel, actor-centred perspective to (1) examine how Scope 3 data collection is organised and experienced across different supply chain tiers, (2) identify the key sustainability tensions triggered by the shared CO_2 data system, and (3) explore how these tensions can be managed in practice.

1.4 Research Questions

RQ1: How is CO_2 data collection for Scope 3 emissions organised and carried out at different levels of the retailer's supply chain?

RQ2: What tensions emerge within and between supply chain actors when a retailer mandates reporting into a shared CO_2 data collection system for Scope 3 emission auditing?

RQ3: How are these tensions currently managed, and how could they be managed more effectively?

1.5 Explained concepts

Defining tensions

Tensions are understood as enduring contradictions between competing yet interdependent goals, demands or stakeholder expectations that cannot be fully resolved over time. They are commonly discussed in the form of trade-offs, compromises and paradoxes, originating in organisational research on conflicting stakeholder interests and the ambiguity this creates for managerial decision-making (Fayezi, Zomorrodi & Bals, 2018). Trade-off tensions arise

when stakeholder demands are directly opposing, forcing an either -or choice, whereas compromise tensions involve conflicting but negotiable demands that can be partially accommodated. Paradox tensions, by contrast, capture situations in which opposing demands are simultaneously valid and persistent, such that organisations must pursue them in parallel rather than resolve them, for example combining short-term cost efficiency with long-term sustainability objectives (Smith & Lewis, 2011). In this thesis, tensions therefore refer to these persistent, interdependent contradictions that shape how sustainability is interpreted and prioritised in supply chains.

Clarifying Tensions via the Notion of Barriers

Barriers can be understood as concrete obstacles or contextual conditions that impede the achievement of desired sustainability objectives. Seidel et al. (2010) conceptualise barriers as the absence of key enablers required for the organisational adoption of sustainable business practices. Their model identifies four central enabler categories: strategy definition, organisational support, motivation, and traceability through information systems (Seidel et al., 2010). Subsequent SSCM studies conceptualise barriers as specific organisational and contextual factors that prevent or hinder the adoption of sustainability programmes. With a strong emphasis on resource constraints in various forms, including limited budgets, inadequate skills and capabilities, and insufficiently supportive regulatory frameworks. Trevisan et al. (2023) identified eight dimensions of barriers when they research the adoption of digital technology towards a circular economy, to exemplify; knowledge management (e.g. lack of technical and environmental know-how, skills and awareness), financial (limited resources, high implementation and operating costs) and policy and regulatory (lack of incentives, excessive bureaucracy, high taxes and import costs, weak enforcement and low environmental targets). Overall, barriers are commonly portrayed as a "lack of" critical internal or external conditions that obstruct the initiation or continuation of sustainability transitions (Bey, Hauschild & McAloone, 2013; Trevisan et al., 2023).

2. Literature Review

2.1 Scope 3 emission management

Scope 3 emissions management has recently emerged as a distinct area of inquiry within sustainable supply chain management. The origins of this research stream can be traced to the early 2000s and the establishment of the Carbon Disclosure Project (CDP), which marked a turning point in recognising the need for systematic analysis of value-chain emissions in capital markets. During this period, large buying firms began to request their suppliers to measure, manage and disclose greenhouse gas (GHG) inventories, particularly for upstream activities. Impelled by the growing awareness of the importance of supply chain resilience towards physical and legal changes related to global warming, and with the ultimate objective to reduce extended emissions (KPMG 2008, Halldórsson, Á., & Kovács, G. (2010). CDP positioned itself as the primary provider of corporate climate data and enabled buyers to request standardised emissions information from suppliers through a common reporting infrastructure. Their supply chain report in 2010 set the foundation for the first articles of scope 3 emission (CDP, 2010, Jira and Toffel, 2013). Consequently, the earliest academic contributions on Scope 3 emissions focused predominantly on how firms obtain suppliers' emissions data for procured goods and services and on the strategies buying firms can deploy to induce suppliers to disclose such information.

The study "*Engaging Supply Chains in Climate Change"* by Jira and Toffel, 2013 is the first paper to address under which conditions buyers and suppliers are most likely to coordinate sustainability activities, by looking into the attributes of the buyer seeking- and the supplier providing climate data. Their research shows that when buyers demonstrate commitment to using emissions information and repeatedly request it, suppliers become more willing to disclose data. Especially if the buyer appears to be using the information for future procurement decisions, for example by integrating environmental data into sourcing and supplier evaluation. The greater number of buyers asking for data, the more likely the supplier will provide it. The supplier context also affects their propensity to share climate information. Firms operating in more profitable industries are more willing to disclose climate data because greater bottom lines relaxes resource constraints and increases the ability to absorb the costs and risks of disclosure (e.g. data collection and potential scrutiny). Coercive institutional pressures on suppliers in countries with GHG emission regulations

increased data disclosure from an average probability of 49.5% to 57.4% , as well as the comprehension and quality of such disclosures. The research found no evidence that suppliers within heavy GHG sectors would be less willing to share climate data, however, was it a moderator for buyers' requests on obtaining it (Jira and Toffel, 2013).

Over the past decade, the line of Scope 3 management has evolved towards a stronger emphasis on the effects of stakeholder pressures on emissions tracking. This development reflects the institutionalisation of ESG reporting as both a standard practice and a legally binding requirement in many jurisdictions. Liesen et al. (2015) show that greater climate concerns from stakeholders increase the likelihood that firms disclose quantitative GHG emission. However, stakeholder pressure does not significantly improve the completeness of those disclosures. Indicating that many firms use partial disclosure as a legitimacy tool, releasing selected environmental data for symbolic reasons rather than pursuing full transparency (Liesen et al. (2015). Depoers, Jeanjean, and Jérôme (2016) further elaborate that managers adjust the disclosure of environmental data depending on the stakeholders demands. In general, firms CO2 figures are lower in their CR (ex annual reports) compared to the ones reported through CDP. Causing an inconsistency between reported figures. Managers are found to increase information and traceability of the smaller emissions stated in their corporate report, analysed as a behaviour to enhance the credibility of the data despite the discrepancy across communication channels (Depoers, Jeanjean, & Jérôme, 2016).

Villena, V. H., & Dhanorkar, S. (2020) elaborated scope 3 emission research by looking into *"How institutional pressures and managerial incentives elicit carbon transparency in global supply chains"*. They examine how coercive, mimetic and normative institutional pressures from buyers and industry peers affect suppliers' disclosure of carbon emission, to form a more complete conceptualization of carbon transparency. Coercive pressure refers to the buyer's ability to require environmental disclosure and even the adoption of green management systems, leveraging on the suppliers' financial dependence on key customers. Mimetic pressure captures the competitive force of imitating industry peers' sustainability activities and is raised from the perception of having a successful competitor, which the firm by any means wants to avoid losing market competitiveness to. Normative pressure reflects firms'pursuit of legitimacy by following industry norms of the leading firms, adjusting to environmental reporting standards of market leaders. By using CDP's data on 835 suppliers

in 41 countries, combined with interviews of CDP- officials, members (buyers) and participants (suppliers), the authors found coercive and mimetic pressure to be most effective for suppliers that lack internal climate incentives. While those with established environmental agendas respond more strongly to normative pressure. The study further analyses how external pressures interact with different types of internal incentive structures. It finds that financial incentives (e.g. bonuses) and non-financial incentives (e.g. awards) generate broadly similar levels of transparency, especially when normative pressures are high. Overall, the findings demonstrate that internal and external drivers of disclosure are interdependent and specify when institutional pressures are more or less effective in promoting carbon transparency. The study also provides an early indication that CO_2 data sharing cannot be governed by any single actor alone but instead emerges from the interplay of multiple dynamics across the supply chain (Villena and Dhanorkar, 2020).

For a decade, most contributions remained confined to a buyer–supplier dyadic perspective and therefore failed to capture the broader, system-level implications of scope 3 management across entire supply chains. Another limitation is their use of CDP datasets and experts for methodology. To date, the non-profit organization CDP does remain as an independent global platform through which thousands of companies disclose their greenhouse gas emissions. The resulting environmental data infrastructure constitutes one of the largest sources for climate-related market analysis and CO_2 benchmarking, supported by a highly structured data-collection process based on standardized questionnaires (CDP). However, because the data is provided as aggregated annual figures, it is insufficient for carbon accounting and decarbonisation efforts which require frequent, granular data (by site, product, process, shipment etc.) (Stenzel & Waichman, 2023).

A more recent study in GHG emission reduction for supply chains demonstrates that multi supplier networks and spatial complexity makes data sharing substantially more challenging. Identifying first-tier suppliers as pivotal intermediaries in such settings. In horizontally complex supply chains, firms receive such large volumes of overlapping information that organising and using it effectively becomes challenging. The authors argue that these types of supply chain may require sophisticated shared software and computing methods to create better tracking of GHG information and achieve consistency (De Stefano & Montes-Sancho,

2023). Reinforces this paper's contention that the management of Scope 3 emissions is considerably more complex than earlier literature suggests.

The study by Canal Vieira et al. analyses under which conditions boundary-spanning (communication and coordination activities for connections, interactions and exchanges with external stakeholders) works as a management strategy to establish shared responsibility of GHGs. It was published at a late stage in the development of this paper, yet it has become its primary conceptual reference point, as it is the first to offer a systematic theoretical and empirical foundation for Scope 3 emissions as a shared supply chain issue. Their article *"Making Scope 3 emissions management count: enhancing shared responsibility in the supply chain"* argues that both measurement and reduction possibilities are affected when scope 3 emission is treated as indirect GHGs of one focal firm instead of a collaborative problem across its network. The authors highlight that previous literature on buyer-supplier disclosure fails to explain Scope 3 management in reality, as the focal firms remain to lack full visibility, data and control over distant tiers. A complex supply chain with several actors and dependence patterns diminish the focal firms impact, reinforcing that one sided control must shift towards collaborative network designed initiatives for effective management. The paper provides empirical evidence to why current GHG practices often plateau and why Scope 3 management must become nuanced and networked aware to improve both measurement and reductions strategies (Canal Vieira, Longo & Mura, 2026).

Another key conceptual anchor is Stenzel and Waichman (2023) paper on the importance of primary data sharing through the supply chain, and what barriers hinders firms to induce such initiatives with accurate measures of Scope 3 emission. First when real data of ex materials and transportation is shared among the connected actors it becomes possible to calculate total CO2 on product level, which is imperative for conducting effective sustainability initiatives. On the contrary, scope 3 emission averages or proxies based on accumulated industry data can actually distort firms' climate policy makings. The authors identified legal challenges, missing interoperability and data privacy concerns to be the most difficult barriers for using primary data. Legal challenges refer to firms' knowledge gap of competition law, liabilities and contractual restrictions. Missing interoperability includes different CO2 calculation standards (ex CO2 or CO2e, or unit differences), and data format (data sets are structured differently). Data privacy and confidential concerns is the firms fear to share sensitive

operational or cost data when disclosing granular primary data. These barriers make firms reluctant to even start the process of real data sharing (Stenzel and Waichman, 2023).

2.2 Tensions in Supply Chains

While the Scope 3 emission management literature largely concentrates on how firms obtain, disclose and use suppliers' carbon data, this thesis adopts a tension perspective to interpret these practices. In this view, Scope 3 management is not only a technical and procedural challenge but also a field of persistent contradictions between competing goals and logics that must be navigated over time rather than fully resolved. Prevailing studies within the field of SSCM lack tension research in the specific topic "Scope 3 emission management". Hence, literature on Procurement Sustainability Tensions (PSTs) will work as guidelines when exploring tensions related to indirect GHGs as these are a direct consequence of procurement strategies. In this case study the Scope 3 emission data have the same trail from first tier producers until retailers as the goods have. Nevertheless, examples of tensions have also been mentioned in earlier Scope 3 emission management literature studies *discussion,* including demands for transparency that collide with suppliers' concerns about confidentiality, or ambitious decarbonisation targets that outpace the capabilities and time horizons of upstream partners (Fayezi, Zomorrodi & Bals, 2018).

In addition to the background of this study where the retailer had identified tensions as a real, practical problem, the strongest support for this perspective in the academic literature comes from the work by Fayezi, Zomorrodi and Bals (2018) on procurement sustainability tensions (PSTs). Their study shows that procurement professionals experience systematic tensions when they are expected to pursue triple bottom line sustainability (economic, environmental and social) alongside traditional cost, quality and delivery objectives. These tensions arise both at company level and across the wider supply chain and are shaped by the firm's position in the network, stakeholder expectations and institutional environments. Fayezi et al. identify how conflicting demands from different stakeholders, temporal and spatial legitimacy contexts, and varying power relations make it impossible for procurement to optimize all objectives simultaneously. This forces managers to continuously balance and re-prioritise. This PST perspective closely mirrors the situation in Scope 3 emission management, where procurement decisions determine a large share of indirect emissions, while data, control and responsibilities are dispersed across multiple actors. This thesis

therefore conceptualises Scope 3 emission management as a tension-laden, multi-level process rather than a neutral exercise in information gathering (Fayezi et al., 2018).

This conceptualisation provides a direct link to the theoretical framework presented in Chapter 3. Hahn et al.'s (2015) model of corporate sustainability tensions and Wannags and Gold (2020) supply chain extensions offers a structured lens to classify and analyse the tensions that Fayezi et al. reveal in procurement, and that this thesis expects to find in Scope 3 data management. The framework thus enables a more nuanced analysis of how tensions occur and shape Scope 3 emission practices, building on and extending the insights from PST research into the specific context of supply chain emissions (Hahn et al., 2015; Fayezi et al., 2018; Wannags & Gold, 2020).

3. Theoretical Framework

Building on the definition of tensions introduced in the Explained Concepts section of the Introduction, this chapter presents the tensions framework developed by Hahn, Pinkse, Preuss and Figge (2015) in their research "*Tensions in Corporate Sustainability*" as the main lens for analysing the case. The model is extended with supply chain dimensions of tensions by adding insights from Govindan et al. (2021), Fayezi et al. (2018) and Wannags and Gold (2020) to design an applicable framework for the case study. The extension contributes with important cues where tensions may arise in multilevel Scope 3 data collection and enables guidelines for a more structured data comparison across actors.

3.1 Core Framework: A systematic model for corporate sustainability tensions

In 2015 Hahn et al. proposed a systematic framework to analyse tensions in corporate sustainability, forming a model of the complex nature of tensions which previously had been hard to fully grasp and visualise. The framework was a result of analysing tensions in ESG activities, including environmental, economic and social sustainability at corporate level.
During the research, the authors found that most of the tension did not simply come from different targets in these areas but rather form between different levels in the company, in

change processes and within a temporal and spatial context. Identifying sustainability tensions and accurately understanding their underlying mechanisms is a necessary precondition for managing them. The second part of the framework, which focuses on the management of tensions, offers structured guidance on how such tensions can be addressed in practice and is presented later in this chapter under the heading *Managing Tensions*.

Figure 2.

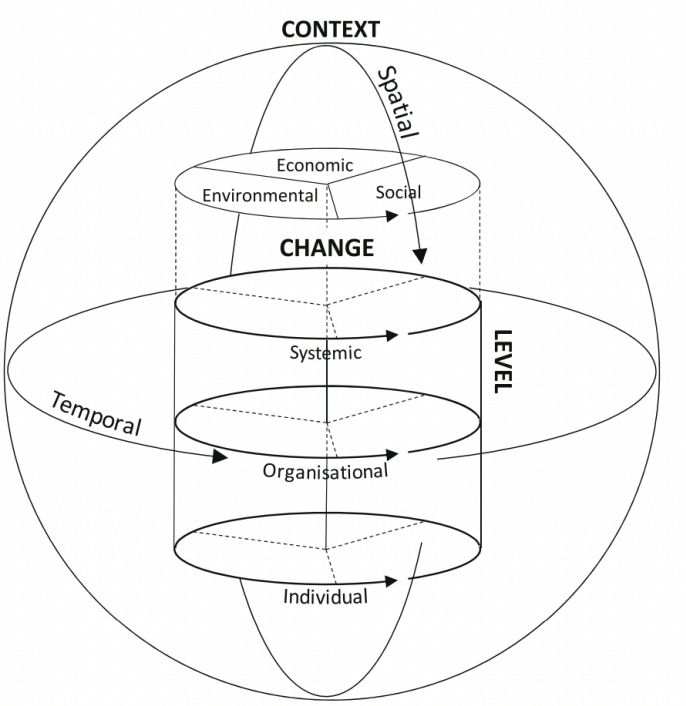


Fig. 2 Hahn et al. systematic framework for sustainability tensions

The ***level dimension*** encompasses the differences between individual, organizational and systemic response to corporate sustainability activities. An employee's individual assessment of a sustainability concern may not be supported at the organizational level. Similarly, an organization's response to environmental issues may fall short when viewed against systemic requirements for sustainable development. Systemic refers to firms' sustainability impact on society at large, formed by institutional pressures and societal expectations regarding pollution, fresh water use, biodiversity loss etc..

The ***change dimension*** captures tensions that arise due to alterations of existing operations, a necessary process for sustainable development. Nevertheless, disagreements about which activities to prioritize and how the transitions of business practices should work remains. Firms can change by pursuing creative destruction where existing organizational forms are abolished and replaced with new systems, or use a dialectical process where the initial operations are adjusted. Tensions ascending from change occur both within and between organizations.

The ***context dimension*** denotes tensions that arise from temporal (time and timing) and spatial (geographical) elements of the sustainability development's context. Temporal tensions occur between long-term sustainability plans and short-term business orientation, for instance future environmental performance versus annual revenue. Spatial tensions are connected to intragenerational equity, which means fair development opportunities for all regions. Organisations that operate sites in both developed and underdeveloped countries may struggle to decide whether to apply home country standards, host country standards or global conducts for their decentralized sustainability activities.

3.2 Supply Chain Extensions

While Hahn et al. consolidate earlier work on sustainability tensions into an integrative framework, while Wannags and Gold (2020) extended it by an actor-oriented dimensionality that encompasses all previous dimensions. Level, change and context dimensions can all occur intra organisationally and inter organisationally. This extension renders the framework particularly suitable for analysing sustainability tensions in multi-actor networks and supply chains. Consistent with prior research, Wannags and Gold emphasise that this distinction is important not only for theoretical refinement but also for enabling companies to develop sustainable management responses (Wannags & Gold, 2020).

3.2 Adapted conceptual framework

The core of Hahn et al.'s model (environmental, economic and social sustainability) is also applicable to this case, since Scope 3 emission data accounting forms part of ESG and thus clearly falls within the domain of corporate sustainability. In this thesis, however, only

tensions that explicitly relate to Scope 3 data management are analysed, with the core sustainability dimensions adapted as follows:

Economic dimension = The economic dimension captures how Scope 3 data collection projects may affect financial targets through costs for system acquisition, training and the time required for data gathering.

Social dimension = The social dimension covers data security, GDPR compliance and related risk perceptions. These issues become socially relevant when the retailer's practices undermine fair conditions along the supply chain through power asymmetries in data access and control, or disadvantaged tiers that cannot comply with data requirements. This raises concerns in terms of human rights and the focal firms community engagement.

Environmental dimension = The environmental dimension covers the project's perceived and actual contribution to CO_2 emission reductions, and becomes critical when more granular measurement reveals higher reported emissions without operational change, when default factors misrepresent local production conditions, or when regenerative practices and carbon sequestration fall outside the system's accounting boundaries.

The second layer of tension dimensions is retained in its original form. In addition, an actor-oriented dimension is introduced as a third layer that conceptually encloses all preceding dimensions. The rationale is that all previously discussed tensions can manifest either intra-organisationally or inter-organisationally. For example, if *Retailer A* aims to be able to report Scope 3 emissions by the year 2027, whereas a key supplier's programme targets 2030, this time misalignment gives rise to an inter-organisational spatial tension (Wannags & Gold, 2020).

Figure 3.

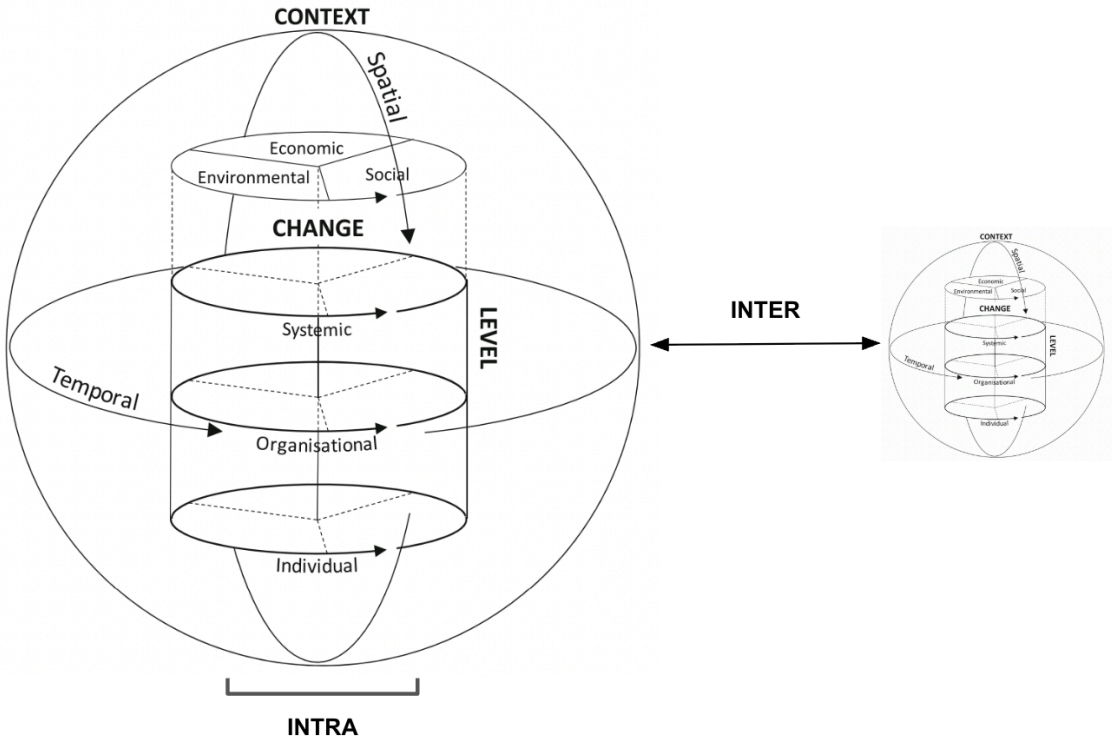


Fig. 3 Adapted conceptual framework for sustainability tensions

3.4 Tensions Management

The second part of Hahn et al.'s framework concerns how sustainability tensions can be managed. It starts from a paradox perspective: the aim is not to eliminate all contradictions but to work with them through acceptance and resolution strategies. Acceptance strategies mean that managers acknowledge competing goals as simultaneously valid and keep the paradox open, for example by reframing tensions as normal and designing decision processes that keep both sides visible in parallel. Resolution strategies mean that managers seek temporal or partial solutions that make tensions more manageable without removing them, for instance by separating conflicting goals across levels (e.g. system vs. firm), time horizons (short-term vs. long-term) or organisational units so that each pole has its own "space". Another resolution strategy is to develop synthesis solutions that introduce a new element or logic capable of accommodating both poles (Hahn et al., 2015).

Table 1.

	Acceptance strategies	**Resolution strategies**
Underlying logic	Distinguish the two poles of the tension, accept it as persistent, and keep both demands visible in parallel.	Transform the tension into a more manageable arrangement, either by separating the poles or by integrating them into a new design.
Method	Opposition – juxtapose contradictory aspects, pursue them simultaneously, without elevating one pole as the best way.	Separation (across time, space or organisational unit) or synthesis (combine the poles into integrated structures or KPIs).
Outcome for the tension	The tension remains and is lived with; both poles continue to operate, generating ongoing improvisation.	The tension remains but becomes more manageable; each pole has its own space, or both are absorbed into a new arrangement.
Typical managerial activity	Reframing tensions as normal; designing decision processes that keep both sides visible; cultivating creative tension and debate.	Setting up parallel pockets, units or time horizons; redesigning incentives and governance so that opposing demands can co-exist.

Table. 1 Strategies for managing sustainability tensions, simplification of Hahn et al. (2015)'s in-depth managerial framework for sustainability tensions.

4. Methodology

4.1 Research Design & Approach

This case study adopts an abductive qualitative research approach to examine how tensions arise when a focal firm collects Scope 3 emission data across its supply chain. As this appears to be the first study of a setting in which the usual barriers to such projects largely have been removed -*through the retailer's decision to acquire and implement a tailored data system for all tiers*- the focus shifts from traditional obstacles to the tensions that emerge in this new stage of Scope 3 emission management. A qualitative design is particularly suitable here, as it enables an in-depth exploration of this complex context and facilitates the identification of tensions that may not yet have been articulated in the existing literature. Furthermore, the abductive approach allows going back and forth between theory and data to continually

reassess which background concepts are needed to interpret emerging empirical findings (Bell, Bryman, & Harley, 2019).

The interviews were semi-structured in order to elicit participants' complete experience of the Scope 3 emission project and related tensions, while still providing guidance and consistency through open, framework-based questions (Bell, Bryman, & Harley, 2019). Because all company representatives were strongly embedded in sustainability work, it quickly became evident that the conversations needed to be well organized to avoid drifting into general sustainability debates. Given the novelty and complexity of the data project, many of the tensions had not yet been explicitly recognised or formalised within the organisation. Anchoring the discussion in questions derived from the extended dimensional framework helped interviewees reflect more systematically on their experiences and bring implicit tensions to the surface (Hahn et al., 2015; Wannags & Gold, 2020). Semi-structured interviews were therefore essential for developing a comprehensive understanding of this previously unexplored research question. The questions were adapted to each interviewee's position in the supply chain to capture inter-organisational tensions linked to tier placement and business context.

4.2 Case and Sample Selection

This case study examines a leading beverage retailer that has adopted a pioneering approach to Scope 3 emission management. The company has an ambitious sustainability initiative in which a tailored Scope 3 data system is offered free of charge to all tiers in the supply chain. This configuration removes many of the usual barriers to Scope 3 emission management and creates a rare opportunity to study how tensions evolve when a shared data infrastructure is in place.

Interviewees were selected through purposive sampling, focusing on company representatives with direct experience of, or responsibility for, Scope 3 emission data management. Sustainability specialists and sustainability managers at the retailer and key suppliers were approached first, as their corporate perspective was central to the aims of the case study. The contact was done through email and linkedin. After the interview they were asked to nominate colleagues at other organisational levels who could provide user-oriented insights and highlight potential level tensions. At producer level, where formal sustainability roles are

uncommon, operations managers were recruited to represent the most upstream part of the supply chain. Because strict non-disclosure agreements prevented the retailer from sharing the names of the firms connected to the data system, additional suppliers were identified and contacted through independent desk research. The firms contributing to this case study varied considerably in size, with annual turnovers ranging from approximately SEK 40 million to SEK 140 billion. This variation reflects the inclusion of actors at various levels of the beverage supply chain and was intended to generate more realistic insights into Scope 3 emission management. Rather than reproducing the large retailer - supplier bias that tends to skew much of the existing SSCM research (Bell, Bryman, & Harley, 2019).

Table 2.

Title	Anonymized Company Name	Business Context	Date	Duration
Sustainability Specialist	Retailer	A retailer selling beverages to end customer	April 10, 2025, 1:59PM	20 Min
Sustainability Specialist	Retailer		May 23, 2025, 9:00AM	60 Min
Project Manager	Retailer		November 28, 2025, 8:59AM	35 Min
Sustainability Manager	Supplier	A supplier that develops, manufactures, and distributes beverages. Large brand portfolio.	November 20, 2025, 12:58PM	50 Min
Retailer Relations Manager	Supplier		December 2, 2025, 11:59AM	33 Min
Operations Manager	Producer	A producer that produces high quality beverages. Manages 10 hectares of arable land	December 2, 2025, 16:19AM	45 Min
Operations Manager	Producer		December 3, 2025, 17:13AM	15 Min

Table. 2 Table of all interviews. The name alias given to each company includes supply chain level to make the result understandable and easy to follow.

4.3 Data Collection

The research process included two separate parts; a pre-study and a main-study.

Pre-Study

The pre-study consisted of a market analysis with a guiding interview, followed by a literature review on the subject. The market analysis included a thorough research of the relevancy of studying CO2 data collection in value chains. This included reading into the European Parliament's sustainability goals, directives and legislative proposals under revision. A review of the private sector's statements regarding CO2 data collection was also completed by looking into public resources such as business news articles and newsletters on companies' websites. Once the significance of the subject was established, a handful of data system providers for carbon footprints reporting were explored to collect insights of the process.

Main-Study

Prior to data collection, it was determined that the number of interviews would be governed by the point of theoretical saturation (Bryman and Bell, 2015), rather than by a fixed target. In practice, this resulted in seven interviews with five informants, of whom two were interviewed twice. The interview with the corporate-level representatives was deliberately longer, as only these respondents were asked the first research question, given their overarching insight into the company's emissions processes. Repeating that discussion at other levels was not expected to add empirical value.

Interview duration ranged from approximately 15 minutes to one hour. No upper time limit was imposed, in order to allow respondents to elaborate where needed and to give the researcher scope to probe promising avenues without being constrained by a preset timeframe. The interviews were conducted online via Microsoft Teams between April and November, and recorded and automatically transcribed with the participants' consent to minimise the risk of misinterpretation (Ahrne and Svensson, 2022).

4.4 Data Analysis

The data analysis was done following a thematic analysis, completed manually as resources as NVivo was concluded to be superfluous for this limited and small case study. Thematic analysis was selected as it offered a structured way to sort the data into interpretive themes that highlight both recurring patterns and notable differences between interviewees.

Step 1: Preparing data. Transcription was verbatim and cleaned. Anonymisation (codes for retailers, suppliers, roles). No translations were used in this stage, to keep close to the original expression. Observational notes on nonverbal reactions and emotions were taken to give context and depth to interview data.

Step 2: First-round coding to overview tension themes from interviews. Using post-it to structure the process. Carefully read all transcripts and coded segments where interviewees described tensions. (e.g. cost vs climate, transparency vs confidentiality, timelines, resources).

Step 3: Categorising themes through the framework. The tension codes were mapped onto the dimensions in the adapted framework: economic / social / environmental; level / change / context; intra- vs inter-organisational.

Step 4: Building higher-level themes

Step 5: Interview excerpts were translated from Swedish to English, and lightly edited for clarity and anonymisation; product names, company names and certain context-specific details have been generalised to protect confidentiality, while preserving the substantive meaning.

Note; During the process I iterated between data, codes and framework to refine both the themes and their placement in the framework.

4.5 Methodological Rigour

Ethical Considerations

The study was conducted in accordance with GDPR. Company representatives were informed about the purpose of the research at the invitation stage, the sampling was then completed through volunteering. All participants were given the SSE consent form with clear policies regarding confidentiality, data handling and the right to withdraw from the study at any time (Stockholm School of Economics, 2025). No names, gender, age or registered company of the interviews are used to prevent disclosure of personal data. All direct company references

that occurred during the interview are also renamed to aliases to protect participants from being identified.

Reliability & Validation

Although this study explicitly examines the beverage supply chain, with no guarantee of transferability of the findings to other industries, it's important to highlight that some of the companies belong to larger world wide groups with operations within other sectors too. The corporate perspective from these participants increase the transferability of the study, that these findings are expected to occur in other value chains too. In addition, the majority of the scope 3 emission data collection tensions identified in the beverage supply chain are directly translatable to other *material* value chains, such as producers claiming negative emission which could occur regardless if we are studying agriculturist as in this context or cotton farmers in the fashion industry.

The interviews were structured in two parts; internal scope 3 emission management, followed by external scope 3 emission management. First, general questions regarding the company's internal scope 3 emission management were asked to the most senior manager at *all* companies, to avoid getting a subjective bias towards the retailers system. In the second phase, project specific questions were asked with follow up questions. All interviews were recorded and re-watched directly to make sure no post clarifications were needed. Perplexity was used as a translation tool when shifting data from Swedish to English, in order to avoid distortion of the company representatives' original statements. Unlike many other bachelor's theses, this study spanned over a year, making it possible to compare the retailer's experience of the case over time. Since the data was consistent over time, it improves the dependability. All together increasing the reliability of the study (Bell, Bryman, & Harley, 2019).

Weakness of the method is the small data sample that makes the transferability questionable. A downside of the longer study span is that actors reflect on the CO2 data system at different snapshots of time, which could arguably weaken the validity of the identified tensions found in the next chapter.

5. Empirics

RQ1: How is CO_2 data collection for Scope 3 emissions organised and carried out at different levels of the retailer's supply chain?

Retailer

Corporate perspective - Sustainability Specialist

The Data System: The first project pilots focused on methodology and the supply chain's ability to contribute with the requested data, the Retailer evaluated whether the received data would be enough to meet their needs and what they ultimately are set to achieve. In time of the first interview, the team was operating their 3rd pilot, and had procured a system support from *System Provider X* explicitly designed to fit the retailer's supply chains carbon calculation needs. *"The intention is that every actor in the supply chain should report their own data through the system".* The retailer does not have the capability to have direct contact with all parts of their supply chain, the main hindrance is that they lack contact details. To a certain extent, the retailer doesn't know what its value chain looks like. For this reason, their strategy is to demand their national suppliers to invite their producers, who in turn should invite their suppliers and agriculturists. The data system is designed to support this kind of joint by joint reporting throughout the value chain. What happens to the product post purchase, for instance recycling, will not be accounted for in the retailers system. The sustainability specialist refers to "cradle to gate" principally. *"That's not to say it's unimportant for us - we're looking into that as well - but collecting primary data in that area is difficult, so for now we're still relying on templates.* It is the system provider who in the end owns all data but every actor who reports also owns their own data.

All the actors who connect to the retailer's scope 3 emission system are able to follow their own total CO2e impact. Users can see their total emission, but also split the data into categories such as *transport* or *fertilizer*, making it useful for their own Sustainability/ESG reporting. Transportation emissions are allocated to the one who purchased it. *"If they made a conscious choice to use partially electrified vehicles, or deliberately selected a transport option with a lower climate footprint. They understandably want to receive recognition for that choice, and for it to be reflected in the product's climate footprint.* Yet, the retailer worries this question might become infected. Another key decision on system design is the metrics, *"What we have been considering is whether we should express it in litres or kilos,*

but with the way the data is collected today, you obtain the product's climate footprint in kilograms of CO_2-equivalents per kilo." They are not sure how the climate footprint will be presented to the customer to make it intuitive for beverages, it might be per liter or serving unit. *"But to keep data collection simple, we need to use a common unit, so it is kilograms of CO_2-equivalents per kilo."* The retailer collects data 4 times a year in connection to their product realization, which is standard in the food industry, adding that reporting level is suitable for the scope 3 data system too. *"It is then each party's responsibility to ensure that their data is accurate at that point. We will base decisions on whether a product may be launched, and whether it meets the requirements set out in the tender, on that data."* Rather than annual reporting, *"it is better if reporting can essentially take place on a flexible basis."* Immediate feedback after investments is seen as central to motivation: *"If you make an investment, for example by installing solar panels at your production facility, you will want to be able to enter that into the platform immediately and see that it has an effect on the product's climate footprint."*

Data Operations: The retailer manages the CO2 data system in-house, highlighting their dependence on the system provider when it comes to development. All costs for the system are covered by the retailer. *"We give away this solution, which is an incentive to make companies jump on the project, it's normally very costly for a company to do a LCA or CO2 emission calculation on their own."* The sustainability specialist expressed very happy feelings about being able to contribute to these types of operations. *"We're removing the barrier, so to speak"*. The data project has full support from the corporate level.

Motives: The retailer's main ambition with this sustainability project is to receive better data and data on product level. "*One of the incentives is that we are connected to science based target initiatives implying we need to halve our emissions until 2030, and we know the majority of our emissions comes from our assortment products. Therefore we need a more legally secure manner to measure emissions of our products*." The sustainability specialist describes the CO2 data system as a tool to endeavor in that direction. Another driving force is the customers. "*We know that eight out of ten customers want to make more sustainable choices but find it difficult to do so, so the intention is also to be able to communicate this to customers, and that's why it's important for this information to be included on the product - because that's what customers base their choices on."* Finally the sustainability specialist at

the retailer takes on a supply chain perspective. *"We know there are a great deal of companies in our supply chain working to decrease their emissions, it's an important matter in our industry, but we have no good way of highlighting and rewarding it".* She explains that the national producers have been very urgent to join because they know their climate footprint is low and competitive. *"They see a benefit in being able to showcase this on their products."* She adds several suppliers are mature when it comes to data reporting *"Other chains are also imposing these requirements, even if they are not necessarily collecting data at product level,"*adding *"We do not want to contribute with increased administration, rather the opposite, we want to contribute with a solution that is as smooth as possible to a process that is very complex."* The overarching approach is to design a system that is as very simple while still grounded in scientific methods. The manager highlights their willingness to address tensions at user level, both in terms of adjusting the data system and through managerial support.

Goal: The retailer has both short term (pilot) and long term related goals. *Short term:* receive data, to be able to start the analysing process at all. "*This is a very educational process for us as well; it's the first time we're doing this, so we don't know much yet". Long term:* The ultimate goal is to use the data system as a tool when planning their assortment. *"We have been quite clear about this in our communications with suppliers." She adds, "If you do not meet the requirements set out in our tenders, it will become increasingly difficult to qualify."* However, she emphasizes this requires that the data system works well and fairly. They'll give advantages to promote data disclosure in the system; free of their climate footprint per product. Furthermore they can give business advantages and insights on what investments they should do to decrease their footprints. *"It will be a learning experience for them too. After all, the overarching goal is for us to reduce our collective carbon footprint",* Adding that their industry is under heavy impact from climate changes, *"It is ultimately about the future-proofing the industry and helping more actors understand how to reduce their climate impact. That is, above all, what this is about."*

Supplier

Corporate Perspective - Sustainability Manager

The Data System: The supplier has several sustainability platforms where they report various data. A global sustainability reporting platform is used, where both environmental and social

aspects are reported and measured, including scope 1, 2 and 3. Another separate CO2 data reporting platform provides the total climate footprint in each scope, based on the aggregated data. This was previously measured every 3rd year but is now being done every year.

Data Operations: The reporting in these systems are done by central purchasing teams. *"For example, even though we are a global supplier having transportation activities in various markets, these are usually acquired by centralized departments",* the reporting is *"based on contracts and invoices to get exact numbers".* The supplier also conducts checks at their production facilities. These are used to control that centralized reported data actually is true.

Motives: "We joined the Science Based Target initiative (SBTi), when we released our first sustainability program. To be able to join you need to have sustainability targets and ways to measure the company's impact. That has increased our sustainability reporting a lot". The legalisation environment influences what areas the supplier focuses on, to exemplify; CSDDD. However, the sustainability manager illuminates that their interest in sustainability goes beyond legal compliance. *"When we launched our global sustainability programme, it was one of the most ambitious in the global beverage industry."*

Goal: "We are continuously sharpening our targets". The supplier says their ability to measure their own CO2 emission is complete, however, they need to find ways to make sure their data is usable for their customers. They have joined several networks in the grocery sector to make sure they are measuring carbon footprints in a homogeneous way and adopt industry shared CO2 calculations methods. *"We are working together with the retail sector to try to establish these calculation tools, and it's not fully in place yet - and not entirely straightforward. They want the data at product level – 'we sell this many units of this product, so what is our climate footprint?' That is quite challenging",* since they collect emissions at bulk level. *"We can do it, but it involves a lot of approximations, because in practice we can only divide by hours and volume to arrive at an indicative figure."* This will be their focus in the near future. Another goal is to keep up with the requirements, she says *"Much of this is still very loosely defined at EU level, and it is about trying to remain compliant with a shifting set of legal requirements, regulations and directives."* It's very complicated and difficult to emphasise it all.

Producer

Corporate Perspective - Operation Manager

The Data System: The producer is an ecological agriculturist and to receive the eco certificate on their products, they need to follow EU regulations, Country regulations and regional regulations. The operation manager highlights that France is beyond when it comes to technology, a lot of reporting is done on paper. "*By law it has to be on paper; all measures carried out in the fields or in the production facility are recorded in a notebook so that everything is traceable."* He says that all the actions must be dated and added in chronological order. It should show all the actions between seed to the final product, such as field activities and additives. The yard keeps track only of their scope 1 emission.

Data Operations: The emission amounts are usually not estimated by the producer itself but rather the ecological certificate stakeholders. The yard logs all their procurements, ex of additives or diesel, and accounts how much they used for a period. They need to document all inputs necessary to calculate the CO2 footprint, however, the final emission number is done by the organizations and departments of inspection.

Motives: Customer behaviour is the one reason behind their climate programs. The manager explains that their product category is always divided into either eco-friendly or not. Fulfilling the customer preferences for eco products is a business opportunity. *"There are customers who specifically ask for organic beverages".* It is well established within the entire organization that the producer is an ecological agriculturist. *"The requirements placed on the estate - which products and additives we are allowed to use and how production is permitted to be organised - are understood as the baseline, the minimum we have to comply with in order to be able to run the business."*

Goal: The producer has a well functioning climate reporting system in the perspective of the French government, EU directions and stakeholders of the eco certificate. It is always stressful however, since the government authorities come unannounced, and sometimes several times in a year, so they can never be lazy with their contemporary reporting methods.

RQ2: What tensions emerge within and between supply chain actors when a retailer mandates reporting into a shared CO_2 data collection system for Scope 3 emission auditing?

Retailer

Corporate perspective - Sustainability Specialist

Onboarding the supply chain turned out to be difficult. *"Many actors and parties in our chains are small… and they are already under considerable pressure from declining sales since consumer demand continues to fall."* At the same time, *"they are affected by the impacts of climate change… which in turn results in lower profits or tighter margins."* That combination creates resistance. "*The combination of already being under considerable financial pressure and then the worry that this will lead to additional work, another administrative burden, is challenging."* The Retailer has had an easier time onboarding first-tier suppliers than with further upstream actors: "*These are actors who may not even know who we are or that their products form part of our supply chains, and that also creates challenges because, as we do not have direct contact, this information and knowledge somehow has to be passed down the supply chain. I think that is more difficult, a bit like a game of telephone. Things tend to get distorted or lost along the way."* She explained why they cannot ease the granularity of the reporting. "For this to become a tool, a steering instrument for us, it has to be at product level. We simply do not see any other way for us" Yet, there is no industry consensus among other FMCG on this.

Employee perspective – Project Manager

She illuminates the CO2 system's legal boundary, the Retailer can only see its importers, not the rest of the chain, which creates an immediate challenge: *"how do we obtain that transparency to understand to what extent it has been adopted and reported on?"*
Anonymised data from the provider showed engagement varied by category; in one category, large suppliers had enough of their own data not to need their sub-suppliers engaged. The pilot's short time horizon was a constant constraint. The joint-by-joint spread upstream was very slow. However, adding *"Overall, I would say that the pilot went well. We achieved an average PDS (Primary Data Score) of 54 %." "A few products even reported up to 92 % primary data."* Larger suppliers reported more than smaller producers: *"The level of knowledge about climate impact is still quite limited, and there is a need for much more*

support in the onboarding process." A second tension is differing footprints across systems: *"you may already have reported a climate footprint in another system, and then you report in this system and the climate footprints differ completely. We will face this challenge for as long as there is no standardised way of calculating it."* The Retailer's ambition differs from neighbouring industries, *"Our level of ambition differs markedly from the rest of the industry. In the grocery retail sector, for instance, companies primarily work with emission factors and averages,"* an averaging approach the Retailer considers insufficient for its own assortment.

Supplier

Corporate Perspective - Sustainability Manager

The sustainability manager says that the CO2 data system will probably become a good tool but currently requires substantial adjustments. The granularity required is itself a tension; *"For example, exactly how much reusable material do you have in the packaging, what share is actually recycled, how were the raw materials grown, and how were they produced?"* Even though the system is granular, some inputs are still multiplied with default-factors that may distort the result. *"There was a default factor for a key agricultural input used in our products. However, the default factor in the system was based on Southern European conditions, which is not accurate, because producers in our context rely on crops that are grown and processed in the Nordic region. In this case, the Retailer handled it very well: they took it on as a case, approached the largest supplier in the category and, with their support, developed a new default value that was tailored to our business, which in turn lowered the calculated climate impact."* A comparability concern follows: *"the best thing for you as a consumer would be if there were one way of measuring it." "A higher degree of standardisation in calculation methods is needed."*

The Supplier is not fully convinced that a retailer-driven CO_2 data flow is right. SKU-level reporting approaches recipe level: *"You need to find a way to get around confidentiality and commercial sensitivities if you are going to report at this kind of detailed level."* On joint-by-joint pass-through, she accepts registering sub-suppliers but holds that educational support must remain with the Retailer. *"In my view, it is ultimately the responsibility of those who own the data, or those requesting it, who are responsible for providing the training."* She also describes how interoperability is structural, *"everyone uses different system providers, and those system providers are competitors." "If the systems do not communicate*

with each other in a good way, then you have to transfer information from one system to another, which is inefficient and time-consuming." The reporting landscape spans far beyond a single firm, the Retailer's tool runs in parallel with the Supplier's global sustainability reporting platform, its CO2 platform, a previous shared CO_2 initiative for the beverage industry (also including the Retailer), and statutory reports to the Swedish EPA, Returpack and the Medical Products Agency. *"It is… not really sustainable,"* she adds with a frustrated laugh. *"This whole area of reporting is not mature yet; there is still a lot that is unclear."* In addition to the operability tension, she evaluates the Retailer's system as only partly useful. "T*hat does not materially benefit us as a company, since we operate through many other channels and product lines"*, around 70 % of production is resold elsewhere. Highlighting again *"The problem is that it leads to a very large number of different systems."* The Retailer's system will only work for some of their skus.

Employee Perspective - Retailer connections manager

The relations manager is optimistic about the Retailer CO2 data system, but adds, *"They are driving this project forward in an impressive way, but it creates significant challenges for us as a company."* They have experienced geographic and legal frictions upstream. "*As long as production takes place in the Nordic region, it has worked very well, but since we are a large company that purchases products from our wider universe, i.e. 2PP or 3PP providers, they do not use the same methods for collecting data." "Just because we have signed agreements to purchase each other's products and to safeguard each other's brands, this is still knowledge that can actually become business-critical."* The technical artefact of the data system is the easier part, but *"Who on earth is supposed to own the data?"* The Supplier has not delegated reporting responsibility downstream because engaging non-Nordic suppliers is too demanding: *"As soon as I need to contact people in other countries, a hierarchical effect comes into play… and I face a very high threshold in having to explain what it is we are doing."* Instead, the team has worked with the Supplier's internal sustainability programme's specialists in transport, energy and procurement who already accommodate all upstream emission data.

Practical experience surfaces several technical frictions. *"One of the challenges I encountered was that the tool by System Provider X was still in a beta version. Since we manufacture products that are delivered in litres, whereas they require the information in kilograms, this in itself creates a significant complication." "It honestly made me quite*

annoyed." At this point she takes off her cardigan and, half jokingly, remarks that she is getting so worked up that she needs to remove a layer. Luckily the density of a litre of beverage was almost exactly a kilo. The overall experience was that they had to guess: *"It was a challenge when we had to add ingredients, because not all of them were available in the list and then you had to register them manually, and that was where people started improvising a bit."* Help from the system provider did not always reconcile: *"The calculation they provided did not align with our internal calculations… as it did not, for example, take into account various certificates that also affect the calculation." "I had expected some things to work better than they actually did." "I do not consider this acceptable; it must be possible to resolve it in the tool in some way."* Educational sessions tend to be anchored in the retailer's leading beverage category, which the supplier doesn't supply, making them *"end up listening to presentations that are not relevant to us at all."* She would prefer category-specific sessions. Despite the friction the tool is useful: *"single-use glass bottles have a higher impact than aluminium cans… It gave us much more clear-cut evidence.*" She frames the overall fairness limit clearly: *"Personally, as someone who is deeply engaged in the climate crisis, I think it is absolutely fantastic. However, in my role as an employee at the Supplier, I can see that the System Provider X's tool is not yet fair or fully functional."* An SKU from a French supplier may end up with a higher footprint than one from a smaller Chilean supplier purely because their downstream logistics are reported differently. Her closing reflection moves beyond the tool: *"The main problem is not related to the System Provider X; it concerns sustainability more broadly. There is no common unit or shared benchmark, and that is really the core challenge."* She believes they have to work together with the retailer to come up with a solution for the legal aspects of the data. One possible solution could be that the system supplier owns all data, and that it's not open for the connected actors. *'I also see problems with that, if we do not agree with the data we receive."* In her opinion, building a data system is a minor achievement, coming up with a solution for the legal aspects of the data is the million dollar question. *"Who on earth is supposed to own the data?"*

Producer

Corporate Perspective - Operation Manager

The Producer is concerned about the administrative burden that will eventually reach the estate. *"It would be a major financial burden for a small agriculturist",* the system is free, but someone has to look after it. *"I am generally positive about having traceability in the supply chain, but redirecting money to run data systems and additional administration would be tough."* Reporting cadence is decisive: *"Annual reporting would be the best option; then we could simply go through all the receipts for fuel and so on."* Educational support would be necessary: *"We're not Neanderthals in France [laughs], but as I said, we write things down in a notebook."* From the estate's perspective they already comply with all relevant regulations and regard current practices as sufficient; many estates, including his own, would not engage with the Retailer's digital system even if it became a listing condition, since the Retailer represents only a minor share of total sales.

Part of the Producer's activity is regenerative. *"We manage arable land, and our crops absorb carbon dioxide from the air."* He explains that it is good for the environment but extremely difficult to measure. *"Once the beverage is fully produced on the estate -including the glass bottle- it can be net zero."* Green manure and carbon-sequestering plant species are used but he knows of no way to convert these effects into negative CO_2 figures. If products are to be stamped with a footprint, he considers it unfair if the system accounts only for negative impact: *"The majority of the difficulty lies in distribution; that all happens off the estate… it is also what generates most of the emissions."* On confidentiality, he sees no problem with detailed disclosure. *"What makes a difference is not the recipe." On cost, however, the initiative is demotivating as currently framed: "If it were promoted by the retailer, like, 'Hey, if you get on board with this, you get a fast track into the standard assortment,' then sure. That would be insanely attractive."* Without that, additional cost does not make sense. An LCA assessment is not a sufficient incentive: their consumers care more about the ecological certificate than a CO_2 number. He evaluates this as a trade off situation between marginal cost of the CO2 tool to marginal sales at the retailer. The Producer would leave the Retailer if the cost of learning, adopting and propagating the system exceeded their marginal sales at them. He also flags a systemic risk: only large companies are currently financially able to engage in CO_2 reporting, which places the burden on larger actors and risks de facto discrimination of smaller producers. Those with already thin margins may be forced to sell their brands, enabling consolidation of the market.

RQ3: How are these tensions currently managed by supply chain actors, and which strategies do interviewees suggest?

Retailer

The Retailer's response clusters into four practices. First, a softening of the requirement. The sustainability specialist suggests *"a more lenient approach, where you do not say 'you must have this PCF' or set strict threshold values, but instead state that a prerequisite is that you report, for example, while not necessarily attaching any requirements to the actual result",* with ambitions raised gradually. *"This is one tool among many, a complement to our existing toolbox."* They will not base assortment steering on this alone. *"As a major requirement-setter, we also have to be considerate and generous, and we are very willing to make adjustments along the way,"* combined with consistency, *"have the courage to stand by what you are doing and signal a clear direction; if you do that, the resistance will eventually subside."* The Retailer collaborates with similar retailers worldwide: *"We are the first to do this, but the idea is that when the other similar retailers follow, they will use the same method, so that at least the same type of data is collected." The Retailer is also open to working with domestic competitors. "We already collaborate with them in other areas through multi-stakeholder initiatives that address shared challenges in our value chains… Working together in this way is therefore not unfamiliar to us; on the contrary, we actively welcome this kind of dialogue."* She even adds, *"Tension does not necessarily have to mean something negative."*

In the future, the Retailer will gradually reposition its role from delivering support to financing it. Because confidentiality settings prevent the Retailer from seeing the data its suppliers report, quality assurance must increasingly sit with the system provider, says the project manager: *"It is still the system provider's platform, and they need to deliver training and ensure that this kind of support is available. "We may be shifting our role from being the ones who provide support to, frankly, paying for our system provider to ensure that such support is in place."* Incentives are also being explored, the Retailer suggests they could *"purchase sustainability licences for everyone who reports"* so they can use their own footprint externally.

Supplier

The Supplier's strategies fall into two groups. First, organisational restructuring: a new function, Group Sustainability Finance, expands ownership of sustainability reporting beyond the sustainability department and into finance, in response to financially audited disclosures from the EU and CSRD. The sustainability manager says, *"More and more departments in the group are taking sustainable responsibility."* Second, conditional delegation paired with centralised support. The sustainability manager accepts registering sub-suppliers but holds that educational and training responsibility must remain with the Retailer. The relations manager extends this with the concrete suggestion that the Retailer prepare standardised onboarding materials that the Supplier can simply forward. She also wishes the sessions be category-specific rather than general. *"It would also be very helpful if the retailer made it possible to invite people to meetings and forums, enabling both us as the main supplier and our external partners to participate."*

Producer

The Producer offers a sharply different set of responses, reflecting its position at the upstream end. First, alignment of reporting pace with the estate's existing rhythms. Annual reporting would let the estate use receipts and inventory records already on hand. Second, incentive design at the Retailer's end as the benefits framed as climate insights or LCAs are insufficient. *'If it were promoted by the Retailer, like, "Hey, if you get on board with this, you get a fast track into the standard assortment," then sure. That would be insanely attractive.*" But taking the additional costs without a beneficial incentive from the retailer simply doesn't make sense for a small producer. In addition he proposes methodological inclusiveness. The system must record negative emissions for regenerative producers, or footprints will systematically penalise those who do most for soil and biodiversity. Lastly, accountability transfer, the Retailer must own the management of these tensions, as the estate considers its current sustainability practices sufficient and the Retailer represents only a small share of sales. In a hypothetical scenario in which CO_2 reporting became standard across Europe, the operation specialist says that compatibility across tools would be essential to limit administrative work.

Despite different starting points, all three tiers converged on one suggestion; a shared system at industry or EU level would reduce duplication, although interoperability between separate systems may be a more realistic short-term goal. Recurring tensions cut across actors: cost vs. administrative burden, transparency vs. confidentiality, granularity vs. standardisation, Nordic vs. non-Nordic practices, short pilot horizon vs. the time needed for joint-by-joint propagation, procurement regulations vs. producer fear of deselection, technical limitations vs. ambitions placed on the tool, and individual strategies vs. systemic coordination. These patterns form the analytical material for Chapter 6.

6. Analysis

6.1 Interpretation of themes through framework

A large number of tensions emerged from the in-depth interview sessions with the three actors representing different tiers of the beverage supply chain. The nature of these tensions proved complex, and the extended framework combining Hahn et al. (2015) and Wannags and Gold (2020) turned out to be well suited both for thematising the most readily identifiable tensions and as an analytic tool for surfacing those that were harder to recognise. Each tension was mapped according to its character using (trade-off, compromise or paradox), its core dimension within the framework, and by the inter- versus intra-organisational extension. Two main patterns emerged: intra-organisational tensions were predominantly descended from the inner triad and the level dimension, whereas inter-organisational tensions more often had a change or context origin. The character of the tension appeared to be situational rather than tied to specific dimensional properties. Since the case yielded a comparable number of intra- and inter-organisational tensions, the analysis below is structured around these two scopes. Table 1 presents the full mapping, see below;

Table. 3 Identified tensions in the case, mapped onto the extended Hahn & Wannags Framework.

Tension example	Actors involved	Tension character	Core framework dimension	Inter / intra	Case-specific themes (extension)
A salient context tension concerns the temporal mismatch in preferred reporting frequency: the retailer wants flexible, near-real-time updates, while the producer prefers annual reporting aligned with existing receipt and inventory routines.	Retailer & Producer	Compromise	Context – temporal	Inter	—
The system has no technical means of recording regenerative carbon absorption from cover crops or arable land, producing footprints that systematically disadvantage producers practicing carbon-sequestering agriculture.	Retailer & Producer	Compromise	Context – spatial	Inter	Technical (no method for negative emissions)
The supplier's employee-level representative is highly favourable towards the data system, whereas corporate level is critical, since system interoperability across competing platforms consumes too many internal resources.	Supplier	Paradox	Level – individual vs. organisational	Intra	Technical (interoperability)
Producers fear being deselected if their CO_2 footprint appears high, although the retailer's market position makes deselection on emission grounds constitutionally impossible.	Retailer & Producer	Compromise	Change	Inter	Meta (counter-factually unsupported)
The supplier objects that transportation accounting is unfair – a beverage from France may show a higher footprint than a beverage from Chile – while the retailer claims to have built a fair reporting solution for transport into the system.	Supplier & Retailer	Compromise	Context – spatial	Inter	Meta (perceived asymmetry)
The supplier finds the system both too reliant on templates for key ingredients and, at the same time, too complex and time-consuming having to do manual adjustments with primary activity data.	Supplier	Compromise	Inner triad – Economic vs. Environmental	Intra	Technical (system design / architecture)
The producer feels the system fails to capture regenerative inputs and on-estate practices, yet a system detailed enough to do so would directly contradict the need for a simpler and faster reporting routine.	Producer	Compromise	Inner triad – Economic vs. Environmental	Intra	Technical (system design / architecture)

Competing CO_2 data system providers do not communicate with each other, forcing actors to report into multiple parallel platforms and undermining the value of the underlying granular data.	Supplier & Producer	Paradox	Change dimension	Inter	Technical (interoperability)
Reporting requires kilograms while the beverage industry operates in litres, creating constant manual conversions and a high risk of unit-mismatch errors when data is entered into the system.	Supplier & Retailer	Trade-off	Change dimension	Inter	Technical (unit calibration / system architecture)
The retailer must design a system simple enough for foreign producers unfamiliar with CO_2 reporting, yet sophisticated enough to remain relevant for Nordic actors who are mature in data and wish to communicate sustainability efforts to consumers.	Retailer	Paradox	Context – spatial	Intra	Technical (system design / architecture)
The pilot's short time-horizon prevents a fair evaluation of the system, since joint-by-joint propagation upstream is inherently slow and engagement is still rising at pilot closure.	Retailer	Compromise	Context – temporal	Intra	—
The retailer prefers to retain control over the data project but must increasingly delegate quality assurance to the system provider, since confidentiality settings prevent it from seeing supplier-reported data.	Retailer	Trade-off	Change dimension	Intra	Meta (control-loss perceived)
As the first focal firm to deploy this kind of system, the retailer carries a high innovation risk with no industry precedent, no roadmap, and limited visibility on whether the chosen approach will succeed.	Retailer	Compromise	Change dimension	Intra	Technical (no precedent system)
Procurement regulations limit the retailer's ability to act on supplier assessment results, preventing it from using system results to deselect actors with higher footprints, even where this would otherwise be most effective.	Retailer	Paradox	Level – organisational vs. systemic	Intra	—
It is structurally unclear who owns the granular data flowing through the system – the focal firm, the reporting actors, or the system provider – which complicates governance, quality assurance and any downstream use.	Retailer & Supplier	Trade-off	Inner triad - Social vs. Level – org. vs. systemic	Inter	Technical (system architecture)
The retailer claims to absorb all system costs, yet both supplier and producer experience high administrative costs, as the free tool still has to be operated alongside the producer's manual book and the supplier's existing systems.	Retailer vs. Supplier & Producer	Paradox	Inner triad – Economic vs. Change	Inter	Technical (interoperability)
The retailer's tool covers only around 30 % of the supplier's SKUs (70 % is resold elsewhere), making the reporting effort hard to justify economically – although it has	Supplier	Compromise	Inner triad – Economic vs. Environmental	Intra	Technical (interoperability)

delivered concrete emissions insights for the SKUs it does cover.					
The supplier resists recipe-level reporting due to commercial sensitivity, while the producer sees no risk in disclosing ingredients, since taste depends on terroir – exposing a paradoxical experience of confidentiality across tiers.	Supplier vs. Producer	Paradox	Social	Inter	Meta

Table. 3 Note. Tension character follows Smith & Lewis (2011) and Fayezi et al. (2018): trade-off = either/or, compromise = negotiable, paradox = simultaneously valid demands. Core framework dimensions follow Hahn et al. (2015); intra/inter follows Wannags and Gold (2020). Case-specific themes denote the technical and meta dimensions proposed in Chapter 6.

6.2 Intra organizational tensions

Intra-organisational tensions in this case study clustered around two dimensions in particular: the inner triad of economic, environmental and social aspects, and the level dimension. Several inner-triad tensions surfaced as compromises between competing demands placed on the same actor by the same project. The supplier, for example, simultaneously regarded the system as too reliant on templates for key ingredients and as too complex and time consuming to populate manually with primary activity data. Causing an economic versus environmental tension contained entirely within the firm's own boundary. A similar conflict was described by the producer who wanted a system detailed enough to capture regenerative inputs and on-estate practices, which contradicted the need for a simpler and faster reporting routine. The most important intra tension to highlight regards the data tool's usefulness; The supplier's sustainability manager further observed that the tool *"does not materially benefit us as a company, since we operate through many other channels and product lines"* since the retailer's system covers only around 30 % of its SKUs, making the reporting effort hard to justify economically even though the resulting insights are genuinely useful for their sustainability work, stated by the retailer relations manager *"aspects became very tangible and interesting to see. It gave us much more clear-cut evidence"*. This tension is complex and raises the question of whether retailer-designed data systems are an adequate solution, given that they function only as partial tools for upstream tiers in the value chain. Furthermore, a profound level dimension tension is analysed to occur at the supplier between an individual and the organization. The retailer connections manager, at the employee level, is highly favourable towards the CO_2 data system, stating: *"Personally, as someone who is deeply*

engaged in the climate crisis, I think it is absolutely fantastic." In contrast, the organizational stance is markedly more sceptical about the system's usefulness, both in the short and long term, as reflected in comments such as *"If the systems do not communicate with each other in a good way, then you have to transfer information from one system to another, which is inefficient and time-consuming … It is not really sustainable."* This contrast constitutes a textbook illustration of a sustainability tension between an employee with strong personal climate engagement and a firm that must prioritise limited resources and multiple commercial logics. In each of these cases the tension is real and persistent, yet contained within the actor's own organisational boundary, which is what places it on the intra-organisational side of the mapping.

6.3 Inter organizational tensions

Inter-organisational tensions, by contrast, arose more often from the change and context dimensions. This is analysed to follow from the structure of the case itself; it is difficult for an employee at one organisation to be sufficiently familiar with another firm's internal sustainability decisions to register inner-triad or level frictions across the boundary, whereas misalignments in time, geography and pace of change become visible as soon as data flows between actors. Two change dimension tensions emerged repeatedly. First, the system interoperability gap mentioned by the supplier's sustainability manager: *"Another aspect here is that everyone uses different system providers, and those system providers are competitors,"* which forces actors to operate multiple parallel platforms and dilutes the value of the underlying granular data. Second, unit calibration: *"tool by System Provider X was still in a beta version. Since we manufacture products that are delivered in litres, whereas they require the information in kilograms, this in itself creates a significant complication,"* a friction that the supplier employee describes generating ongoing manual conversion work and a measurable error risk. These change-dimension tensions are particularly significant, as they underscore the need for retailers to adopt a supply chain perspective when acquiring and designing Scope 3 data systems. A salient context tension concerns the mismatch in preferred reporting frequency between the retailer and Producer. From a temporal perspective, the retailer aligns the CO_2 system with its existing quarterly product realisation cycle and even aspires towards near real-time updates after major investments. Highlighted by the sustainability specialist, *"We also believe that annual reporting is too infrequent … if you make an investment,..., you want to be able to enter that immediately into the platform and*

see that it affects the product's carbon footprint ... we believe this is important for maintaining motivation." Arguing that decisions on tenders and listing should rest on up-to-date data. In contrast, the Producers operations manager emphasises the administrative burden of frequent reporting, highlighting that detailed emissions data *"would be a major financial burden for a small farm"* and that anything beyond quarterly—and especially daily reporting—would effectively require hiring an additional full-time employee. For the Producer, *"annual reporting would be the best option; then we could simply go through all the receipts for fuel and so on*," which would make the task compatible with existing routines and limited staff resources. The retailer's CO_2 data system also generates an important spatially inflected environmental tension around how carbon is accounted for. Producer described green production practices and emphasises that *"we manage arable land, and our crops absorb carbon dioxide from the air,"* in their view a bottle could be "net zero" once it leaves the estate. Yet these locally generative effects are not captured in the retailer's footprint metric. At the same time, the manager notes that *"the majority of the difficulty lies in distribution ... glass is heavy, liquid is heavy,"* so the system primarily attributes emissions to transport and packaging downstream of the estate, while ignoring the producer's sequestration. This creates a context spatial tension: a standardised product-level footprint, designed to support portfolio steering and consumer comparisons, clashes with producers' claims that their particular agro-ecological context delivers unrecognised negative emissions. Making the single CO_2 number on the shelf appear environmentally reductive and, from their perspective, unfair. These are examples of actors holding competing yet mutually dependent expectations on the CO2 data system. Tensions arise between organisations rather than inside a single firm due to the change process that the project requires and its context.

6.3 Residual themes: Meta and technical tension

Some patterns recurred across several interviews and could not be adequately classified within the existing dimensions, after careful analysis this study proposes two additional dimensions; a technical and meta dimension.

Technical Dimension

The empirical material suggests a further underlying technical dimension of sustainability tensions that is not fully captured by existing frameworks (Hahn et al.; Wannags & Gold, 2020). Across cases, seemingly mundane issues such as unit conversion and system

interoperability repeatedly trigger or amplify other tensions. For instance it amplifies the tension regarding different data standardisation as it causes heavy resource allocation to operate these simultaneously, the original tension would perhaps not even exist if there was interoperability. An example is the supplier's remark on the difficulty of measure conversion. *"One of the challenges I encountered was that the tool by System Provider X was still in a beta version. Since we manufacture products that are delivered in litres, whereas they require the information in kilograms, this in itself creates a significant complication." "It honestly made me quite annoyed."* And the suppliers sustainability manager's conclusion of the reporting landscape *"It is… not really sustainable".* These examples indicate that technical frictions around data formats, measurement conventions and interoperability form a kind of infrastructural substrate in which economic, environmental, social, level, change, context, intra and inter tensions are enacted. Rather than a separate category of tension alongside these dimensions, the technical dimension can be conceptualised as a new core layer at the centre of the inner triad: a technical backbone that conditions how all other tensions materialise. It is added as a backbone of the model to underpin how it forms an infrastructure in which other sustainability tensions become sharper and harder to manage, even among these actors who share similar goals and are supportive to joint sustainability efforts.

Meta Dimension

The meta dimension refers to "made up" tensions that come from worry or misinterpretations between actors. Several times the case study revealed how one parity could experience tensions that were not anchored in real practices, but arose due to imagination. One practical example is when the supplier opposes the way transportation is added to the PLC, since they own their logistics, saying it's *"unfair if, say, a beverage we buy from France gets a high footprint while beverages from Chile look better on paper".* But the retailer also worries about transportations, and had specifically added a reporting solution in the system to make it fair, as the sustainability specialist said *"They understandably want to receive recognition for that choice, and for it to be reflected in the product's climate footprint."* Although the actors want the same solution in the CO2 data system, even though the tension does not "exist" the belief that it does still causes real implications and turns the non tension into an actual tension, since in this case the supplier managers waste resources in terms of time and energy focusing on an unreal issue. That is a mission doomed to fail since the tension never existed in the first place. This analysis believes it is important to bring these meta tensions to surface

as they cause managerial effects, and hence must be discovered and managed in CO2 data collection system implementations.

6.4 Towards an Extended Framework

Building on the residual patterns identified above, this study proposes an extension of Hahn et al.'s (2015) integrative framework, supplemented by Wannags and Gold's (2020) actor dimension. Figure 5 introduces two additions. First, the technical dimension is positioned as a backbone at the centre of the economic, environmental and social triad, reflecting that it underpins and amplifies every other tension rather than functioning as a parallel category. Second, the meta dimension is placed as a separate bubble outside the model, since it originates in actor perception rather than from practical substance. The extension is additive: it preserves the dimensional logic of the original framework while making visible two recurring patterns that its existing categories cannot accommodate.

Figure 4.

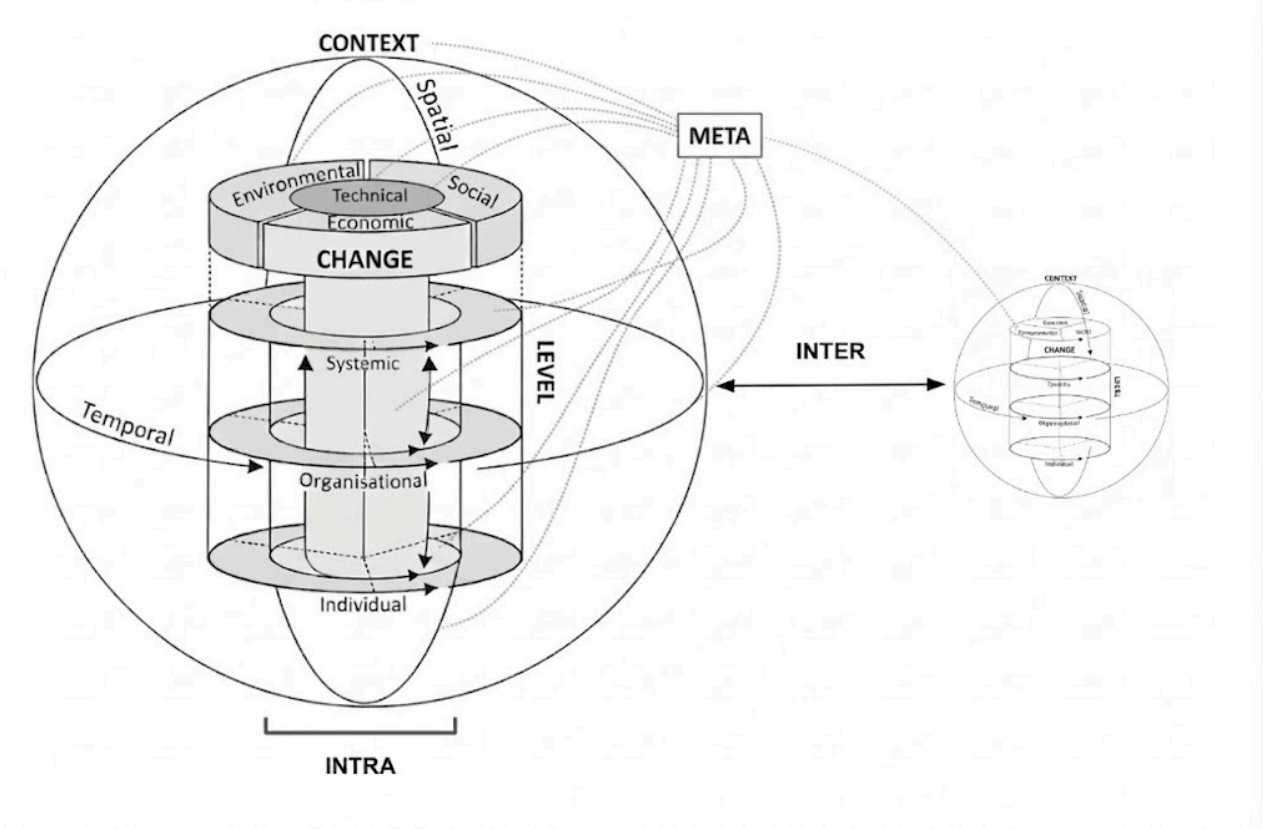


Fig. 4 Extended systematic framework for sustainability tensions

6.5 Management

As a result of the multidimensional nature of the tensions identified above, the CO_2 data system management requires both compromises between short-term efficiency and long-term sustainability; some tensions must also be pursued in parallel across organisational boundaries rather than definitively resolved in favour of one side. Consistent with Hahn et al.'s (2015) second-part framework, the actors' responses fall into acceptance and resolution strategies, the latter further divided between separation and synthesis.

Acceptance

Acceptance strategies are most visible at the retailer. The sustainability specialist acknowledges that *"there is an inherent resistance to change in general"* and reframes the friction as part of the process rather than an obstacle to it: *"Tension does not necessarily have to mean something negative."* The project is openly described as one that "almost inevitably entails tension and discomfort along the way," with the team choosing to live with the contradiction rather than design it away. This is acceptance in Hahn et al.'s sense: both poles of the tension are kept visible, and the sustainability agenda is pursued in parallel with the operational reality of supplier resistance.

Resolution

Separation strategies are most clearly used by the retailer too. The soft-launch approach is a temporal separation of the reporting obligation from the performance threshold: *"a more lenient approach, where you do not say 'you must have this PCF' or set strict threshold values, but instead state that a prerequisite is that you report"*. The ambition is raised gradually, allowing the requirement and the result to live at different points in time. A second form of separation runs through the retailer's gradual repositioning from delivering support to financing it: *"We may be shifting our role from being the ones who provide support to, frankly, paying for our system provider to ensure that such support is in place",* said the project manager. Responsibility is redistributed across organisational units rather than reconciled, leaving the underlying tension between control and confidentiality intact but more manageable.

Synthesis strategies are less common but still visible in the case. The suppliers new Group Sustainability Finance function expands ownership of sustainability reporting from the sustainability department into finance, integrating two organisational logics that previously sat apart.

7. Discussion

The empirical material and analytical mapping of tensions provide a picture of Scope 3 emission management that is more conflicted than existing literature anticipates. Many of the conditions that prior research identifies as enablers of supplier disclosure are present in this case. Including; clear communication of how data will be used, full corporate backing, free access to a tailored system, and a focal firm willing to absorb cost on behalf of the chain. Yet, tensions persist along every dimension of the extended "Hahn-Wannags" framework, including the two new dimensions this study has proposed.

7.1 When clarity is not enough: revisiting the buyer commitment mechanism

Jira and Toffel (2013) proposed one of the most cited mechanisms for supplier disclosure: when buyers demonstrate commitment to using emissions information and repeatedly request it, suppliers become more willing to share data. Especially if the buyer is to integrate the data into procurement decisions. The Retailer in this case fulfils that condition almost to the letter. The sustainability specialist says explicitly that their CO2 data system will be used for assortment steering: *"If you do not meet the requirements set out in our tenders, it will become increasingly difficult to qualify."* Although the project has corporate backing, runs across several pilots, and is communicated repeatedly to the supply chain, the empirics show that this clarity has not dissolved the underlying frictions. Suppliers do report *"a PDS of 54 % was reached during the pilot"* but tensions persist around confidentiality, interoperability, fairness and burden allocation. The retailer relations manager at the Supplier captures the limit of the mechanism plainly: *"The main problem is not related to the System Provider X; it concerns sustainability more broadly. There is no common unit or shared benchmark, and that is really the core challenge."* The implication is that Jira and Toffel's commitment mechanism is necessary but not sufficient in this case study. In a setting where the technical and structural conditions for smooth sharing of data remain unresolved (different units, different system providers, recipe-level sensitivity, unequal exposure across SKUs), the buyer

evidently cannot on its own resolve the tensions it surfaces. This is consistent with Villena and Dhanorkar (2020), who showed that disclosure emerges from the interplay of multiple dynamics, and with Liesen et al. (2015), who found that pressure for disclosure does not automatically translate into completeness. The case adds a sharper point: even when the buyer is unusually transparent about end use, it leaves tensions unaffected. Indicating further research is necessary for understanding what brings motivational effects when a retailer acquires a supply chain CO2 reporting tool and wants its tiers to disclose data into it. One reason why this study's results differ from earlier work may be that previous buyers predominantly requested template data, usually annual CDP figures. This involved a yearly compilation of CO_2 benchmarks and aggregated totals, supported by a highly structured collection process based on standardised questionnaires. In contrast, the demand examined here concerns more granular product-level data at shorter intervals, where clarity of expectations does not appear to have the same pacifying effect. When organisations work with such systems, they may therefore have to accept the persistence of tensions despite clear communication and incentives, and instead focus on how these tensions can be managed.

7.2 Extending the management repertoire: communication and its long-run limits

Three established managerial strategies for handling tensions were observed in the previous chapter. However, no solution was presented for the meta dimension neither by existing framework or empirical material. Since meta tensions stem from misperceptions rather than from concrete contradictions, they neither require acceptance or resolution. In theory, clear information would be enough to dissolve them. Communication is therefore suggested as a fourth strategy to cope with meta sustainability tensions.This raises the question whether such patterns qualify as tensions in Smith and Lewis's (2011) sense, since that distinguishes them from persistent contradictions, paradoxes or trade offs. Yet the case shows that the meta dimension is consequential, if left unaddressed, and perceived tensions consume managerial attention as if they were real. Nevertheless, this distinction is still clarified in the proposed framework by visualizing the meta tension as a separate bubble rather than nested in the dimensional core (Figure 5). From the author's perspective, the analysis implies that acceptance, separation, synthesis and communication form a useful repertoire for navigating the current pilot stage of the CO2 data system. A more critical observation is that these strategies are not necessarily sufficient over the longer run since the technical dimension

proposed in Chapter 6 acts as an amplifying mechanism beneath every other tension. This risks pushing tensions that today register as compromises towards a trade-off character over time as the project scales.

7.3 The shared-tool fallacy: why a sophisticated CO2 data reporting system is not the resolution

A second prominent argument in recent Scope 3 literature is that complex multi-supplier networks require sophisticated shared software and computing methods in order to track GHG information consistently (De Stefano and Montes-Sancho, 2023). The Retailer's project is precisely such an attempt. Despite this, empirics show that the deployment of a shared advanced data tool is not a solution. Even though it was designed to overcome common environmental barriers, the tool itself becomes a locus of new, difficult to manage sustainability tensions; unit incompatibilities (litres vs. kilograms), templates calibrated to the wrong geography, recipe-level confidentiality risks, beta-stage functionality that forces actors to "improvise", and a system boundary that the Retailer cannot see across are empirical refutation of the idea that a sophisticated shared software is the sufficient solution. The underlying reason is structural. Large suppliers operate in multiple value chains across several sectors and are required to report by many customers, into multiple systems in parallel. Even a sophisticated tool for a whole industry or one retailer's value chain, becomes one more parallel system rather than a substitute for the others. The Supplier's sustainability manager describes their present reporting landscape; Global environment reporting platform, CO2 reporting platform, the Retailer's PCF tool, an earlier shared beverage-industry initiative, internal group systems, statutory reports to Returpack and the Medical Products Agency, and concludes with a frustrated laugh: *"It is… not really sustainable."* This is the reason for why this study has proposed technical tension as a foundational "backbone" dimension rather than an extended category. The technical layer underwrites all dimensions in Hahn et al.'s framework of economic, social, environmental, level, change and context tensions simultaneously, and cannot be designed away by a single firm or a single industry. Canal Vieira, Longo and Mura (2026) argue that Scope 3 must be treated as a network-level problem rather than the responsibility of one focal firm. This case supports that diagnosis empirically and extends it: a network-level treatment requires the technical layer to be network-level as well; supply chain orientation is not enough in this complex market structure.

7.4 EU Regulation simultaneously demand and constrain

Contemporary EU regulation simultaneously demands granular Scope 3 data and constrains the conditions under which it can be shared. The CSDDD obliges large companies and groups to identify and limit value-chain impacts, through required Scope 3 emissions audited disclosures. At the same time, EU competition law, the GDPR and contractual confidentiality protections constrain what data can be moved between independent actors in a supply chain. Stenzel and Waichman (2023) identified legal uncertainty and confidentiality concerns as barriers to sharing of activity data. The empirical material in this case study confirms their theory. The Supplier's relations manager frames data ownership as *"the million-dollar question*". Both the retailer and the supplier are unsure if the reported data would remain valuable if it was only controlled by the system provider, to meet confidentiality terms, and disclosed as final results for each actor's SKU. The supplier thought it could become problematic if they did not agree with the numbers. Read together, contemporary EU regulation does not only set the ambition for Scope 3 data; it also reinforces the tensions identified in this study.

8. Conclusion

This study sought to extend Sustainable Supply Chain Management research by examining how tensions shape the implementation of Scope 3 CO_2 data collection systems in retail supply chains, and how these tensions are managed in practice. The primary research question asked how CO_2 data collection of Scope 3 emissions was organized and carried out at different levels of the retailer's supply chain, in order to obtain a full picture and better understand the origins of tensions connected to the operationalisation of their new system. Actors at different levels turned out to work completely differently with CO_2 data reports: the retailer at PCF level, the supplier at bulk level, and the producer at production level with no focus on Scope 3 emissions. The retailer's data system operates through a joint-by-joint propagation logic to obtain disclosed data from tiers far upstream that they lack contact details for and are sometimes barely aware of, yet which contribute to their Scope 3 emissions. It follows a cradle-to-gate principle and a flexible reporting cadence aligned with product-launch cycles. The retailer carries the full project cost and offers free access to all actors in its supply chain. At the same time, the supplier already reports CO_2 data to several

other stakeholders and has acquired its own emission-management platforms. The producer also has a complete reporting system according to the government and the climate-certification organisation, carried out through a manual notebook, which is required in the country where they operate.

Secondly, the study sought to explore what tensions emerge when the retailer mandates the use of a shared CO_2 data collection system for Scope 3 emission auditing. Empirical findings disclosed several tensions, many of a complex nature. Eighteen sustainability tensions were mapped using the extended Hahn and Wannags framework and distributed almost evenly between intra- and inter-organisational tensions in the actor dimension. Intra-organisational tensions clustered around the inner triad and the level dimension, whereas inter-organisational tensions arose mainly from the change and context dimensions. Two recurring patterns could not be accommodated within the existing framework, prompting the study's principal theoretical contribution: (1) a Technical Dimension working as a backbone, amplifying tensions across all other dimensions; and (2) a Meta Dimension, understood as perceived tensions that consume managerial attention as if they were real, if left unaddressed. A particularly notable finding is the weight carried by technical tensions specifically. While the retailer designed its CO_2 data system to streamline and standardise Scope 3 reporting across the chain, the technical dimension repeatedly undermined that ambition in practice. System interoperability gaps between competing platforms, unit mismatches between litres and kilograms, and missing templates generated friction rather than the seamless data flow the retailer envisioned. The technical tension actively amplified other tensions in the case, intra- and inter-organisational alike, turning what was intended as a smooth, centralising solution into a recurring source of manual rework, error risk, and frustration across the chain. This suggests that technical tension is not a peripheral, fixable implementation detail but a structural driver of friction in retailer-led Scope 3 data systems, one that future system design and SSCM research should treat as a primary tension dimension rather than an afterthought.

Addressing the third research question on how these tensions are currently managed and could be managed more effectively, the actors deployed three of Hahn et al.'s (2015) established strategy families: acceptance, resolution through separation, and resolution through synthesis. A fourth, lighter strategy, communication, emerged from the data as particularly suited to the meta dimension. The distribution of strategies across tiers was

uneven: the retailer relied most heavily on acceptance and temporal separation, the supplier moved most clearly into synthesis, while the producer was structurally less able to deploy any of them. Taken together, these strategies form a partly workable repertoire for the current pilot stage of the retailer's Scope 3 data collection system, but their long-run sufficiency depends on whether the technical backbone identified in this study can be resolved at the industry or EU level and if the retailer increases their resolution strategies. The managerial implications that follow translate this conclusion into concrete recommendations for retailers and policy-makers.

8.1 Managerial Implications

This study indicates that sustainability work is negatively affected by the interoperability of CO2 data reporting tools, and is a central source of tension in Scope 3 value-chain reporting. Rather than a single common platform, interviewees point towards the great need of standardised calculation methods, units and emission factors to enable data exchange between independent system providers. The advice for policy makers at EU-level is to decide for such standardization, or develop a technical infrastructure for CO2 data emission tracking that could be used by all firms. This is necessary to avoid that organizations waste earmarked sustainability funds on administrative work (data reporting tools and the administrative burden of these) and instead on real sustainability efforts (such as acquiring green transportation).

For practitioners, the central implication is that a retailer-led, in-house data system is not, by itself, the solution to Scope 3 reporting. As this case shows, such systems can backfire: instead of smoothing data flow across the supply chain, they introduce new technical, organisational, and inter-organisational tensions. Companies considering a similar approach should reconsider this default, involving upstream tiers from the very beginning of the design of scope 3 collection processes to avoid technical tensions. They should also critically assess whether the pursuit of product-level CO_2 data justifies the required investment and the cost of managing the resulting tensions, given that much of the underlying estimation remains approximate and current regulation does not, in any case, mandate product-level disclosure.
Collecting Scope 3 emissions at the bulk level would align the retailer's approach with the methods already used by the remaining supply chain tiers, while still satisfying the requirements of the new directive.

Retailers that already operate similar systems are advised to strengthen their use of resolution strategies when confronted with sustainability tensions related to Scope 3 emissions data collection. Mature organisations, understood as firms with long experience of handling such tensions and substantial resources, appear able to rely more heavily on acceptance strategies and "live with" contradictions. For weaker actors in the supply chain, however, it may be preferable that the retailer actively pursues resolution strategies so that emerging tensions do not harden into explicit trade-offs.

In this case, the retailer could apply a separation strategy by phasing the project over different time horizons. Initially, data disclosure could be mandated only for suppliers that are both willing and relatively well equipped, allowing the programme to be tested and improved under favourable conditions. In a second phase, smaller producers would be brought into the system and subject to mandatory disclosure only once the data platform operates reliably and support structures are in place.

8.2 Limitation and encouraged research

This study is, to the author's knowledge, the first qualitative case study to examine tensions in Scope 3 CO_2 data management, and a number of limitations should be noted. The sample is small; seven interviews across one supply chain in the beverage industry, and a short duration of time following the retailer's scope 3 emission project. Although the multilevel design captures perspectives across three tiers, larger studies are needed to follow such initiatives over longer time horizons and to include additional actor categories such as system providers, certification bodies and end consumers.

A second limitation concerning scope is that the study focuses on upstream cradle-to-gate emissions and does not address downstream Scope 3 emissions or post-purchase impacts such as recycling. Therefore, limited insight exists on sustainability tension that occurs when Retailers start managing downstream emissions. Future research would benefit from examining both ends of the value chain in combination, with particular attention to management practices on shared responsibility sustainability challenges.

Furthermore, the study identifies but does not test managerial solutions for avoiding implementations that lock the technical dimension into the backbone of a Scope 3 data project. Once embedded, technical frictions appear to amplify every other tension. Quantitative or longitudinal follow-up work could investigate which scope 3 emission management design choices most effectively prevent that lock-in, and whether an EU-level data standardization or infrastructure suggested in *8.1 managerial implications* would indeed reduce the identified tensions in practice.

A final word is that these findings are qualitative by design, but SSCM research overall has been noted to lack quantitative validation of the mechanisms it identifies (Panigrahi et al., 2019). Further quantitative research on the subject is encouraged, for instance a survey-based test of the two additional dimensions this study proposes (technical tension and meta tension) would strengthen the generalisability of the framework extension.

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10. Appendix

Exhibit A: Interview Guide

1. Overall process and boundaries

1. Could you briefly walk me through your process for collecting CO_2 (scope 1,2 and 3) data?
2. How do you obtain this data in practice – primarily via your direct suppliers, or do you also have direct contact with producers?
3. How do you encourage actors in the value chain to collaborate and be transparent in sharing CO_2 data?
4. Do you also collect CO_2 data downstream in the chain, i.e. after the product has left your organisation (for example via recycling companies or waste handlers)?
5. Is any part of the data collection process outsourced to external partners, or is everything managed in-house?

2. Strategy and objectives

6. What is your strategy for developing the CO_2 data collection process? Is the focus primarily on continuously improving your existing process (for example by training involved actors), or on adapting to the specific needs and processes of different partners?
7. Have you set explicit targets related to CO_2 data (for example coverage, quality or frequency of updates)?
8. Can other actors in the value chain align with these targets, or are they mainly internal to your organisation?

3. Tensions and responsibilities

9. I would now like you to reflect more freely: what kinds of tensions or resistance arise in this process between you and:
    - your suppliers?
    - producers?
    - any downstream actors (for example recyclers or waste companies)?
10. Who is responsible for collecting CO_2 data related to the transport and storage of products between the different stages before they reach you? Does this responsibility allocation give rise to any tensions?

4. Level of granularity and measurement units

11. At what level of granularity do you collect CO_2 data – per individual product, purchase occasion, supplier, or per unit (for example per litre or per kilogram)?
12. Could you briefly describe your current approach, and what you would consider the optimal solution?

13. Do disagreements or problems arise with other actors because of the chosen level of granularity?

5. Systems & software

17. What software do you use to manage CO_2 data?
18. Was this system developed specifically for you, or is it a generally available solution?
19. Do other actors in your value chain have access to this system?
20. Do problems arise because different actors in the value chain use different software solutions?
21. Can the format in which data are delivered cause problems (for example different templates, file types or structures)?

6. Time horizons

22. How often do you aim to update your CO_2 data?
23. Do your expectations regarding frequency and time horizons create resistance or tensions with other actors?

7. Product decisions

24. Have you ever chosen to deselect products because their CO_2 data are too difficult to trace?
25. Do you see this as something that could happen more in the future?

8. Collaboration and regulation

27. What is your view on collaborating with similar organisations in other countries to help the sector meet regulatory demands such as the CSDDD?

10. Paradoxes, key challenges and value of data

31. How do you view the paradox that the better you become at collecting CO_2 emissions across your value chain, the higher your reported emissions may appear?
32. In your view, what is the single greatest challenge for your organisation when it comes to collecting CO_2 data?
33. What do you think is the greatest challenge for other actors in your value chain?
34. Do you consider your collected CO_2 data to be a strategic resource for your organisation? If so, in what ways?
35. Do you consider the collected CO_2 data to be a resource for other actors in the value chain? If so, how?

11. Closing

36. Finally, is there anything else you would like to add that you feel is important to highlight regarding CO_2 data collection and Scope 3 management?

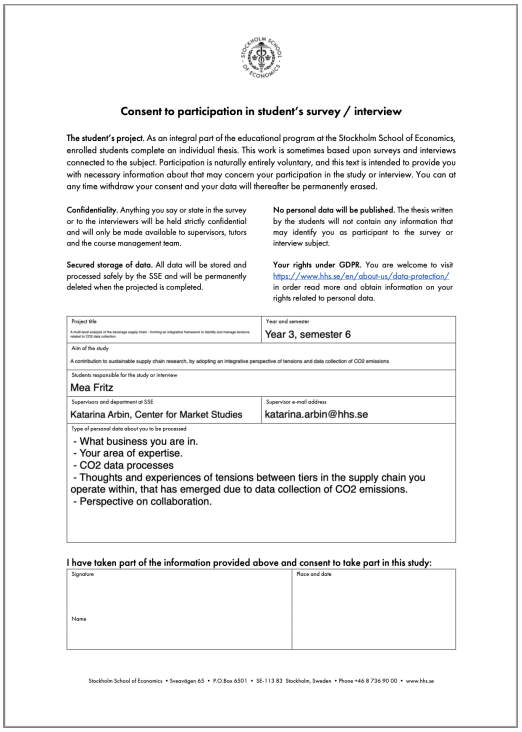
Exhibit B: AI Disclosure

	Disclosure
AI tools used to support the research	Perplexity, Gemini, Claude, Microsoft Teams Automatic Transcription, and ProQuest Research Assistant.

How they were used	**Perplexity** — text improvement. Supported grammar, structure and tightening of passages that were too long. **Gemini** — image creation. Used to finalise the extended framework figure visually. The model itself was built manually in Google Drive; screenshots were combined with prompting to produce a clean, research-styled version of the updated framework. **Claude** — supported the identification of tensions once the author had reached saturation. A dedicated project was built within Claude, giving it access to all research-relevant material. Most AI-proposed tensions aligned with the author's, and a few additional ones were incorporated; all were classified manually, as the tool did not capture the full complexity of the case. Claude was also used to generate research-quality tables, such as the glossary. **Microsoft Teams Automatic Transcription** — transcribed all interview recordings automatically. Output quality was insufficient for direct use, so quotes used in the thesis were transcribed manually from the audio. **ProQuest Research Assistant** — supported efficient navigation between a focal article and related research papers in the literature review.
Identified risks and measures taken to reduce them	Text improvement tools occasionally rephrased the author's handwritten literature review passages into wording that resembled an AI summary of the cited articles. Verifying that such suggestions did not introduce inadvertent plagiarism is difficult at sentence level and time-consuming. To mitigate this risk, random checks were carried out against the original sources for any improvement adopted. AI-based translation of interview quotes can subtly alter meaning. As a single-author thesis, peer cross-checking was not available. Instead, the author tested several translation tools on the same passages and selected Perplexity as the most accurate for the Swedish-to-English conversions used in the thesis. All AI output was evaluated through human judgement before inclusion, in order to avoid hallucinations and ensure that the substance of every claim could be traced back to the underlying source material.
Insights gained on using AI in a thesis-writing process	AI tools effectively supported the author at several stages of the research process, in particular when conceptual ideas were difficult to translate into written form. The interaction with the tools often functioned as a thinking partner, and thought blocks were sometimes resolved simply through the act of formulating a prompt. Although the author was initially sceptical about using AI in academic work, the tools provided consistent "peer-like" support and substantially improved the efficiency of the process, especially in raising the academic standard of the language.

How AI improved thesis quality	AI assistance enabled a higher academic-language standard and more precise, tightened expression. Routine work such as table design, reference handling, spelling and grammar could be supported by AI, allowing greater effort to be allocated to the analytical work on the case itself. AI by its nature contributes to an iterative work process, which is expected to improve the overall quality of the thesis.

Exhibit C: Consent Form



Consent to participation in student's survey / interview

The student's project. As an integral part of the educational program at the Stockholm School of Economics, enrolled students complete an individual thesis. This work is sometimes based upon surveys and interviews connected to the subject. Participation is naturally entirely voluntary, and this text is intended to provide you with necessary information about that may concern your participation in the study or interview. You can at any time withdraw your consent and your data will thereafter be permanently erased.

Confidentiality. Anything you say or state in the survey or to the interviewers will be held strictly confidential and will only be made available to supervisors, tutors and the course management team.

No personal data will be published. The thesis written by the students will not contain any information that may identify you as participant to the survey or interview subject.

Secured storage of data. All data will be stored and processed safely by the SSE and will be permanently deleted when the projected is completed.

Your rights under GDPR. You are welcome to visit https://www.hhs.se/en/about-us/data-protection/ in order read more and obtain information on your rights related to personal data.

Project title A multi-level analysis of the beverage supply chain - forming an integrative framework to identify and manage tensions related to CO2 data collection.	Year and semester Year 3, semester 6
Aim of the study A contribution to sustainable supply chain research, by adopting an integrative perspective of tensions and data collection of CO2 emissions	
Students responsible for the study or interview Mea Fritz	
Supervisors and department at SSE Katarina Arbin, Center for Market Studies	Supervisor e-mail address katarina.arbin@hhs.se
Type of personal data about you to be processed - What business you are in. - Your area of expertise. - CO2 data processes - Thoughts and experiences of tensions between tiers in the supply chain you operate within, that has emerged due to data collection of CO2 emissions. - Perspective on collaboration.	

I have taken part of the information provided above and consent to take part in this study:

Signature Name	Place and date

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