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Switching the telescope lens: a sociomaterial perspective of sustainable agricultural (proto)practices transfer in an agrifood supply chain

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Abstract:	This study investigates the implementation and transfer of sustainable agricultural practices (SUSAPs) across a multi-tier agrifood supply chain (SC) using Brazilian poultry farming as the empirical context. We conduct an interpretive case study of buyer–supplier–subsupplier triads, including those certified under Global Good Agricultural Practices (GAP) and non-certified counterparts, using interviews, observations, and secondary data. Adopting a sociomaterial perspective, we investigate how SUSAPs' components—meanings, materials, and competencies—are embedded within specific SC tiers and transferred across the triad. A zoom-in analysis reveals that only animal welfare is a fully adopted practice, whereas waste management, working conditions, and biosecurity remain in development as protopractices. A zoom-out analysis of SUSAPs' components shows limited buyer influence across the triad, while first-tier suppliers facilitate SUSAP transfer. We advance theory by demonstrating how a sociomaterial perspective explains the degree of SUSAPs' implementation and transfer, and introducing the boomerang effect, illustrating how first-tier suppliers enable SUSAP implementation among certified and non-certified subsuppliers to ensure safer and more sustainable products. These insights help managers transfer SUSAPs into their SCs by leveraging first-tier suppliers as boundary spanners.

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This study investigates the implementation and transfer of sustainable agricultural practices (SUSAPs) across a multi-tier agrifood supply chain (SC) using Brazilian poultry farming as the empirical context. We conduct an interpretive case study of buyer–supplier–subsupplier triads, including those certified under Global Good Agricultural Practices (GAP) and non-certified counterparts, using interviews, observations, and secondary data. Adopting a sociomaterial perspective, we investigate how SUSAPs' components—meanings, materials, and competencies—are embedded within specific SC tiers and transferred across the triad. A zoom-in analysis reveals that only animal welfare is a fully adopted practice, whereas waste management, working conditions, and biosecurity remain in development as protopractices. A zoom-out analysis of SUSAPs' components shows limited buyer influence across the triad, while first-tier suppliers facilitate SUSAP transfer. We advance theory by demonstrating how a sociomaterial perspective explains the degree of SUSAPs' implementation and transfer, and introducing the *boomerang effect*, illustrating how first-tier suppliers enable SUSAP implementation among certified and non-certified subsuppliers to ensure safer and more sustainable products. These insights help managers transfer SUSAPs into their SCs by leveraging first-tier suppliers as boundary spanners.

Keywords: Sustainability practice, multi-tier supply chains, subsuppliers, triads, sustainable agricultural practice, sociomaterial perspective, zoom-in/zoom-out method

1. Introduction

Sustainability violations in global supply chains (SCs) remain a critical challenge, particularly concerning environmental factors (e.g., land and water protection) and social aspects

(e.g., fair working conditions). Such sustainability violations are frequently attributed to subsuppliers, whose roles are often overlooked in the literature (Durach et al., 2024; Jamalnia et al., 2023; Tachizawa and Wong, 2014; Villena and Gioia, 2018). Ensuring sustainability among subsuppliers is particularly vital in agrifood SCs, as subsuppliers' practices directly impact food safety, environmental conservation, and social well-being (Food and Agricultural Organization [FAO], 2023). However, despite the increasing emphasis on sustainability, research on how these practices are implemented and transferred across SC tiers remains limited.

To address this gap, we examine how the Global Good Agricultural Practices (GAP) certification promotes safe and sustainable food production and influences sustainability adoption across different SC tiers. Specifically, we focus on Brazil's poultry SC, as the country accounted for approximately 40% of global poultry exports in 2023 (Associação Brasileira de Proteína Animal, 2024). By analyzing how sustainability practices are implemented and diffused across multiple SC tiers—including farmers, processors, and retailers—this study provides insights into the mechanisms driving sustainability implementation in complex agrifood networks (Jamalnia et al., 2023; Villena, 2019).

A key aspect of sustainability in an agrifood SC is the implementation of sustainable agricultural practices (SUSAPs). While these practices are typically mandated through certification programs or corporate sustainability initiatives, their adoption across different SC tiers varies significantly. SC actors exhibit varying levels of compliance: some fully adhere to prescribed measures, whereas others selectively implement certain aspects or reject them due to cost constraints or contextual barriers. Despite extensive research on sustainability governance, little is known about how SUSAPs are implemented, and transferred within multi-tier agrifood SCs.

To address this issue, we adopt a sociomaterial perspective within the operations management (OM) context. This perspective acknowledges the entanglement of the material and the social in everyday organizing, highlighting their mutual shaping and inseparability (Schatzki, 2010; Wieland et al., 2024). Furthermore, a sociomaterial OM perspective defines a practice as

knowledgeable actions that are continuously produced and reproduced within a social context, acknowledging the intentionality and agency of all SC members in implementing SUSAPs (Silva and Figueiredo, 2020; Gherardi, 2009). Specifically, by conceptualizing practice as comprising three components—meanings, materials, and competencies (Shove et al., 2012)—this study offers a novel, in-depth understanding of how SUSAP components may vary across SC tiers while aligning with stipulated sustainability requirements.

The sociomaterial OM perspective differs from existing approaches to SUSAP implementation and transfer, as depicted in the literature. Prior studies have largely examined sustainability requirements as cascading processes in which sustainability measures are either (i) imposed by buyers on their first-tier suppliers, who are then expected to transmit them further upstream, often with limited success (Villena, 2019; Villena and Gioia, 2018; Wilhelm and Villena, 2021; Wilhelm et al., 2016); or (ii) cascaded bidirectionally—upstream and downstream—by first-tier suppliers (Johnsen et al., 2022). Our study contributes to the ongoing debate on the role of first-tier suppliers as boundary spanners (Chae et al., 2024; Durach et al., 2024; Jia et al., 2021). This perspective highlights the need to better understand how indirect governance mechanisms, such as certification programs, aid in managing multi-tier SCs effectively (Dias et al., 2023; Wilhelm et al., 2016). Although previous studies have explored the adoption of sustainability requirements in multi-tier SCs, none have employed a practice-based approach grounded in the sociomaterial OM perspective of SUSAPs. Instead, prior studies often assumed that once an SC member understands an SUSAP, that member simply cascades the exact requirements to other tiers.

In the multi-tier SC context, we contend that the implementation and transfer of SUSAPs are shaped by triadic relationships, which introduce structural complexities (Choi and Wu, 2009; Choi et al., 2021; Sauer and Seuring, 2018). For instance, subsuppliers possess a unique understanding of their social context, influencing why and how they adopt sustainability practices (Nath et al., 2021; Santos et al., 2023). By adopting a sociomaterial OM perspective, this study

reveals how SC actors exercise intentionality and agency in implementing and transferring practice components while simultaneously adapting them to their specific contexts.

To explore this empirically, we examine Brazil's poultry SC, focusing on interactions among poultry farmers (Tier 2), cooperative suppliers (Tier 1), and buyers. We employ an interpretive case study to investigate SUSAP implementation (Darby et al., 2019). Our research is guided by the following question: *How are SUSAPs implemented and transferred across specific and multiple tiers in the agrifood SC of Brazilian poultry farming?*

To answer this question, we apply the zoom-in/zoom-out method of analysis (Nicolini, 2009), akin to adjusting a telescope—zooming-in to explore how specific SUSAPs are enacted at the local level and zooming-out to understand their transferable components across the SC. We focus on a poultry SC in southern Brazil for two key reasons: (1) Brazil is the world's largest poultry producer, and (2) the industry is the cornerstone of the local economy (Pohlman et al., 2020). The cooperative structure of this poultry SC also provides valuable insights into managing subsuppliers. Our analysis focuses on buyer–supplier–subsupplier triads, including certified and non-certified subsuppliers. Within this poultry multi-tier SC, we examine four SUSAPs: animal welfare, working conditions, biosecurity, and waste management.

Our study makes two key contributions to the OM literature. First, it is the only empirical study to provide a detailed understanding of *how* SUSAPs are implemented and transferred in multi-tier SCs. Specifically, by applying a sociomaterial OM perspective and examining practice components, we explain why SUSAPs are fully, partially, or not implemented at all. Our findings indicate that buyer influence plays a limited role in shaping transferable SUSAP components. Second, we introduce the *boomerang effect* concept to explain how first-tier suppliers transfer SUSAPs to certified and non-certified subsuppliers to ensure safer and more sustainable products.

2. Theoretical background

Instead of viewing practice as a simple list of best-practices (Silva et al., 2022), we adopt an alternative perspective to explain the complexity of a firm's daily operations (see Appendix A for key concept definitions).

2.1 Theories of practice: a sociomaterial perspective

Various theories aid in understanding practice, drawing from longstanding traditions in sociology and philosophy (Nicolini, 2012; Schatzki, 2002). Since the 1970s, theories of practice (TPs) have gained traction in management and organizational studies (Gherardi, 2022). However, their application in OM is more recent, where they are referred to as the practice-based view (Bromiley and Rau, 2016) and SC practice view (Carter et al., 2017). Previous OM studies have examined actors' actions but overlooked their intentionality and agency in performing a practice. A sociomaterial perspective helps uncover these aspects (Carlile et al., 2013; Hultin, 2019; Orlikowski, 2007).

To define a practice, we follow the argument that a practice cannot be "assumed to be synonymous with 'routine,' 'competitive advantage,' [or] 'embodied skills,' or taken to be a generic equivalent of 'what people do,' without theoretical foundations illuminating the nature of the object of study and its original and distinctive contribution to understanding the social order" (Gherardi, 2009, p. 536). Practice does not merely reflect an activity but also encapsulates the social intentionality and agency of the materials surrounding this activity to generate a habitus (Hultin, 2019; Schatzki, 2010). Thus, practice is shaped by the reality and context in which social actors and materials interact, informed by everyday activities and decisions (Carlile et al., 2013).

Sociomateriality is a key approach in studying TPs (Schatzki, 2003, 2010, 2012). A practice involves interactions between various components, such as material arrangements and prior knowledge (e.g., understanding, know-how, emotional states, and motivational knowledge). These elements are interconnected and mediate the formation of habitus, linking individuals to broader

structures (Gherardi, 2009; Schatzki, 2003, 2010). This perspective asserts that practice is contingent on the existence of specific relationships among these components and cannot be reduced to any single element (Schatzki, 2003, 2010).

Embodiment is central to TPs because it represents the sociomateriality within OM (cf. Gherardi, 2022). A practice encompasses more than what is labeled as knowledge (Gherardi, 2022); it also includes knowing and knowledgeable actions (Gherardi and Miele, 2018). A sociomaterial perspective thus offers a relational understanding of the components constituting a practice (Carlile et al., 2013). Scholars have classified these components using various terms, such as images, meanings, technologies, materials, competencies, cultural conventions, and temporal and spatial organizations (Shove and Pantzar, 2005; Shove et al., 2012). Identifying these components reflects not only how practices are embodied but also how they are performed over time (Shove et al., 2012).

Among studies employing a sociomaterial perspective, we selected Shove et al. (2012) because of their focus on sustainability, specifically sustainable consumption. Their work, anchored in Schatzki's (2003, 2010) social and materiality perspective, identified three key practice components:

(i) *Materials*: Objects, infrastructure, tools, and technologies embedded in and integral to practice while remaining distinct from it (Shove et al., 2015). For example, recycling bins play a central role (i.e., having agency) in recycling efforts.

(ii) *Competencies*: Skills required to perform a practice, including know-how, background knowledge, and abilities that enable practice execution. Training in recycling enhances competencies.

(iii) *Meanings*: Social and symbolic understandings that inform practice performance. For example, when recycling becomes part of employees' workdays rather than an obligation.

These components are integrated into practices and connected through links that allow tracking change. This process explains how a practice becomes embedded in a specific context (Shove et al., 2012, 2015). Understanding how practices emerge, evolve, or disappear, necessitates moving beyond the material component (e.g., infrastructure) and acknowledging that practice arrangements are not static (Shove et al., 2015). Strong direct links between the components signify a fully developed practice. In contrast, weak indirect links indicate a protopractice, which hinders the effective formation of a genuine practice (Shove et al., 2012). Our study expands this understanding beyond individual intra-organizational practices to inter-organizational contexts. Table 1 summarizes the key concepts adopted in this study with illustrative examples.

The inter-organizational perspective aligns with recent SC studies demonstrating how a sociomaterial OM lens reveals nuances in sustainable practices. Walker et al. (2024) studied how bioplastic SC players practice waste management, reporting that meanings (e.g., "bioplastic is circular") were shared among the actors through materials (e.g., life cycle assessment tools); however, waste management did not emerge as a practice for the entire SC, and therefore, was not recognized as a genuinely sustainable practice. Similarly, Carmagnac and Naoui-Outini (2022) found that actors' emotions (e.g., curiosity and happiness) influence sustainable innovation practices, indicating that practice is multilayered and shaped by social context. These findings highlight the power of the sociomaterial perspective in understanding sustainable practices, although its application in SC sustainability research remains nascent (Silva et al., 2022). We add to the SC sustainability literature by using a sociomaterial perspective to investigate multi-tier SC relationships. As discussed in Section 2.2. below, multi-tier SCs are in particular need of greater practice-based research.

Table 1: Understanding sustainability practices at the intra- and inter-organizational levels

Theme	**Intra-organizational level**	**Inter-organizational level**	**Examples**
	Description	Description	
Practice	**Strong direct links** between all existing practice components (meaning, materials, and competencies) within an organization	**Full links** for at least one of all existing practice components (meaning, materials, and competencies) across the relationship	*Intra-organizational level*: Recycling is a practice within an organization when it includes circular economy principles (meaning), creates a related infrastructure (material), and trains employees (competence) to properly perform recycling activities. Therefore, a practice is not an obligation; instead, it becomes an everyday habitus.
			Inter-organizational level: Recycling is a practice across the relationship when (at least) a circular economy principle (meaning) is shared between different organizations in such a relationship.
Protopractice	**Weak indirect links** for at least one of all existing practice components (meaning, materials, and competencies) within an organization	**Partial links** for at least one practice component (meaning, materials, and competencies) across the relationship, regardless of the number of components existing	*Intra-organizational level*: Recycling is a protopractice within an organization when at least one of all components has weak indirect links. For instance, circular economy principles (meaning), infrastructure (material), and knowledgeable employees (competence) exist, but these components have little interconnection. Furthermore, recycling is more of an obligation than a source of employee engagement.
			Inter-organizational level: Recycling is a protopractice if at least one of all components is partially linked across the relationship. For instance, one organization understands the circular economy as a principle (meaning), while others view it as a measure of efficiency (meaning). Although these meanings are not identical, a partial link exists across the relationship.
Not a practice	**Inexistence of links** and/or **a lack** of practice components (meaning, materials, and competencies) within an organization	**Inexistence of links** between practice components (meaning, materials, and competencies) across the relationship	*Intra-organizational level*: Recycling is not a practice within an organization when a circular economy principle (meaning) exists, but no infrastructure (material) is created to properly perform recycling activities. In this case, at least one component is missing.
			Inter-organizational level: Recycling is not a practice across the relationship when everyone understands it differently; that is, no links are identified between organizations.

2.2 Multi-tier SC sustainability: emphasizing practices

Research on multi-tier SCs has increasingly incorporated sustainability considerations (Choi and Wu, 2009; Choi et al., 2021; Mena et al., 2013). Tachaziwa and Wong (2014) identified four governance mechanisms (i.e., direct, indirect, third-party, and "do not bother") used by leading firms to manage different SC tiers. However, the study of *sustainable practices* in multi-tier SCs has only recently emerged as a means of operationalizing sustainability principles (Dias et al. 2023; Nath et al., 2021; Wilhelm et al., 2016). For instance, Chae et al. (2024) highlighted the relevance of transactions managed through direct, indirect, or hybrid governance structures, demonstrating that buyer firms engage in SC relationships in multiple ways, including through sustainability practices.

Research has often focused on the buyers' roles in addressing sustainability across SC tiers (Gong et al., 2018; Jamalnia et al., 2023; Kähkönen et al., 2023; Sauer and Seuring, 2018). However, information on other multi-tier SC members is required. For example, while Villena and Gioia (2018) contended that first-tier suppliers complied with the specific sustainability standards demanded by multinational firms, Jia et al. (2021) and Soundararajan and Brammer (2018) described the role of first-tier suppliers as including dissemination and monitoring of knowledge related to sustainability standards. Johnsen et al. (2022) revealed the nuances of cascading sustainability requirements by exploring first-tier suppliers and their effects on upstream and downstream SC relationships. Santos et al. (2023) investigated subsuppliers' sustainability practices, revealing diverse learning mechanisms based on specific local routines. Although some scholars have suggested that subsuppliers are passive in addressing social and environmental issues (cf. Villena and Gioia, 2018), others highlight their potential for active engagement in sustainability practices.

Thus, although the literature recognizes that subsuppliers are likely to violate sustainability requirements in global SCs, leading to adverse environmental and social impacts (Gong et al., 2018; Meinlschmidt et al., 2018; Nath et al., 2021; Villena and Gioia, 2018),

additional analytical perspectives are needed to understand sustainability practices in global SCs. Villena and Gioia (2018) identified three key sustainability-related practices—capability building, assessing sustainability practices, and managing sustainability opportunities and risks—but focused narrowly on leadership performance. Kähkönen et al. (2023) examined sustainability-related risks, emphasizing how direct and indirect practices, such as collaboration and monitoring, connect multiple stakeholders (e.g., pressure groups and first-tier suppliers) to enhance risk management.

While research has emphasized replicable sustainability practices (Meinlschmidt et al., 2018) their implementation remains underexplored. Sustainability-related practices are not just repeated actions but embodied social processes integrated into everyday life tasks as a habitus (Silva and Figueiredo, 2020). As sustainability practices are closely influenced by surroundings, subsupplier sustainability management depends on context-specific variables (Jamalnia et al., 2023; Sauer and Seuring, 2018), particularly in resource-intensive industries. For instance, in the food industry, raw material suppliers account for the majority of natural resource consumption (Mena et al., 2013). Traceability and animal welfare standards are essential for sustainable multi-tier SCs in the UK (Mena et al., 2013), the US (Wu and Pullman, 2015), and Italy (Golini et al., 2017), underscoring the need to integrate sociomateriality into sustainability frameworks.

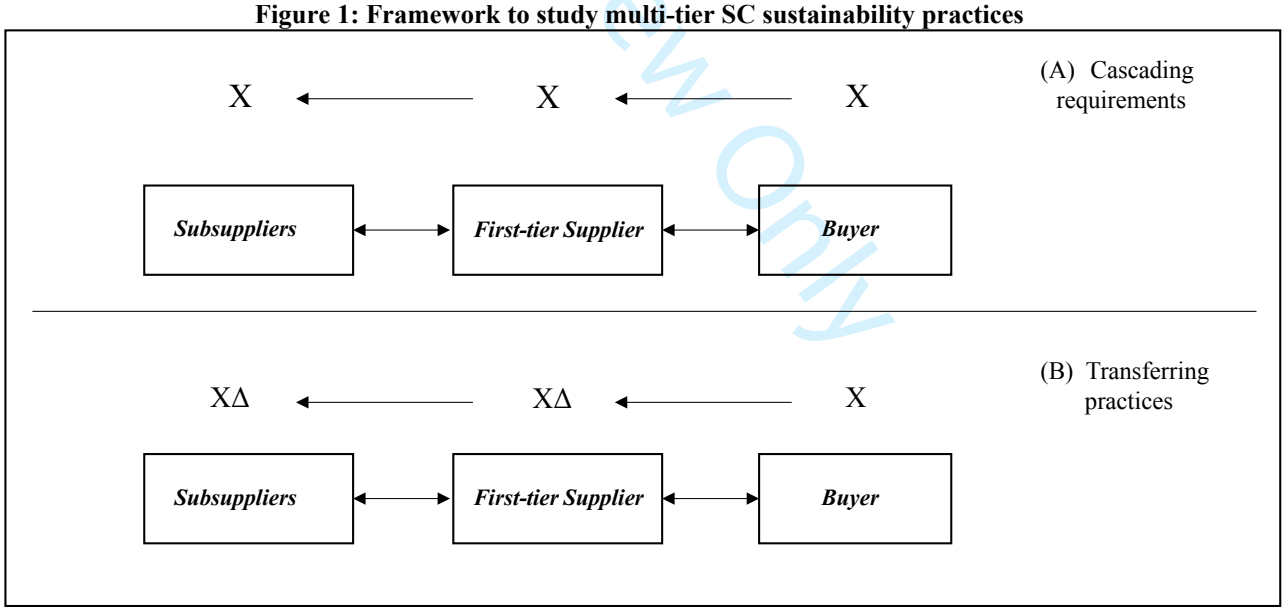
2.3 Sociomaterial framework for multi-tier supply chain sustainability practices

Figure 1 presents our conceptual framework, integrating sociomateriality and sustainability in multi-tier SCs. Consider sustainability practice X, where one buyer manages multiple SC tiers. The literature suggests that the *cascading effect* governs sustainability practice X's diffusion across SC tiers (Villena, 2019). This effect relies on the cascading of sustainability-related requirements (Villena and Gioia, 2018; Wilhelm and Villena, 2021); consequently, practice X moves across SC tiers as a replication process (see Figure 1, Part A). However, such an approach seems to disregard the influence of multiple contingencies (e.g., knowledge and

power; Tachizawa and Wong, 2014) on each SC tier, particularly when referring to context-driven subsuppliers (Jamalnia et al., 2023; Sauer and Seuring, 2018). We argue that replicating sustainability requirements is insufficient to guarantee sustainability practice implementation.

Accordingly, drawing from the sociomaterial OM perspective, we contend that sustainability practices in multi-tier SCs are transferred rather than simply diffused (Bromiley and Rau, 2016). As illustrated in Figure 1, Part B, sustainability practice X is enacted with variations (XΔ) when shared with first-tier suppliers. Although sustainability practice XΔ may have adaptable components when compared with the original practice X, XΔ can still be viewed as part of the tier-specific practice. The same process occurs at the subsupplier level, where XΔ is enacted while retaining the core components of X. As Carter et al. (2017) suggested, firms adopt or reject practices based on their management approaches. Consequently, sustainability practices manifest differently across SC tiers, a dynamic captured in our framework.

Figure 1: Framework to study multi-tier SC sustainability practices



Note: This framework differentiates between cascading requirements and transferring practices by exploring practice (X) and its variations (XΔ) across SC tiers

This perspective aligns with research suggesting that sustainability practices are among the least visible aspects of SCs (Hardy et al., 2020; Wieland, 2021). The transfer process relies on the implementation of the practice components (as outlined in Section 2.1), and recognizes

that buyers can manage this process in different ways according to their governance mechanisms (Chae et al., 2024; Tachizawa and Wong, 2014). In this context, the framework requires (i) zooming-in to determine the ways in which the components of meanings, competencies, and materials appear within and across each SC tier, and (ii) zooming-out to understand the transferable components of the SUSAPs, and hence, the interactions of the practices with one another. Therefore, instead of recycling being a practice diffused based on specific requirements, such as "tons of materials recycled," by the transfer process, recycling as a SUSAP must consider the singularity of each SC tier and how it interacts with other practices. Intentionality and agency are key factors during transfers (Orlikowski, 2007). For example, the recycling infrastructure may vary during the transfer process, which is unexpected under the cascading effect. Based on these theoretical assumptions, our study examines sustainability practices within agrifood SC.

3. Research method

To investigate how SUSAPs are implemented and transferred across multiple tiers of an agrifood SC in Brazil, we employ an interpretive case study approach (Stake, 1995). This perspective enables us to comprehend socially constructed phenomena based on context-dependent knowledge (Darby et al., 2019). Our case study method contributes to OM literature by extending multi-tier theory through a sociomaterial perspective. This approach highlights the interdependence of social and material elements in SC sustainability, offering fresh insights into multi-tier SC management (Ketokivi and Choi, 2014; Wieland et al., 2024). Theory elaboration is guided by a hermeneutic process essential for interpretive studies (Darby et al., 2019). To achieve this, we draw on the framework provided in Section 2.3 and view qualitative researchers as interpreters and collectors of interpretations who must manage "multiple perspectives or views of the case that need to be represented. [Indeed], there is no way to establish, beyond contestation, the best view" (Stake, 1995, p. 108).

The unit of analysis in this study is practice, following previous studies on SC management (e.g., Silva and Figueiredo, 2020). This unit of analysis allows situated knowledge (e.g., sustainable agriculture) to be entangled with a situated action (i.e., a practice; Gherardi, 2022) and differs from the unit of observation as data collection occurs at buyer–supplier–subsupplier triads.

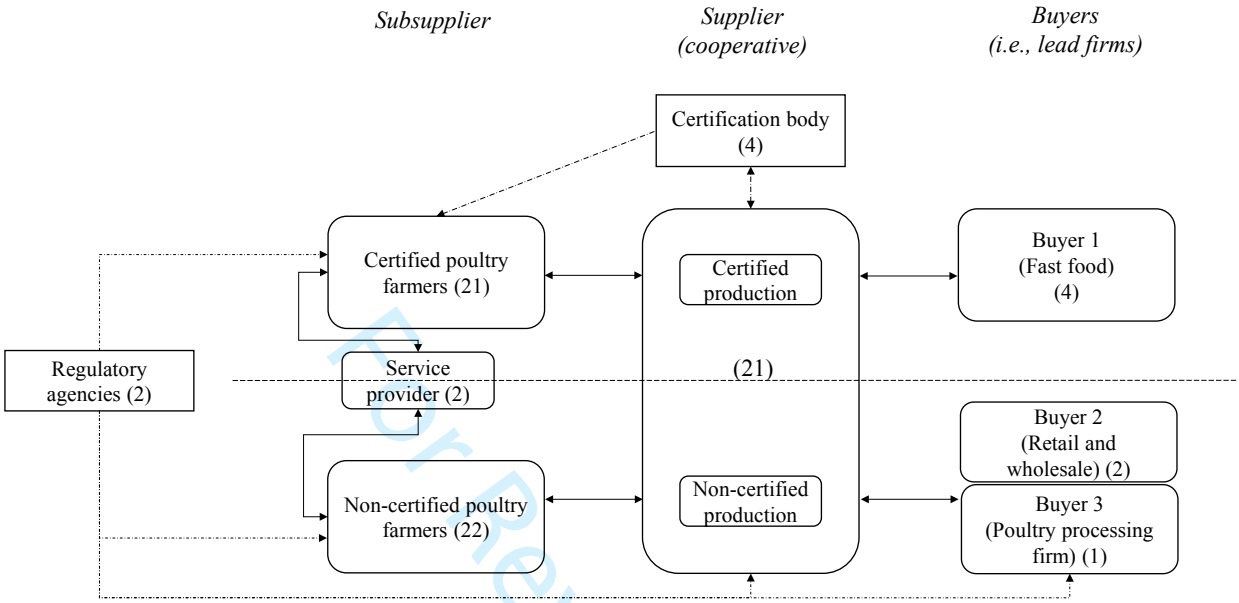
An exploratory phase in September 2019 helped refine the research design. This phase included five preliminary interviews (excluded from the final sample) with two poultry farmers, two veterinarians, and the vice president of the cooperative selected as the supplier in this study. This phase informed the development of interview scripts (Appendix B) and provided a deeper understanding of the poultry industry's structure. Additionally, it helped identify the key buyers, their sustainability requirements, entities responsible for defining these requirements, and the mechanism through which sustainability practices are implemented and transferred across multiple SC tiers. Following this phase, we conducted the first round of interviews to identify potential practices, followed by observations and two additional rounds of interviews to understand SUSAPs.

3.1 Setting the research context

According to Halme et al. (2024), qualitative studies in low-income settings must be contextualized based on scholars' previous engagement with and knowledge of the industry (in this case, poultry, a context-dependent SC) and the context (i.e., Brazil). Thus, to investigate how SUSAPs are implemented and transferred across a multi-tier SC, we selected a poultry SC located in southern Brazil for three primary reasons: (1) this SC is recognized for its integrated system—a cooperative SC configuration where vertical integration can facilitate the understanding of SUSAPs (Associação Brasileira de Proteína Animal, 2021), (2) historically, this SC has had a negative impact on the environment (Pohlmann et al., 2020) and (3) the lead authors have extensive knowledge of the Brazilian context and prior engagement with the industry. These

factors highlight the poultry SC's relevance, particularly given its recent shift toward sustainability. Figure 2 illustrates all poultry SC members interviewed in this study.

Figure 2: Poultry multi-tier supply chain structure



Note: Numbers in parentheses represent the total number of interviews conducted per entity (see Appendix C).

We consider a triadic relationship to be managed differently by each buyer (Figure 2). This follows Choi and Wu's (2009) and Mena et al.'s (2013) definitions of multi-tier SCs, as three-tier structures are common in cooperative SCs (Dias et al., 2023; Wu and Pullman, 2015). Notably, subsuppliers are either certified or non-certified, depending on the buyer they supply to. In this study, buyer 1 is the only entity actively driving SC sustainability practices, and all 21 certified suppliers supply to this buyer. We also include non-certified subsuppliers in our analysis, as comparing both groups provide insights into how the first-tier supplier transfers SUSAPs. A brief description of each analyzed SC member is provided below.

a) Buyer 1: This buyer is a leading global food service retailer hosting 34,000 local restaurants in 119 countries, primarily in Latin America and Europe. The firm relies on Global GAP certification, delegating responsibilities to the certification body to identify sustainability requirements and monitor suppliers' and subsuppliers' sustainability practices.

b) Buyer 2: This buyer is among the six largest supermarket groups in Brazil (73 wholesale and retail stores in 27 cities). Its relationship with the supplier is limited to the purchase and sale of products, with direct engagement in sustainability requirements. Buyer 2 does not directly interact with subsuppliers and has low visibility.

c) Buyer 3: This German processing firm operates in the frozen and refined meat/poultry market and exports to Europe. Although it benefits from the supplier's health and sustainability certifications, it does not impose its own sustainability requirements.

d) Supplier: This supplier is one of the largest cooperatives operating in Brazil's livestock sector. As an independent institution, it integrates Global GAP-certified and non-certified poultry farmers. Farmers do not own the cooperative but collectively engage with one another to meet market demand. The supplier's approach to subsuppliers varies depending on buyer requirements. The supplier transfers technical knowledge about certification guidelines based on buyer 1's requirements using veterinarians, who have the primary responsibility for this process. Additionally, the supplier manages the slaughterhouse and meat processing operations, as well as an in-house feed production facility.

e) Subsuppliers: The sample consists of 43 poultry farmers selected from a total of 1,073 integrated farmers. This high number of integrated farmers reflects the cooperative SC configuration. While certified farmers exclusively supply to buyer 1, non-certified farmers are also expected to adopt sustainability practices through the supplier's transfer process.

f) Global GAP certification: This is issued by a global organization that, together with buyer 1, actively participates in developing and updating socioenvironmental and animal welfare criteria. These standards are followed by the supplier and subsuppliers. Global GAP seeks to balance predefined global standards with interpretations of local regulations.

g) Regulatory agencies: Two agencies were studied to assess their roles in promoting and controlling animal health, food safety, and plant health. One agency focuses on water management and the other oversees agricultural licensing.

h) Service provider: A small third-party local firm responsible for collecting live chickens for slaughter in the region.

3.2 Data gathering

Primary data were collected through three rounds of interviews: (1) 14 interviews from September 2019 to October 2019, (2) 38 from August 2020 to January 2021, and (3) 27 from February 2021 to April 2021. Multiple rounds allowed for the collection of diverse insights. For instance, the first round helped identify potential practices that guided this study. Overall, our study includes 79 interviews with 3 buying firms, 1 supplier (cooperative), 43 subsuppliers, 1 certification body, 2 regulatory agencies, and 1 service provider (see Appendix C and Section 3.1 for further details). Interviewees, selected for their expertise in sustainability, held decision-making roles. To avoid bias, a snowballing sampling technique was followed, starting with the supplier who suggested three primary buyers and some subsuppliers (cf. Klein and Myers, 1999). Subsequent interviewees were selected based on their relevance in providing a comprehensive understanding of the poultry multi-tier SC. Notably, some data were collected during the global pandemic; however, as agrifood SCs remained largely unaffected on the production side, most interviews were held in person. All interviews were conducted in Portuguese, recorded with participants' consent, and transcribed to ensure data accuracy.

Interview transcripts were supplemented with data from 14 days of observations documented through researcher diary notes, including (i) formal observations of the housing process in different aviaries, (ii) informal conversations and site visits, and (iii) participation in supplier-led webinars designed to maintain regular contact with subsuppliers. These additional data provided valuable contextual insights into SUSAPs. Finally, secondary information was

gathered simultaneously to enhance data credibility. We analyzed 23 sources, including videos provided by the supplier and a farmer (e.g., footage on aviary ambiance for animal welfare), internal and technical manuals (e.g., instructions related to biosecurity and waste management), institutional reports provided by buyers and the supplier (e.g., sustainability report and code of conduct), and buyers' webpages, outlining sustainability commitments.

3.3 Data analysis

A dynamic, systematic six-stage approach was employed to analyze the collected data. We followed a process-as-activity perspective, focusing on the implementation and transfer of practices rather than solely examining their evolution over time (Grimm et al., 2024). Table 2 summarizes the six analytical stages: (1) research design, (2) analysis of potential practices, (3) temporal understanding of practice, (4) zoom-in analysis, (5) zoom-out analysis, and (6) theoretical elaboration. Stage 2 was used to improve our research protocol before the interviews were conducted in Stage 3 (Appendix B-1), generating a set of four potential SUSAPs: waste management, working conditions, biosecurity, and animal welfare (Figure 3).

Table 2: Data analysis method

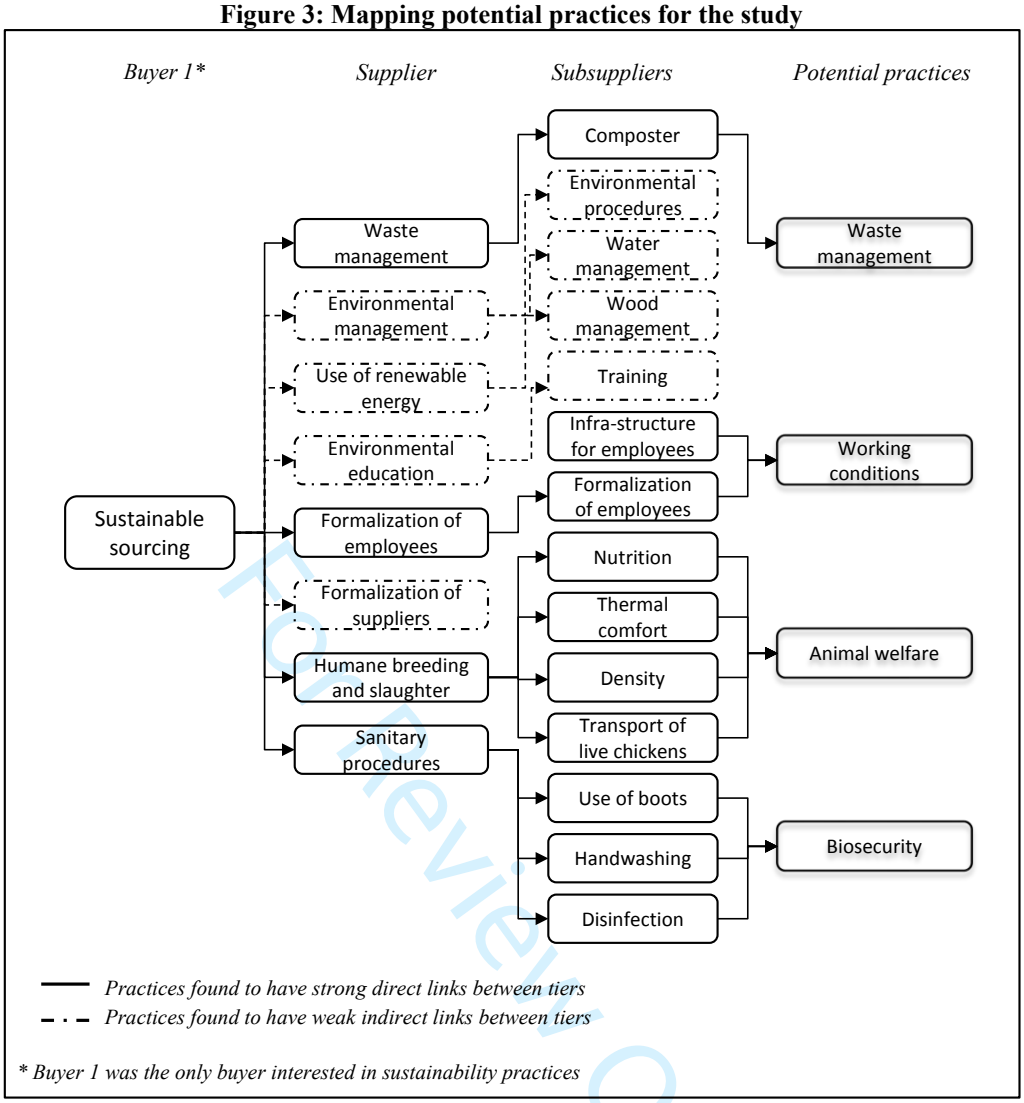
Stage	Process
1	A case is represented by buyer–supplier–subsupplier triads and conducted using practice as the unit of analysis. This practice can be observed at the intra- and inter-organizational levels.
	To comprehend all the information gathered, we conducted an interpretive intra- and inter-textual analysis following the hermeneutic cycle according to the orienting frame-of-reference, referred to in this study as our framework, (Figure 1; Darby et al., 2019; Strauss and Corbin, 1997). Citations related to each practice were pooled and combined with observational notes and secondary data.
2	Data gathered in the first round of interviews were used to map potential practices across SC tiers. We call them potential practices because sociomaterial relationships must be analyzed rather than assumed to ensure a comprehensive understanding of a practice (Carlile et al., 2013; Silva et al., 2022).
	a) An intra-textual analysis of interview transcripts was conducted using open coding of all potential practices observed in each SC tier of the triads under study.
	b) An inter-textual analysis of interview scripts incorporating secondary data was performed through axial coding, leading to the identification of four potential SUSAPs (Figure 3).
3	Data were then gathered through two new rounds, allowing an extended examination of practices within each tier over several months. This approach provided rich insights for analysis and reinforced the temporal flow expected in sociomaterial research (Hultin, 2019). The iterative data gathering and analysis process deepened our understanding of these practices.

4	The next stage of analysis employed the zoom-in method to investigate the implementation and transfer of practices, facilitating an in-depth examination of our case.
	a) As in Stage 2, we conducted open coding (through intra-textual analysis) of interview transcripts, observation notes, and secondary sources to identify elements related to practice components (i.e., meaning, materials, and competencies) within each tier. We explored practice implementation in the context of the four potential SUSAPs (Figure 3). To identify the details of how the SUSAPs exist in within SC tiers, we investigate visible components not observable from a distance. Based on this information, we identified strong direct, weak indirect, or non-existent links, classifying each as an intra-organizational practice, a protopractice, or not a practice (Table 1). The lack of a component within a tier indicated that the potential practice was not an actual practice.
	b) Axial coding (through inter-textual analysis) of the interview transcripts, observation notes, and secondary sources was employed to reveal links across SC tiers (i.e., inter-organizationally), which aided in understanding the transfer process. This coding revealed patterns of practice components observed across tiers. By mapping full, partial, or non-existent links, we determined whether a given instance constituted an inter-organizational practice, protopractice, or not a practice (Table 1). These observed links were vital for analyzing the transfer of practices.
5	The zoom-out stage of analysis employed separate descriptive coding to identify transferable practice components shared across and within SC tiers. By drawing on insights from the open and axial coding, this stage allowed us to discern component linkages across spatial and temporal dimensions (Nicolini, 2012).
6	Finally, we developed a multi-tier-related theory using a sociomaterial perspective by analyzing the implementation and transfer of SUSAPs. This process enabled us to reflect on the initial assumptions shown in our framework. Therefore, we explain the relevance of a sociomaterial perspective to daily operations at both intra- and inter-organizational levels, offering a novel understanding of the role of first-tier suppliers through the *boomerang effect*.

3.4 Trustworthiness criteria

Four trustworthiness criteria were used: credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985). To enhance credibility, we applied multiple validation strategies. First, methodological and data triangulation through different sources during data collection (i.e., interviews, observations, and secondary data) ensured alignment between the research protocol and study objectives. Second, prolonged engagement with the research context facilitated informant validation. Informants remained available for follow-up questions via email or social media, enabling timely verification of findings (cf. Stake, 1995). This interactive approach was particularly beneficial for confirming data accuracy, especially with buyers and the supplier (Klein and Myers, 1999). To mitigate bias, a snowball sampling method was used. Interviewees were contacted directly, without intermediaries, ensuring independent responses.

Figure 3: Mapping potential practices for the study



Regarding transferability, the primary aim is to explain how the findings of one study can be applied to other contexts (Klein and Myers, 1999). To achieve this, we provide a detailed account of the cooperative SC configuration, ensuring that other similar contexts—characterized by a cooperative supplier, a combination of certified and non-certified subsuppliers, a certification body, and one key buyer of the certified products—can fully grasp our research setting and design. Villena et al. (2021) used a comparable approach, investigating the suppliers of one key buyer (Philips Lighting), yielding results widely applicable to other contexts with multiple suppliers and one primary buyer. Therefore, our findings are not limited to the Brazilian agrifood sector but also have potential applicability to other sectors (e.g., textiles) and country contexts that have a co-operative SC configuration. This perspective aligns with the principle of

abstraction, which underpins our study's theoretical contributions (Klein and Myers, 1999). Additionally, by introducing a novel analytical method (zoom-in/zoom-out), our study offers a broadly applicable contribution beyond the specific topic studied (Wieland et al., 2024).

Finally, as part of the hermeneutic cycle, a part-to-whole analysis is essential (Klein and Myers, 1999). Therefore, dependability and confirmability were targeted through multiple independent data interpretations, minimizing bias in the representation of practices (Klein and Myers, 1999; Lincoln and Guba, 1985). During the six stages of our analysis, we identified the SUSAP components within and across SC tiers, ensuring that each analyzed element was informed by the respective SC member studied. Furthermore, triangulation was achieved through multiple data sources, enabling independent analyses and interpretations that were subsequently cross-validated by other researchers.

4. Findings

Our multi-tier analysis reveals that although buyers 2 and 3 purchase large volumes of poultry products from the supplier, their interest remains purely economic. By contrast, buyer 1, despite purchasing lower volumes, plays a pivotal role in initiating sustainability practices in the agrifood SC. Thus, while buyers 2 and 3 adopt a "do not bother" approach to multi-tier SC sustainability management, buyer 1 actively manages its supplier and subsuppliers through a delegated indirect governance mechanism. The following section provides an overview of the study's key findings.

4.1 Zooming-in on SUSAPs within and across multiple agrifood SC tiers

Examining multiple agrifood SC stakeholders is crucial, as insights from public and private sector representatives help us understand how certification requirements differ from legal requirements by incorporating local needs. The four SUSAPs investigated in this study are defined as follows.

- *Waste management* involves identifying appropriate methods for disposing of waste to prevent food contamination and ensure food safety. This includes composting carcasses of dead or sick chickens, managing residual materials post-housing, and addressing waste accumulation in chickens' living areas.
- *Working conditions* encompass measures to ensure employees' well-being and hygiene while housing chickens. This includes formal employment contracts, regulated working hours, and adequate infrastructure to ensure food safety. Given the prevalence of migrant workers in the study region, working conditions emerge as a significant concern.
- *Biosecurity* covers all safety requirements necessary to avoid bacterial transmission to birds and ensure that aviaries remain disease-free before and during housing. This includes using specific protection equipment when entering aviaries and implementing rigorous disinfection measures, which are fundamental to food safety.
- *Animal welfare* refers to all requirements ensuring animal health and, by extension, food safety. These include proper feeding, quality housing, health measures, and behavioral conditions (Wiengarten and Durach, 2021). For instance, maintaining optimal temperature control falls under this heading.

Figures 4(a)–4(d) illustrate the zoom-in analysis for each SUSAP and Figure 5 (Section 4.2) presents the zoom-out analysis. Only buyer 1 demonstrated an interest in SUSAPs through sustainability-related certification. Figures 4 and 5 show each potential practice, represented by a different geometrical shape to distinguish them (i.e., a teardrop for waste management, a diamond for working conditions, a hexagon for biosecurity, and a triangle for animal welfare).

4.1.1 Waste management

The zoom-in analysis of waste management is visually depicted in Figure 4(a) (see Table A.1 in Supplementary File A for further details). Buyer 1's tier lacks materials and competencies,

limiting the establishment of a fully developed practice. Instead, the emphasis is primarily on meanings related to environmental impact reduction, which are only partially shared across SC tiers as part of the certification requirements. Secondary data highlight buyer 1's sustainable sourcing practice (e.g., "[We stimulate] a more productive soil that better sequesters carbon" [Institutional web page, 2021]).

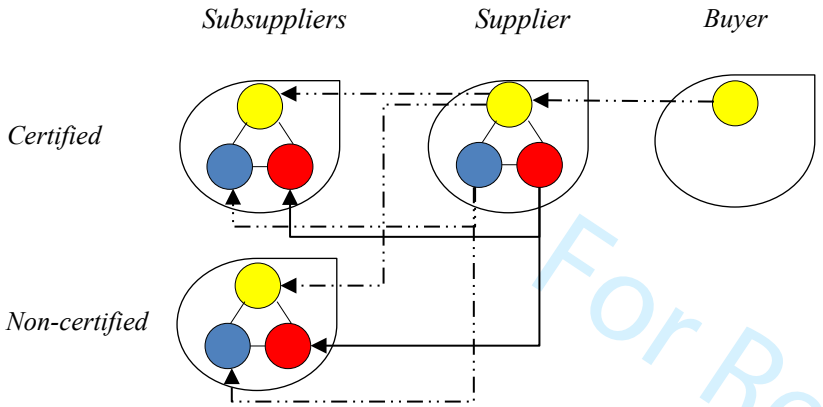
At the first tier, the supplier explicitly demonstrates all three well-linked practice components. Although the documents provided by the supplier state that "waste management [has] the purpose to reduce environmental pollution and provide an appropriate destination for waste," data analysis reveals that the supplier interprets waste management primarily as a sanitary control measure rather than an environmental concern, diverging from buyer 1's perspective. For instance, one veterinarian noted, "We advise [for correct disposal] because if contamination happens with their live chickens, it will be worse for them" (VET-NC4). Regarding materials, the respondents highlighted the use of orientation videos as one method to disseminate knowledge on proper waste disposal. These videos, shared with subsuppliers, facilitate practice implementation and enhance technical awareness within the supplier's operations.

Finally, at the subsupplier tier, waste management is framed as a requirement—either for certification compliance or first-tier supplier standards. These requirements push subsuppliers not only to adhere to their own meanings of waste management but also to respond to pressures cascading across multiple tiers. However, for some certified subsuppliers, waste management has evolved into an ingrained habit associated with continuous control processes, as noted in the following observation data:

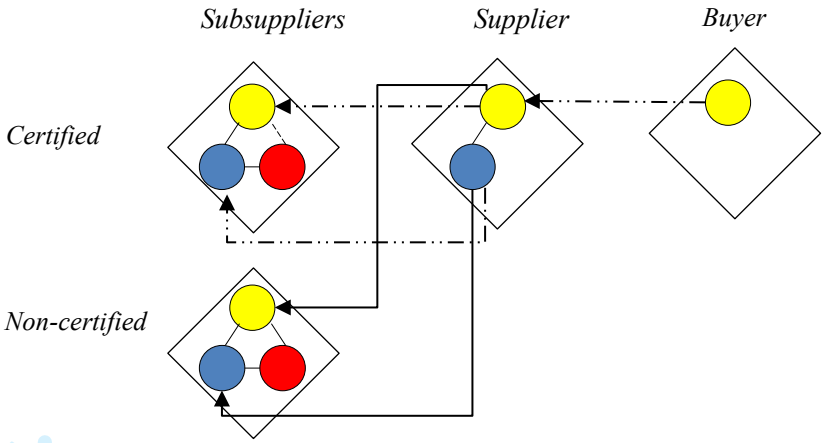
> Observation data at a certified farm [12/04/21–08:06:00]: Walking toward the aviaries, the researcher and the poultry farmer discuss the routines and tasks. At that moment, the poultry farmer confesses that he cannot understand poultry farmers who do not dispose of waste properly, do not dispose of it at all, or even complain about this task. For him, for example, doing this every morning is like having breakfast: "you do it every day, and you do not even remember; it is not an obligation; you just must do it."

Figure 4: Zoom-in analysis of SUSAPs

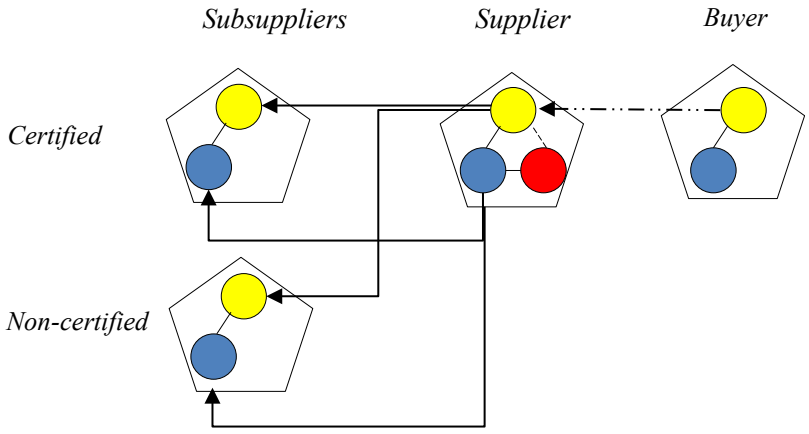
(a) Waste management (teardrop shape)



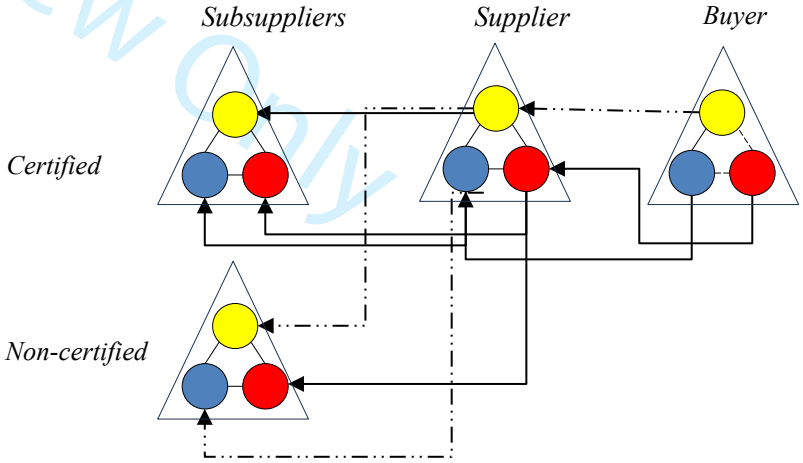
(b) Working conditions (diamond shape)



(c) Biosecurity (hexagon shape)



(d) Animal welfare (triangle shape)



Legend: Yellow Circle = Meanings; Blue Circle = Materials; Red Circle = Competencies. The links within tiers are related to strong direct links (solid line) and weak indirect links (dashed line), while across tiers links are denoted by full (solid line) or partial (dashed line) links.

By contrast, non-certified subsuppliers do not assign the same level of importance to waste management. Observations indicate that the supplier's veterinarians at non-certified farms prioritize chicken batch performance—measured in terms of feed conversion (a measure of animal productivity)—over proper waste disposal. Unlike their counterparts at certified farms, these veterinarians do not actively monitor waste management practices.

A variety of materials are employed to support daily practice of waste management on the farms. As observed during a visit, the process at certified farms included walking through the aviaries, collecting dead chickens and waste, transporting them to the compost bin, recording data on a spreadsheet, washing the bucket used for waste collection, and washing hands before proceeding to other tasks. In this process, poultry farmers generally follow the recommendations of veterinarians and the documents/manuals shared by the supplier. For example, in the *Manual of Good Production Practices*, provided by the first-tier supplier, disposal is described as "an alternative sustainable process that helps avoid lot contamination."

The meaning and material components of this practice are supported by the technical knowledge of non-certified subsuppliers. For instance, with veterinarian support, FAR-NC12 confirmed learning how to effectively handle waste disposal equipment. Several other instances were noted during the visits, including explanations on how avoiding disposal in the soil prevents contamination and how composting methods can be optimized (see Table A.1 of Supplementary File A). For certified subsuppliers, we identified competencies related to process innovation, organization, and adaptability, such as identifying alternative methods of composting with equally effective outcomes. This demonstrates the supplier's ability to internalize waste management in its daily operations, thus, reinforcing the practice.

Overall, while waste management is a SUSAP for the supplier and subsupplier tiers, it becomes a sustainable agricultural protopractice across SC tiers because existing meanings are

only partially shared. Specifically, buyer 1 interprets waste management in broad terms, whereas other upstream SC members associate it more directly with sustainable agriculture.

4.1.2 Working conditions

The findings on working conditions as a potential practice are represented in Figure 4(b), with further details in Table A.2 of Supplementary File A. Regarding specific tiers, buyer 1 defines working conditions as a social obligation that all SC members must uphold. As the Sustainability Director explains, "Suppliers receive all protocols and are asked to do their own self-assessment." However, despite buyer 1's emphasis on human rights in the poultry SC, as stated in its code of conduct, its role in transferring the practice is limited. This result is further evidenced by the Sustainability Director's response that "the poultry chain itself is a well-regulated chain, regulated in terms of legislation" (B1-2). This response suggests that buyer 1 perceives working conditions as a regulated obligation rather than an active practice it needs to reinforce. Our analysis suggests that buyer 1 does not engage in direct implementation, as no materials or competencies related to working conditions exist at this tier.

Similarly, at the supplier level, working conditions do not constitute a fully developed practice. Although the supplier connects meanings (employee retention) with materials (benefits such as food stamps and dental plans), the absence of related competencies prevents working conditions from evolving into a full-fledged practice. In this context, the supplier views working conditions primarily as an employee retention tool rather than a broader social responsibility measure.

By contrast, at the subsupplier tier, we identify two perspectives. First, our analysis suggests that working conditions constitute a protopractice for certified subsuppliers because only a weak indirect link exists between meanings and materials. This result might be related to the scarcity of workers in the region (FAR-CE 3), which requires subsuppliers to focus more on the overall elements. Second, working conditions are viewed as a daily practice for non-certified

subsuppliers because—following the same issue of worker shortages—they use contracts to manage the practice and invest in infrastructure improvements for employee retention. Competencies then appear as an element of practice for certified and non-certified subsuppliers. As shown in Table A.2 of Supplementary File A, proactivity and adaptability emerge as competencies. To pursue a high quality of life and maintain appropriate hygiene, subsuppliers recognize the importance of *cascading* information while also identifying efficient solutions tailored to their unique needs for employee retention.

In this context, infrastructure is presented as a key material arrangement related to subsuppliers because they must adapt to the workplace environment to ensure quality of life and hygiene for employees managing poultry. For instance, during an interview with certified poultry farmer 5, we observed "three builders were on the property, expanding and adapting the rooms that house the employees and the chicken collectors [i.e., the service provider]." These infrastructure improvements extend beyond aviaries to include employee housing, as workers usually reside on the farms. For instance, FAR-NC2 noted, "We built a space for resting here. It has an area with a table, chairs, fridge, stove, and microwave." Another respondent shared, "We do everything right. The *granjeiro* [term referring to the employee] receives the contract and we deliver it to the supplier [...]. It is to protect him and us, too, right?" (FAR-NC10). These statements align with the supplier's approach of using contracts and benefits as mechanisms to ensure good working conditions.

Therefore, working conditions emerged as sustainable agricultural protopractices as our analysis revealed that, although each tier of the poultry SC adopted a unique approach to implementing this potential practice, the links between components remained partial across the SC tiers.

4.1.3 Biosecurity

Figure 4(c) provides an overview of our zoom-in analysis of biosecurity, based on the evidence presented in Table A.3 of Supplementary File A. In terms of the meanings within the specific tiers, buyer 1 emphasizes the need for food safety: "On this sanitary issue, [buyer 1] increasingly has a stronger, more demanding position" (SUP-2). However, biosecurity is not a practice for the buyer—an unexpected finding given its critical role in food safety. As the president of buyer 1's sustainability committee stated, "When we look at specific, more demanding countries, [...] there is a tendency to be much more focused on food safety, on the sanity of the process" (B1-2). Similarly, the certification body representative explained that "The producer signs a contract with the certifier and the certification scheme, saying that he will follow all the rules to achieve certification and to maintain it" (CGG-1). Despite this, buyer 1 can share its interests through contracts, making contracts the objects with the agency that shape biosecurity practices among SC members.

By contrast, the supplier understands biosecurity in terms of financial outcomes. In the words of one of the veterinarians, "Biosecurity is a pillar. The result of the supplier depends on a good conversion. A sick chicken is bad [financially] for the supplier and for the poultry farmer" (VET-NC2). The supplier uses contracts, WhatsApp messages, and printed notices displayed on farms to facilitate easy communication between tiers. These materials enhance knowledge transfer at the supplier level, although this competence is not disseminated, as the subsuppliers merely follow instructions. A subsupplier confirmed this observation: "You take a course, [and] the supplier tells you everything you need to do, the biosecurity procedures" (FAR-CE 7). Nevertheless, biosecurity was a protopractice for the supplier, given the weak indirect link between meanings and competencies—an outcome of a lack of alignment of meanings shared with the buyer.

For subsuppliers, biosecurity is not an established practice due to a lack of competencies identified during the study. Biosecurity does not follow sustainability logic and is adopted purely for financial reasons—to maximize the number of live chickens at the end of the housing process. For instance, a non-certified subsupplier noted, "A series of actions should be taken for biosecurity [because] if you do not raise chickens, you do not have money." To this end, subsuppliers mobilize multiple objects for biosecurity, including using boots, as explained by several farmers. Certified and non-certified subsuppliers adopt similar approaches to this potential practice because of close contact with veterinarians, who share the same understanding with both groups of subsuppliers.

Overall, based on these analyses, we conclude that biosecurity appears to be a sustainable agricultural protopractice because only one component (meaning) is linked across all SC tiers; however, such a link is only partial between the buyer and the supplier. While SC members may comply with the certification, their focus is primarily on financial implications rather than sustainability or food safety risks.

4.1.4 Animal welfare

Figure 4(d) summarizes our findings on animal welfare (see details in Table A.4 of Supplementary File A). Our primary data reveals that buyer 1 perceives animal welfare purely in terms of product quality, despite publicly stating the need for "prioritizing animal health and welfare" (Institutional web page, 2021). Contracts serve as objects to produce this protopractice and generate knowledge about animal health and rights. Although buyer 1 does not directly handle animals, it shares technical knowledge to align with certification requirements.

For the supplier, animal welfare is primarily understood as a quality requirement from buyer 1. Based on this, the supplier's employees define their actions to care for the animals. In addition to contracts, other artifacts, including printed notices and videos, are regularly shared to demonstrate the importance of improving animal health and protecting their rights. For instance, an internal supplier notice highlights the need to support animal welfare through animal freedom,

asserting that animals should be "free from hunger and thirst, free from discomfort, free from injury and/or disease, free to express behaviors, and free from fear and stress." These materials help veterinarians enhance their technical knowledge and improve animal welfare practices among certified and non-certified subsuppliers.

In this agrifood SC, even non-certified subsuppliers introduce animal welfare into their daily operations. One farmer noted, "[…] on the issue of animal welfare, they [supplier's veterinarians] were quite demanding" (FAR-NC12). Certified and non-certified subsuppliers employ various materials to enhance animal welfare, including traditional technologies, such as fans for environmental control, and innovative materials, such as semi-kraft paper, to improve the quality of life of chickens in aviaries. A certified farmer explained: "I started to put a strip of paper under the nipple where the chick eats and drinks water. Then he is not dehydrated; he also eats better, in my opinion" (FAR-CE8). As Table A.4 of Supplementary File A illustrates, the mobilization of multiple materials to enhance animal welfare fosters competencies (e.g., adaptability, proactivity, and technical knowledge), as subsuppliers themselves ensure animal welfare in their daily operations. Thus, several farmers independently develop their animal welfare approaches, demonstrating deep familiarity with poultry needs.

Animal welfare is the only SUSAP that fully transitioned into a daily practice. This is due to strong links between buyer 1, the supplier, and certified subsuppliers, although buyer 1 remains primarily focused on quality rather than animal welfare. Partial links exist between the supplier and non-certified subsuppliers in terms of meanings and materials. However, as evidenced in Figure 4(d), full links exist between materials and competencies, demonstrating that animal welfare has been comprehensively pursued in the studied agrifood SC.

4.2 Zooming-out on SUSAPs in an agrifood SC

Beyond examining each practice within and across SC tiers, our sociomaterial perspective allows us to understand the factors that influence the set of daily operations in the poultry SC.

Therefore, a zoom-out analysis was conducted to identify the transferable components of the implemented practices. Figure 5 summarizes how meanings, materials, and competencies were mobilized to address our research question.

Figure 5: Zoom-out analysis of the transfer process

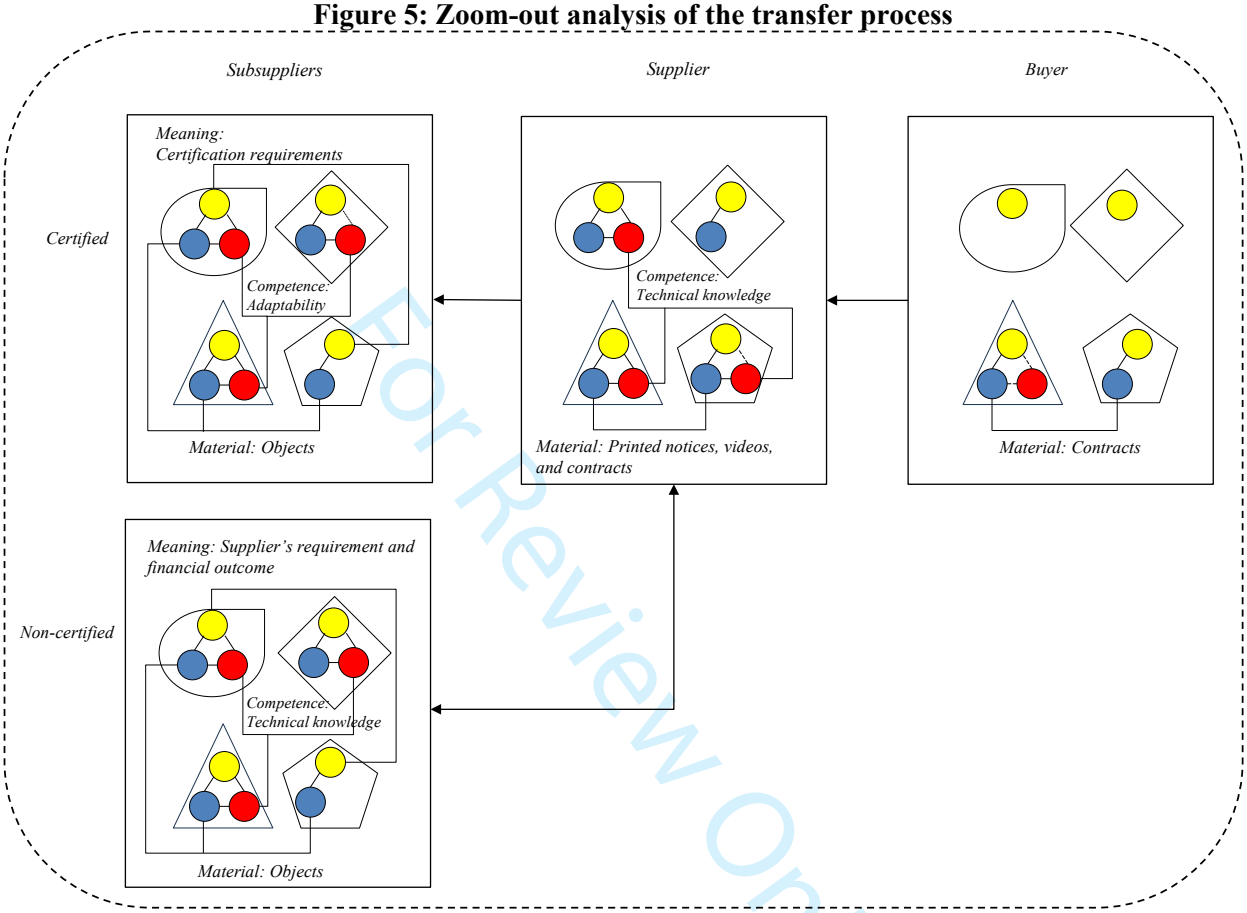


Figure 5 illustrates that buyer 1 relies on contracts, which embody sustainability certification requirements, as evidence of potential practices that lead to SUSAPs in the poultry SC. Thus, materials are the only component mobilized, indicating that buyer 1 has limited influence in transferring SUSAPs. This reinforces our theoretical reasoning that focusing on cascading requirements—in this case through certification—is insufficient for establishing sustainability practices.

Despite this, we find that the supplier plays a boundary-spanning role between buyer 1 and the subsuppliers. As the supplier's vice president (SUP-1) stated, this occurs because

"Sustainability is an everyday policy." In this way, the supplier "shows to the producer that to have a better performance, to achieve a greater gain, [and] have a lower cost in the process, he just needs to dedicate himself a little more [and] make some adjustments in his installation" (SUP-1). Although no explicit meanings are shared between potential practices, we find that materials and competencies are mobilized. In terms of materials, this is reflected in the printed notices, videos, and contracts. For example, the supplier constantly reinforces the need to support animal welfare using manuals detailing feeding, housing, and ambiance (e.g., temperature). As the vice president of the supplier explained:

> The way in which we alert the producer is an important part of our role, to make sure he does these things in a sustainable way, so that we can maintain them as certified subsuppliers, and there is no question that, more and more, there are issues of animal welfare. He must be adaptable according to market requirements. That is sustainability. (SUP-1)

Therefore, the supplier prioritizes competency development by fostering technical knowledge and information-sharing. The boundary-spanning process demonstrates that these elements are essential for transferring the practice, although some potential practices are considered sustainable agricultural protopractices.

Regarding the subsupplier tier—the supplier's primary focus in this case—the explicit requirement for sustainability certification would suggest that only certified subsuppliers are targeted. However, we found that practices developed with certified subsuppliers are also transferred to non-certified subsuppliers. This becomes evident when we analyze how meanings, as one of the three SUSAP components, differ between the two groups of subsuppliers. As Figure 5 illustrates, certified subsuppliers primarily understand sustainability practices through the lens of certification compliance. While some may exceed these requirements, certification serves as their key motivation. By contrast, non-certified subsuppliers are driven by financial outcomes, shaped by the supplier's emphasis on sustainability as a fundamental requirement. This alignment ensures consistency in practices across all subsuppliers. As the supplier noted, "Over the years,

waste management has always been sought as a key sustainability issue because the producer follows the correct destination of waste (including dead chickens) through composting" (SUP-1).

A key distinction between these groups, identified through the zoom-in analysis, concerns working conditions (see Section 4.1.2). Notably, non-certified subsuppliers adopt additional measures and allocate more materials to ensure employee well-being, a response to the supplier's influence. As FAR-NC 18 stated, "The pressure is huge [...] because there is no point in demanding anything if the farmer is not doing what they [the supplier] are asking. [If something goes wrong,] the farmer will be pushed out." This influence is evident in the adoption of specialized equipment for bird management and infrastructure improvements aimed at ensuring good working conditions.

Finally, in terms of competencies, we found different approaches for the two groups of subsuppliers. As Figure 5 illustrates, while certified subsuppliers focus on adapting their practices to meet SUSAP requirements, non-certified subsuppliers rely on the technical knowledge shared by the supplier to develop their competencies. For both groups, veterinarians act as key representatives of the supplier, playing a crucial role in supporting subsuppliers' implementation of SUSAPs. These veterinarians serve as key sources of knowledge, guiding sustainability practices. In this context, we emphasize that buyer 1's certification requirements align with national legislation, a crucial factor for the certification body. As one certified subsupplier explained, "Animal welfare has become a standard, a requirement of the [Brazilian] Ministry of Agriculture" (FAR-CE 7). Veterinarians also educate subsuppliers on national regulations, thereby playing an integral role in supporting animal welfare, which emerged as the only explicit practice in the studied poultry SC.

5. Theorizing multi-tier supply chain sustainability

Our findings demonstrate the implementation and transfer of sustainability practices across multiple SC tiers based on four SUSAPs. Overall, we find that implementation and transfer

rely on a combination of intra- and inter-organizational SUSAPs instead of replicable practices (cf. Meinlschmidt et al., 2018). By zooming-in and -out on the SUSAPs, we addressed our research question: *How are SUSAPs implemented and transferred across specific and multiple tiers in the agrifood SC of Brazilian poultry farming?* However, to explain why only animal welfare is classified as a fully established practice, whereas waste management, working conditions, and biosecurity remain protopractices, we present a new interpretation of the multi-tier SC sustainability theory through a sociomaterial perspective.

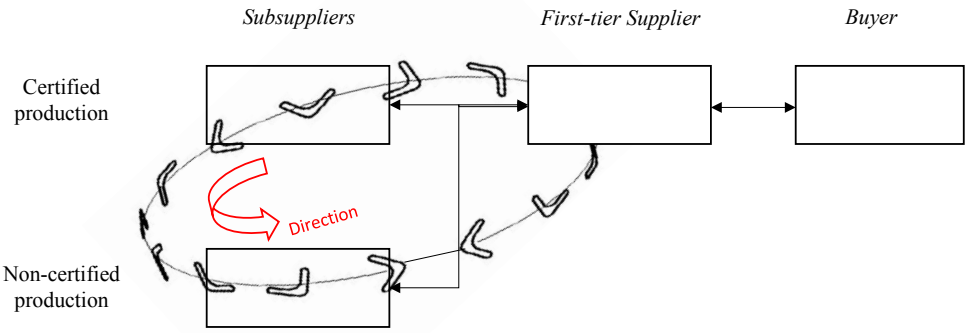
Our findings indicate that while buyers 2 and 3 adopt a "do not bother" approach to sustainability practices, buyer 1 employs an indirect governance mechanism (Tachizawa and Wong, 2014). Through its relationship with the first-tier supplier, buyer 1 relies on sustainability certification. These findings challenge the common assertion in the literature that SC relationships rely on the cascading of sustainability requirements (Johnsen et al., 2022; Villena, 2019). For instance, Soundararajan and Brammer (2018) explored the role of first-tier suppliers in monitoring and disseminating knowledge, whereas Villena and Gioia (2018) assumed that first-tier suppliers simply respond to multinational needs. Recently, Johnsen et al. (2022) identified two additional roles—amplifier and transmitter—acknowledging two-way influences in these relationships. We build on more recent research to explain how the first-tier supplier plays a boundary-spanning role in linking buyers and subsuppliers. Although this result aligns with that in the extant literature that refers to first-tier suppliers as bridges (Chae et al., 2024; Durach et al., 2024; Jia et al., 2021), we significantly extend this literature by detailing how this role is enacted.

Specifically, from the sociomaterial perspective, we found that the boundary-spanning role does not merely involve compliance- and improvement-oriented actions, as suggested by Jia et al. (2021), but requires integrating material and social elements into a practice-oriented role. While SUSAP implementation outcomes vary across buyers, suppliers, and subsuppliers, the cooperative governance mechanism enables the first-tier supplier to directly influence the use of materials,

development of competencies, and shaping of meanings to strengthen sustainability. Thus, within multi-tier SC sustainability theory, cascading sustainability requirements prove inadequate for operationalizing sustainability principles. Instead, transferring practice emerges as a more effective approach, enabling first-tier suppliers to act as a bridge between the buyer and subsuppliers as well as translate requirements based on their understanding of the social context.

Our key finding revealed a previously overlooked dynamic between the supplier and subsuppliers, which we termed the *boomerang effect* (see Figure 6). Goltsos et al. (2018) explored the return of used products in closed-loop SCs, questioning whether this process follows a boomerang trajectory. However, the authors' optimization-based approach showed that the return trajectory cannot be controlled due to high process uncertainty. By contrast, in this study, we find that the first-tier supplier *throws* components of SUSAPs during the transfer process and *catches* the boomerang back by receiving safer and more sustainable products. This effect enables the first-tier supplier to span its boundaries to promote SUSAPs beyond targeted subsuppliers, reinforcing sustainability practices throughout the SC. In our study, this boundary span was strongly shaped by veterinarians who shared meanings, materials, and competencies with all subsuppliers.

Figure 6: Boomerang effect in multi-tier SC sustainability



As Figure 6 illustrates, beyond requiring sustainability certification, buyer 1 does not influence the boomerang effect. To meet buyer 1's demand, the supplier only needs to ensure that certified subsuppliers adhere to sustainability practices. This could lead to SUSAP efforts being concentrated within a specific group. However, due to its cooperative governance approach, the supplier intentionally transfers SUSAP components to non-certified subsuppliers. This perspective differs from the linear, one-way relationships (direct or indirect) described by Tachizawa and Wong (2014) or the two-way interactions mapped by Johnsen et al. (2022). The boomerang effect introduces a more elliptical dynamic, in contrast to traditional linear movements, where critical resources (e.g., veterinarians, materials, and training) are mobilized by the first-tier supplier to promote SUSAPs across the SC.

Unlike Tachizawa and Wong (2014), who explored governance mechanisms, and Chae et al. (2024), who examined transactions between SC members, we identified practice as the defining feature of multi-tier SC sustainability. While the boomerang effect does not apply to every practice, our findings demonstrate that a cooperative SC structure could encourage all subsuppliers to implement sustainability practices. The unique characteristics of our research context stem from the cooperative SC structure, which introduces new contextual subtleties.

Based on the boomerang effect, a first-tier supplier transfers SUSAPs to certified subsuppliers by deploying critical resources. Just as a boomerang returns to its thrower, the first-tier supplier—through cooperative governance—can leverage these efforts by transferring the same sustainability practices to non-certified subsuppliers, thereby enhancing overall SC sustainability. However, certified and non-certified subsuppliers do not influence each other. The boomerang represented in Figure 6 refers solely to critical resources *thrown* by the supplier. By employing this mechanism, the first-tier supplier increases its own capacity to deliver sustainable products because if more certified subsuppliers are needed in the future, noncertified subsuppliers are already practicing SUSAPs. We therefore define the boomerang effect as *the intentional*

strategy of a first-tier supplier to expand the transfer of existing practices—in our case, sustainability practices—to all subsuppliers. Understanding how SUSAPs function for certified and non-certified subsuppliers is thus essential for analyzing multi-tier SC sustainability practices. The boomerang effect offers a strategic pathway for first-tier suppliers in traditional SCs to enhance SUSAP implementation and transfer by spanning boundaries, as observed in our study of cooperative SCs.

6. Discussion

Sustainability has been a central theme in the multi-tier SC debate over the last decade (Mena et al., 2013; Wilhelm and Villena, 2021). However, a comprehensive understanding of how sustainability practices are implemented and transferred across multiple SC tiers remains elusive. Specifically, the understanding of how these practices reach the *invisible* segments of multi-tier SCs, that is, subsuppliers, remains limited (Jamalnia et al., 2023; Meinlschmidt et al., 2018; Wilhelm and Villena, 2021). This issue is especially critical in the food industry, where eliminating food contamination is paramount (FAO, 2023), and contamination primarily stems from poor animal health at the subsupplier level (Mena et al., 2013; Santos et al., 2023; Wu and Pullman, 2015). This study makes a unique contribution by adopting a sociomaterial OM perspective to examine sustainability in multi-tier SCs.

6.1 Theoretical implications

Prior studies on sustainability in multi-tier SCs have largely focused on how buyer firms manage factors such as unseen risks associated with subsuppliers (Villena, 2019) and the lack of supplier and subsupplier accountability in emerging economies (Tachizawa and Wong, 2014; Wilhelm and Villena, 2021). These complex factors influence the implementation and transfer of sustainability practice across SC tiers. Although empirical evidence suggests that sustainability requirements play a key role, these requirements are often imposed by multinational companies

on suppliers and subsuppliers (e.g., Villena and Gioia, 2018) rather than being integrated as sustainability practices (Silva et al., 2022). To advance this body of knowledge through new conceptual foundations, we offer two theoretical contributions to the multi-tier SC sustainability theory and the emerging sociomaterial OM perspective.

The first contribution builds on the theorization presented in Section 5. Multi-tier SC studies, especially in the agrifood industry, have largely adopted a buyer-centric perspective (e.g., Gong et al., 2018; Kähkönen et al., 2023; Pohlmann et al., 2020). However, our findings challenge this view by highlighting the critical role of first-tier suppliers as boundary spanners. Specifically, buyer 1 employed an indirect governance mechanism that led the first-tier supplier to promote SUSAPs across the SC. As previously argued, our study offers a novel concept for multi-tier SC sustainability: the boomerang effect resulting from cooperative SC configuration. Other studies have also explored the cooperative SC configuration. For instance, Wu and Pullman (2015) examined an agricultural cooperative for beef production in western US, highlighting the importance of cooperatives as active players. Recently, Dias et al. (2023) investigated food SCs in Brazil and found specific types of relationships connected with SC practices (e.g., collaboration) in a cooperative context. We expand these findings significantly by exploring the role of a first-tier supplier in managing different groups of subsuppliers in terms of sustainability practices. This leads to the following proposition:

P1: In a multi-tier supply chain, first-tier supplier acts as critical boundary spanners that facilitate the transfer of sustainability practices among subsuppliers. When buyer firms adopt indirect governance mechanisms, first-tier suppliers can leverage cooperative supply chain configurations to promote sustainability practices, creating a boomerang effect that reinforces sustainability across supply chain tiers.

The second contribution of this study concerns sociomateriality in OM. Overall, OM literature acknowledges that practice is a fundamental unit of analysis. Thus, a practice-based

approach has been developed within OM, highlighting variations in adoption and performance within firms (Bromiley and Rau, 2016) and across firms (Carter et al., 2017). Building on our theoretical elaboration, we differentiate between cascading and transferring (see Section 2.3). Unlike prior studies that focus extensively on the cascading effect of sustainability requirements (Villena, 2019; Wilhelm and Villena, 2021), we challenge the mere identification of practices (Bromiley and Rau, 2016). Instead, we adopt a sociomaterial perspective to examine whether a firm's intentionality and agency for sustainability are genuine and sufficient to facilitate transferable practices. Our study reinforces the interdependence between the material and the social elements in OM (Wieland et al., 2024).

As practices shape the contour of a firm's daily operations (Orlikowski, 2007), our intra-organizational-level analysis shows that we must rely on how practices are implemented according to the intentionality and agency of each SC tier rather than concentrating on cascading activities (Wilhelm and Villena, 2021). The use of TPs and the sociomaterial perspective help clarify how social context shapes sustainability practices across multi-tier SCs (in our case, the multi-tier SC scope). Thus, the needs and rules may differ depending on the location of an SC member. In particular, we confirm that subsuppliers are context-driven (Jamalnia et al., 2023; Sauer and Seuring, 2018), thereby affecting SUSAPs in the SC.

Analyzing how daily operations interact with meanings, materials, and competencies (Shove et al., 2012, 2015) can reveal nuances related to single actors in a multi-tier SC. For example, Villena and Gioia (2018) studied subsuppliers in the automotive, pharmaceutical/consumer goods, and electronics sectors and found limited monitoring, equipment, and regulations. By contrast, in our study, the social context involved high levels of certification and regulation. This distinction arises in the poultry industry because disease in a single live chicken can compromise an entire batch, necessitating greater oversight. We also illustrate that the social context should be considered when analyzing a practice; for example, the

employment of migrant workers has led to working condition-related issues that differ from what may have otherwise been the case. This leads to our second proposition:

P2: The successful implementation of SUSAPs by suppliers and subsuppliers depends on their active engagement with social context, intentional commitment and autonomous decision-making.

From an inter-organizational perspective, our analysis explores how each SC member mobilizes different practice components across a triadic relationship (Carter et al., 2017). As shown in Figure 5, materials play a crucial role across all SC tiers—buyer 1 used contracts, the supplier employed printed notices, videos, and contracts, and subsuppliers (certified and non-certified) actively engaged with various objects. Regarding meanings, only subsuppliers embodied social understandings. One interpretation of this result is that, while certified subsuppliers involved themselves with sustainability requirements, non-certified ones were involved in sustainability practices because of the supplier's influence and for understanding the impact of sustainability on their financial outcomes. Finally, competencies were based on technical knowledge and adaptability. The extant literature indicates that supplier capabilities must be developed to manage sustainability-related risks (Villena and Gioia, 2018). Although we investigate competencies rather than capabilities as a practice component, we reinforce the importance of the human (social) element. As explained in Section 4, competencies appear to be relevant to the supplier and subsuppliers because they emerge from the interlinkage of different SUSAPs. By analyzing these components, we argue that a sociomaterial perspective is essential to advancing OM research.

Our findings reveal hidden sustainability dynamics beyond visible supplier practices, thereby responding to calls in the literature (Jamalnia et al., 2023; Nath et al., 2021). A notable example is animal welfare, the only SUSAP that has been successfully implemented and transferred in the studied poultry SC. As shown in Figure 4(d), the definition of animal welfare (i.e., meaning) is widely understood across all tiers, with the highest clarity in the farming context.

This alignment reinforces material use and competency development, thus demonstrating the sociomaterial OM perspective. Moreover, experience-sharing within SCs enhances risk management efforts (Villena and Gioia, 2018), including addressing sustainable agriculture-related risks, and enables the identification of subsuppliers within specific social contexts. This leads to our third proposition:

P3: The successful transfer of SUSAPs across SC tiers depends on whether the three practice components (meanings, materials, and competencies) are linked while allowing for tier-specific differences driven by social context.

Finally, our sociomaterial perspective also introduced the concept of protopractices—practices that, while not fully established, have developed key components for future transfer across SC tiers. We found that the emergence of a protopractice plays an intermediary role in the development of SUSAPs, which differs from the results in existing literature which often presents practices as either fully implemented or absent. This implies that, rather than assuming that existing components lead to genuine practice, we must assume that sustainability practices evolve over time through daily operations. We contend that differentiating between practice and protopractice allows firms to tackle unsustainable SC issues, avoiding the assumption that all transferable practices are fully implemented. As the sociomaterial perspective deals with intentionality and agency (Orlikowski, 2007), recognizing the existence of protopractices can facilitate further engagement with the practice components.

6.2 Managerial implications

Our findings provide practical insights for multi-tier SC managers. Although our findings relate to the food industry, they can be applied to other contexts with cooperative SC configurations. Specifically, managers should actively explore and leverage other SC members' knowledge of SUSAPs to improve their sustainability performance. For example, managers of

buyer firms should target knowledge surrounding specific practices and components to ensure that their own commitments are met. Beyond simply cascading requirements to first-tier suppliers, buyers should engage with practices more deeply, ensuring alignment in meanings, materials, and competencies. Additionally, instead of relying solely on indirect governance mechanisms, buyers can adopt a sociomaterial OM perspective, acknowledging the relevance of the material and the social elements in sustaining SC operations.

Additionally, we suggest that supplier and subsupplier managers, particularly in cooperative farming contexts, should treat sustainability as an embodied practice within their operations. The managers of first-tier suppliers from other cooperative SC contexts can explore the feasibility of developing the boomerang effect with their subsuppliers, which leverages the benefits of sustainability practice according to our findings. These managers can also ensure that they use their position in the SC to mediate between subsuppliers' and buyers' needs and support SC learning. Subsupplier managers must then embrace the sociomaterial OM perspective to continuously improve sustainability practice performance. This is crucial because of their current reputation as the segment most prone to violating sustainability requirements (Gong et al., 2018; Meinlschmidt et al., 2018; Nath et al., 2021; Villena and Gioia, 2018). Furthermore, as SUSAPs often emerged as protopractices, subsupplier managers should proactively strengthen the links between the material and social elements, particularly in food SCs, to contribute to sustainability.

7. Conclusion

Using a practice-based approach, we revealed *how* SUSAPs are implemented and transferred in a multi-tier SC. Moving beyond a static perspective of identifying *what* practices are pursued, we provided a dynamic sociomaterial perspective for OM. Our analysis challenged the prevailing *cascading* perspective in the literature, which views SUSAPs as top-down processes initiated by buyers. Instead, we identified a *transfer* process where the first-tier supplier acts as a boundary spanner, and farming subsuppliers develop the practice components using

intentionality and agency within their specific social contexts. Our sociomaterial perspective demonstrated that potential practices are approached differently in each tier—buyers, the supplier, and subsuppliers—which led to three protopractices (waste management, working conditions, and biosecurity) and only one genuine practice (animal welfare). We conclude that multi-tier SC studies must consider the social contexts in which members operate to implement and transfer SUSAPs.

As with any other study, our study has certain limitations. First, as an interpretive case study, our findings provide in-depth insights but are not intended to be universally generalizable. While our analysis provides a detailed examination of SUSAPs, it primarily represents the Brazilian agrifood sector. However, the theoretical insights have potential applicability to other cooperative SCs. Second, the literature emphasizes multinational firms, where economic relationships dominate. By contrast, our study focused on cooperative governance, which provides novel insights into the practice, social context, and engagement with indirect governance mechanisms through the boomerang effect. Finally, we recognize the limitation of validating our empirical analysis with farmers—although they frequently use social media apps to exchange information with suppliers, they are not always receptive to constant communication. While we validated our findings with some farmers, we could not do so for all of them.

Our study opens several avenues for future research. Scholars can further develop sociomaterial OM theories, incorporating the material and the social elements in SC organizing. Additionally, future studies can employ practice theories to understand for-profit SCs and other configurations (e.g., B-Corp and social enterprises) to examine whether sustainability practices manifest similarly across different contexts. Future studies could also explore whether the boomerang effect also occurs in other industries and SC configurations, thereby enriching OM theory development. Finally, future studies can adopt action research or intervention-based approaches to deepen our understanding of multi-tier SC dynamics. Addressing these gaps will

strengthen the sociomaterial perspective in OM and provide deeper insights into sustainability practice transfer in global SCs.

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Appendix A—Key concepts and their definitions

Concept	Definition
Sociomaterial perspective	A lens for studying practice by examining the interplay between the material and social context
Practice	A habitus formed through knowledgeable actions that shape daily operations
Protopractice	A quasi-practice that is still developing into a habitus
Not a practice	Actions that are not in the process of becoming a habitus
Meanings	Social and symbolic understandings embodied in actions
Materials	Any physical element that supports the embodiment of actions
Competencies	Components that give motion to a practice
Cascading requirement	A process focused on the diffusion of replicable requirements across SC tiers
Transferring practices	A process that embraces practice adaptation to different social contexts
Interpretive case study	A qualitative research method that reveals unique field-specific nuance
Zoom-in/zoom-out method	A method of analysis used to understand practice as a unit of analysis

Appendix B—Interview script sample

Personal profile (for all interviewees) - Can we start with your brief introduction (including your experience and role)? - What is your company's role in the agricultural sector? - Can you briefly describe the supply chain in which your company operates?
Structure and operation (for supplier and service provider) - Do your customers or other supply chain members impose specific procedures or requirements on your operations (external pressure from institutions or government)? If yes, what are they? - What methods do you (and your suppliers) adopt to verify compliance with these requirements? - Do you think the current means of transferring, guiding, and teaching new procedures and/or requirements are sufficient? - Are there specific requirements related to sustainability issues? - How do you prepare/guide the company to meet GG certification? Are there any audits?
Structure and operation (for buyers) - What are the main supply chain sustainability initiatives developed by your company? - How does your company manage sustainability requirements/procedures? - Do you think these initiatives, procedures, and requirements reach your suppliers, subcontractors, and consumers? - What challenges, if any, do you face when sharing and transmitting procedures across the supply chain? - Do you need to reinforce guidelines?

Appendix B-1 – Interview script sample

Sustainable agriculture practices (for all interviewees) - How do you define the following sustainability practices in your industry: waste management, working conditions, biosecurity, and animal welfare? - Are these practices mandatory for obtaining certification?

- Does the certification body assess your performance in these practices? If yes, what are the required measures and/or procedures?
- How is information about these practices communicated and taught to the company/producer and consumers?
- Have any of these procedures been modified in recent years?

Appendix C – Data collection information for interviews

Supply chain tier	Number of interviews	Informant	Mnemonic	Total length of interview
Buyer 1	2	Sustainability Director (Latin America)	B1-1	1h 27min
	1	President of sustainability committee	B1-2	43min
	1	Manager of franchisee restaurant	B1-3	33min
Buyer 2	1	Environment Manager	B2-1	56min
	1	Supply chain Manager	B2-2	32min
Buyer 3	1	Supply chain Manager	B3-1	54min
Supplier	2	Vice President	SUP-1	1h 03min
	2	Director of Foreign Trade	SUP-2	1h 00min
	1	Human Resources Coordinator	SUP-3	53min
	1	Environment Manager	SUP-4	43min
	2	Development Sector Coordinator	SUP-5	1h 36min
	1	Quality and Environment Manager	SUP-6	58min
	1	Feed Factory Manager	SUP-7	1h 28min
	6	Veterinary of non-certified farms	VET-NC	4h 51min
	5	Veterinary of certified farms	VET-CE	6h 10min
Subsupplier*	22	Non-certified farmers	FAR-NC	11h 05min
	21	Certified farmers	FAR-CE	12h 08min
	2	Service provider	SER	1h 45min
Certificatory	1	Global Gap (GG) - Brazil representative	CGG-1	1h 29min
	3	Auditor GG	CGG-2	1h 40min
Government	1	Institute of Water and Land	GOV-1	38min
	1	Agriculture defense agency	GOV-2	24min
Total	79	-	-	52h 56min

* *Note: Given the subsuppliers were a homogeneous group, we analyzed them collectively.*

Supplementary File A – Trail of empirical evidence for each potential practice

Table A.1: Sample Evidence for Waste Management

Supply chain tier	Practice components			Intra-organizational links between practice components
	Meaning	**Material**	**Competence**	
Buyer	*Impact reduction* We have predefined procedures, depending on the product. [...] It is an important step that we take very seriously; the environmental damage is very harmful if it is discarded, especially regarding livestock. (B1-1) We collect recycled material, and we introduce reverse logistics and programs for the use of materials with low environmental impact. [...] We also define parameters for the supplier to reduce the impact on production. (B1-3)	No evidence identified	No evidence identified	No evidence identified
Supplier	*Sanitary control* You know, if he does not do it, he harms himself. The water he uses is from artesian wells, and if he contaminates the water, he has lost everything: he has lost the batch, and the chickens die. (VET-CE 4)	*Orientation videos* We try as consistently as possible to understand whether all the information—whether through interviews, facts, or evidence—gives us the perception that the requirement is actually being met. (SUP-5)	*Technical knowledge* We give all the assistance and guidance, and even, if necessary, we teach them how to properly dispose of the chickens. (VET-NC 7) The supplier has direct contact with the regulatory agencies, and we also have the GG [i.e., certification	*Meaning, competence, & material (strong direct)* It [communication between buyer and supplier] works better because we are concerned about always keeping him [cooperative producer] close to the cooperative, knowing the steps. So, he has at least two—up to three—rounds of meetings per year with these poultry committees. We have an organization by activity, so each activity has its own organized committees. [...] So, this information is now being taken to once again

	[...] The work, in general, is reinforcement; you need to constantly reinforce what you need to do. It is no use talking occasionally and leaving it up to them. (VET-CE1)	In addition to our weekly guidance, the supplier also has some videos showing how to do it. Just log on to Facebook. (VET-CE4) Secondary data: On 05/24/21, the supplier made a video available on its social network about good production practices. In the 04 min 17 sec video, it teaches how to collect and dispose of dead animals. (Video from a farmer.)	body] team. So, when there is any change, we gather all the veterinarians and explain what has changed so they can pass it on to the poultry farmers. If it is too much or a big change, we plan a meeting for all the poultry farmers and explain the situation. Then, the veterinarians in the field only reinforce afterwards. (VET-CE 4)	raise awareness (MEANING). [...] It is a sign that it is possible, he [farmer] just needs to dedicate himself a little more, make some adjustments (COMPETENCE) to his installation (MATERIAL). (SUP-1) *Meaning, competence, & material (strong direct)* So far, we have been doing [the transfer of this knowledge] in person and verbally. We [the corporate university] are hiring an online platform (MATERIAL) so that we can start doing more distance training, including with the staff (MEANING & COMPETENCE). We will start to evolve with [sharing] videos (MATERIAL) with them, but the actual production is still more in person. [...] At the end, it is the responsibility of quality control to evaluate the effectiveness of the training […] because they have daily inspections, [...] and they have all this monitoring because in the certification audit all of this is checked [...] (COMPETENCE). (SUP-3)
Subsupplier certified	*Certification's requirement and control* Composting requires it, right? The GG [i.e., certification body] people come, and they ask questions. The day he came here, the guy went around […] and looked at the compost, looked at the notebook, looked at the chickens, [and] the hood; he looked at everything. [...] That is why we do everything right and take notes and write	*Objects (i.e., composter, equipment, dehydrator, and spreadsheets)* We have an oven where we dehydrate it, decompose it, and turn it into a powder. Instead of becoming a carcass that rots, it enters the process, and six hours later it becomes fertilizer. (FAR-CE3) [...] But there is a spreadsheet where you must enter information every day—quantities, time, day that you	*Process innovation, organization, and adaptability* One day, I did not have any sawdust to make the composter, and I saw some tall bushes on the edge of the aviary, so I decided to use them. [...] The smell disappeared, and it did not spread, which even the technician [referring to the veterinarian from the supplier] came to ask me what I did. [..] Today, I only use grass. (FAR-CE 12)	*Material & competence (strong direct)* It only happens when the oven (MATERIAL) back there cannot handle burning everything because chicken is something that spoils very easily. You leave it for three, four hours, and it starts to open up, smell badly, […] so it had to be something bigger. Let's say, it would burn 500, 600 chickens at once. Composting can be used (COMPETENCE), but we do not have space for composting here or... that can handle that amount. (FAR-CE13) *Competence & material (strong direct)* The IAP [i.e., a regulatory agency] takes care of the environmental license—the facilities, the process—

	everything down so there is no problem. (FAR-CE8) That is a requirement. Nowadays, they have [...] up here, in fact, which is a little newer, there is the oven, which burns the chickens, but this material must be composted, everything. [...] They come to do a survey, and they demand it, but they want us to have the right place to compost it. (FAR-CE14)	added to the compost, and when you took it out. (FAR-CE14)	Speaking like that off the top of my head, [...] I used to keep all those papers, everything they asked for. I used to leave everything somehow unattended, so I kept the papers. [Then] I bought a file cabinet to help store the files and stuff for the office that I did not have before. Even the supplier technician was grateful that the office was a little better. (FAR-CE 6)	but I think they almost mix. For example, what are you going to burn? Hardwood, you will have gas. How will you heat this chicken? What will you do with the dead chickens? So, all of this is in the installation license already in place, so you must make a compost house (MATERIAL). You must do a lot of processes (COMPETENCE). (FAR-CE3) *Meaning & material (strong direct)* [...] For example, I can tell you, the water on my entire property comes from the well (MATERIAL). So, if this liquid, called slurry, that comes out of the compost overflows and infiltrates into the soil, I can lose my water. [...] It is not just because of the fine they charge (MEANING). (FAR-CE 9)
Subsupplier non-certified	*Supplier's requirement* The supplier always insists that we must do it [waste management] because if we do not do it, they call it to our attention. (FAR-NC7) Observation data: The researcher identified a notice placed on a mural in the aviary office warning about the proper handling of dead birds. The "Notice of Critical Points" contained brief instructions for the proper management of such waste.	*Objects (composter and dehydrator)* I compost. There is nothing [else] to do. What are you going to do? There are days when there are more than 300 dead chickens because there are two aviaries. [...] Then at the end, I still use compost as a fertilizer in the field. (FAR-NC20)	*Technical knowledge* But when I bought new equipment, it is not just throwing the chickens there, and that is it. [...] I learned to mix the right amount of sawdust with the chickens, the temperature. Because if not, [...] the powder does not come out at the end. Then it is wrong. (FAR-NC 7)	*Material & competence (strong direct)* [...] In the beginning, I needed to know exactly the amount of chicken, sawdust, and temperature (MATERIAL). [...] I tried, tried to do it, and it did not break everything. Then, the technician invited me to go there to [name withheld] to see that his [equipment] was working. [...] That is when I saw what I was doing wrong (COMPETENCE) because, let me explain, you also have to calculate the number of chickens. It is not all that fits. You must put in the right quantity. (FAR-NC 12)

Table A.2: Sample Evidence for Working Conditions

Supply chain tier	Practice components			Intra-organizational links between practice components
	Meaning	**Material**	**Competence**	
Buyer	*Social obligations* There is nothing more to discuss about labor rights and adequate working conditions nowadays. Here at [name withheld], we have zero tolerance. (B1-1) We are recognized for having strict control over these matters. The same procedures for our retail stores [...] are also extended to suppliers. The demand is the same. (B1-3)	No evidence identified	No evidence identified	No evidence identified
Supplier	*Employee retention* The company is made up of people; if people are not super aligned, the company will not follow the right path. The poultry farmer is the same: if he treats his employee well, he will keep the results, and the employee will not look for another aviary. (VET-CE1)	*Contracts and benefits* I can speak for the internal team that I am responsible for. All our collaborators are formalized [i.e., have formal contracts]. Today, [researcher's name], certification requires 30% of what Brazilian legislation obliges us to do. So, we formalize, sign the employee's work contract, offer food stamps for the slaughterhouse	No evidence identified	*Meaning & material (strong direct)* Last year [2019], [name of coop president] brought up the idea of formatting the corporate university within the cooperative. The business program [...] is very focused on self-performance, [and] the commercial part [is focused on] negotiation, searching for new business. [...] [The] leadership program will think a lot about the issue of succession [and] leadership preparation because, at the end of the day, those who pull these 18,000 people are the leaders, so a very big focus [is] on the preparation and recycling and training of this leadership (MATERIAL), and operational efficiency, which is one of our strong points, has a lot to do with quality, food safety, productivity, (and

		employees, and dental plans, among other benefits. (SUP-3) Those who have an employee working on the property must have a working contract. It is like a partner [...]. There are producers who ask for the payment to be deducted directly by the supplier, and it is credited into the granjeiro's *[term to refer to the employee]* account. (SUP-5)		responsibility). [...] We have the issue of sustainability. It is part of the program of culture, too. We have some projects going on together with the social framework (MEANING). [...] This already happens within the livestock area [...] because we have many client audits, and one of them is very focused on the issue of social responsibility. (SUP-3) *Meaning & material (strong direct)* [...] It is a constant. [...] It is not training once—it is the continuity of the programs that guarantees a better result. [...] It is the continuity that guarantees that this becomes a routine in their lives, a different way of thinking and doing things (MEANING), [...] and we brought this to the slaughterhouse as a way of trying to reduce turnover. […] Many actions arose thinking about this because the animal welfare part is an obligation that we must do, and then the technical area part we already do, and the care for people (MATERIAL), but the training must be continuous as if it were a pill that you take every day because isolated actions are lost. (SUP-3)
Subsupplier certified	*Benefits* These things related to the infrastructure—we complain a little about doing it, but it will be for our use, too. If it is not like that, we will maintain all as it is and will not do anything, right? (FAR-CE2) Some of my employees have been working with me for	*Infrastructure* We are expanding, making two bathrooms, [...] because when the chicken collectors [i.e., service providers] come, it is crowded. I also ordered a large table to fit everyone. Before we did not have enough room for everyone. They sat on the floor. This kind of stuff [...]. So, it will be	*Adaptability and proactivity* It is not very affordable to do these things [related to working conditions]. I researched everything and found this guy at a more affordable price. I had to call the engineer here to make the changes correctly. (FAR-CE 5) [Concerning the use of pellets] You do not need to get up three or four	*Meaning & competence (weak indirect)* *Meaning & material (strong direct)* My wife and I took two courses before this pandemic, right? There they talked about using masks when applying poison, goggles for protection when cutting wood, wearing boots when cleaning the poultry houses (MATERIAL), that kind of thing. It was good, right, because we did not pay much attention to it. Now, we call attention to it and take care of it (MEANING). I leave all the equipment in the little room there

	more than five years. [...] I need to do this, so they want to continue working with me, right? A good employee is hard to find. We need to recognize his value. (FAR-CE3)	better for everyone. (FAR-CE5) Observation data: On the day of the interview with poultry farmer 5, three builders were on the property, expanding and adapting the rooms that house the employees and the chickens' collectors.	times at night; he [the employee] only goes at 9 p.m. to check it out, and at 6 a.m., he goes there again. And it has a warehouse that keeps this fire lit and maintains a very homogeneous temperature all night, so it was an initiative. It is more expensive, but it means the quality of life for the employee is better. Can you imagine if you must wake up every two hours? He [the employee] would be a mess the next day. (FAR-CE 3)	(MATERIAL) […] in the office, before entering the aviary (COMPETENCE). (FAR-CE26) *Material & competence (strong direct)* Did you see there before entering the office? [..] I did everything here [i.e., new infrastructure] on my own; no one asked (COMPETENCE). They asked for a bathroom and a space for people to eat (MATERIAL). (FAR-CE 2)
Subsupplier non-certified	*Employee retention* Whenever there is a good production batch, we give them a treat. I hosted a barbecue. Once I even bought tickets for some of them to travel. These little things make a difference, too. (FAR-NC8)	*Infrastructure and contracts* We built a space for resting here. It has an area with a table, chairs, fridge, stove, and microwave. (FAR-NC2) We do everything right. The granjeiro [*employee*] receives the contract, and we deliver it to the cooperative. [...] It is to protect him and us, too, right? (FAR-NC 10)	*Proactivity* [...] We made the investment and bought a freezer because every day before loading we had to keep filling plastic bottles with water and store them in the freezer here at home because the boys who carry the chicken used to ask [for water] all the time. Now, at night, when sometimes they keep working and we go to sleep, they do not bother us anymore. (FAR-NC 7)	*Meaning & material (strong direct)* Observation data: The aviary owner offers small rewards for recognizing employees' performance (MEANING). After loading the chickens, the owner held a dinner for the families of his employees (MATERIAL).

Table A.3: Sample Evidence for Biosecurity

Supply chain tier	Practice components			Intra-organizational links between practice components
	Meaning	**Material**	**Competence**	
Buyer	*Food security* Before the issue of sustainability became the fundamental pillar, food security guaranteed by biosecurity was the basis. We would not have the product quality and confidence we have today without establishing biosafety standards for our food. (B1-1)	*Contracts* Our suppliers sign a contract assuming responsibility to produce according to the standards defined by [company name], in addition to the requirements of the certification body. (B1-1)	No evidence identified	*Meaning & materials (strong direct)* Normally, when we have changes at this level [food security] (MEANING), they are already made in terms of the [name of the buyer], not for each market (MATERIAL) unless in a given market, in a very specific situation in that market, we have to request some exception to the norm, if it is a normally global norm.
Supplier	*Financial outcomes* Biosecurity is the pillar. The result of the cooperative depends on a good conversion. A sick chicken is bad for the cooperative and for the poultry farmer [...]. (VET-CE2) Observation data: The veterinarian, upon arriving at the aviary office, required the poultry farmer to wash his hands and asked about a missing pair of boots.	*Printed notices, videos, and WhatsApp messages (images and audios)* The farmer cannot say he did not know how to do it. There are WhatsApp messages; here, check it out. All these are messages explaining how he should do it. (VET-NC6) There is the [name of the event] that the supplier always promotes to guide and reinforce what you need to do to not have salmonella or other diseases. (VET-CE1)	*Technical knowledge* There is high pressure and strict requirements for production, regarding which we guide and demand them [farmers] to use the boots. [...] Today, it is not a big deal; they already know they need to use them. But initially, it was difficult until they understood they needed to use them. It is better for their outcomes. All the convincing work needs to be done because they do not have that knowledge. (VET-CE 5) Observation data: On the first day of observation, the veterinarian	*Meaning & competence (weak indirect)* *Meaning & materials (strong direct)* When a producer is interested, we have a responsible technical team that goes to the property to check the conditions of the producer's property (COMPETENCE), his/her history [...]. We do not accept everyone because there are people who do not have the characteristics to work with this, so there is no point in accepting them because they will not be able to perform well. So, we end up denying them, but having the minimum standards required (MATERIALS), we can accept them and then forward, guide, and classify them (MEANING). Yes, there is a technical file prepared (MATERIALS) to see if it meets the requirements […]. We set up a process; there is a checklist of the needs that must be met to be accepted. This makes it known to the technician what is needed (COMPETENCE). So, it is basically this:

			guided me and taught me about using boots and standard procedures. The company makes available on the wall a notice of "Critical points for auditing the control of Salmonella in broiler chickens." This document specifies the biosecurity criteria and procedures recommended by the cooperative.	this technical file, the checklist (MATERIALS), is prepared. Then, the technician does the survey, passes it on to their coordinator, the technical team that gives the final opinion, and then [it] comes to the board for acceptance. Then, this new integrated product, according to the conditions it met, the steps [to get] there, and [the broad] ended up, in the end, approving it as integrated (COMPETENCE). (SUP-1)
Subsupplier certified	*Financial outcome* The cooperative constantly reminds us that we must put our shoes there to enter the aviary, wash our hands, and do everything right. At first, I did not do [all the steps] much because I really forgot, but then the technician came and told us that it is dangerous for the chickens to catch the disease, and we could lose almost the entire batch, so we do it [follow the procedure]. (FAR-CE9)	*Objects (i.e., boots, disinfection arches, toilets, and calcium oxide)* There is a boot washer here, a machine to wash your hands, and lime to put on the boots; these are procedures to enter the aviary so there is no risk of contamination. (FAR-CE8) Biosecurity is very strict, so if an outside vehicle enters, it must pass through a disinfection arch. People must wear boots before entering; a series of procedures must be followed. (FAR-CE3) Observation data: Calcium oxide was used every time someone needed to enter the aviaries.	No evidence identified	*Material & meaning (strong direct)* We have a very big responsibility in terms of health, which the cooperative demands a lot, but in terms of sustainability perhaps not so much (MEANING) because, in our case, for example, when chickens die, we have an oven (MATERIALS) where we dehydrate them, decompose them, and turn them into powder, instead of turning them into a carcass that rots. They enter the process, and six hours later the chick or the small or medium-sized chicken, whatever, turns into powder for health reasons, more for health reasons, not for sustainability (MEANING). (FAR-CE3) *Material & meaning (strong direct)* The cooperative demands a lot. We need to put on our shoes (MATERIAL) to enter the poultry house, wash our hands, and do everything correctly. At first, I did not do much, because I would forget, but then the technician came and told us that it is dangerous for the chicken to catch diseases, so we do it that way (MEANING). (FAR-CE9)

Subsupplier non-certified	*Financial outcomes* A series of items must be done for biosecurity because the most valuable thing on the property is animal health. If you have a disease there, you do not raise chickens; if you do not raise chickens, you do not have money, so the most important thing is sanitation. (FAR-NC5)	*Objects (i.e., boots and calcium oxide)* Biosecurity is heavily demanded. We have boots for each aviary worker and visitors. The veterinarian also uses plastic bags on his feet to prevent him from bringing any disease [in] here. (FAR-NC15) The calcium oxide is added, even after putting on the boots; [thus,] there is no danger of taking contamination into the aviaries. (FAR-NC9)	No evidence identified	*Meaning & material (strong direct)* Observation data: Critical points for auditing (MEANING & MATERIAL) were identified to prevent the spread of salmonella in broilers.

Table A.4: Sample Evidence for Animal Welfare

Supply chain tier	Practice components			Intra-organizational links between practice components
	Meaning	**Material**	**Competence**	
Buyer	*Quality* [...] Now, for example, that we have free range eggs, we observe that the chickens, for example, were not only considered in financial terms for the supplier but also in terms of quality and production. (B1-1) Secondary data: "In 2019, we audited the animal welfare practices of more than 100 suppliers of meat, poultry, pork and laying hen categories." (Institutional Report Buyer 1, p. 34).	*Contracts* Once we are convinced that this is what must be done, then you start a whole planning discussion with the suppliers on how this change will be made. There are multiple ways to do it. Pilot tests. Then we stipulate it in the contract. (B1-1)	*Technical knowledge* We have studies and the working group, as I mentioned to you, which is part of this preliminary work. [...] Among others, the issue of density was one of those changes. (B1-1)	*Meaning & competence (weak indirect)* [...] The Global [Gap] is a comprehensive standard that considers not only good agricultural practices but also aspects related to worker well-being and also addresses food safety (MEANING). [...] The Global Gap certification reeducates employees—everyone goes through training. You can organize all your sectors, [...] you can track [a product] [...] wherever it is [...]. Global Gap is included in agricultural practices, [starting] from planting [...] (COMPETENCE). (CGG-2)
Supplier	*Buyer's requirement* Animal welfare is the most important requirement in several countries. They work a lot with those criteria, but this is a very interesting thing, and we also realize that the customer is also looking for different market niches, and we can serve these markets. (SUP-2)	*Printed notices, videos, and contracts* We will always follow those "five freedoms of chickens," the five commandments—freedom from hunger, thirst, injury. But, anyway, there are five items there. [...] They leave these five items posted on the office wall. That is the commandment of poultry farming. (VET-CE5)	*Technical knowledge* I told him [the poultry farmer] the reason why results are dropping: the huge heat this week, for example, 46 degrees Celsius. There are producers that have low ventilation. The chickens require high ventilation of three meters, three and a half meters per second. (VET-CE 1)	*Meaning, competence, & materials (strong direct)* Those who have a better poultry farm can have greater profitability. [...] In fact, the focus—the company needs to do well, there is performance—ours is basically the producer, his skill (COMPETENCE), because it does not make sense for the cooperative to simply have a poultry slaughterhouse (MATERIALS); it needs to have a producer, who is the member, together (MEANING) [...]. (SUP-1)

	We do it. That is why it generates a greater demand for service so you can meet what was agreed [to] in the contract. (VET-CE5)	The producer is obliged; he has a contract to follow, and he is responsible for ensuring its fulfillment and providing the necessary equipment for a good environment for the birds and proper management according to external guidelines. He is obliged by the cooperative to carry out this improvement. (VET-CE1) Secondary data: Institutional Video 6: Tips from the Poultry Farmer Champion – Ep 1. [04 min 14 sec]. Technology today is a great ally of agribusiness; it is a great ally of poultry production. As we can see, this aviary is a state-of-the-art aviary, where I provide the best environment for the chickens.	Secondary data: Institutional video 4 entitled "Champion Tip - #2" [03 min 54 sec]. Ventilation, it, it is like this. I start working with one or two exhausters, and then I start locking the exhauster according to what the aviary "says." The chicken, it tells me. The chicken, if it lays down and opens its wings, it is a sign that it is too warm. Now, if it is playing, it is eating, that means that it feels good [4 min 32 sec].	*Meaning & competence (strong direct)* Of course, it is, it is evolving, so the concern with sustainability and the concerns with production issues, with sustainability over the years, have always been on our radar. So, we must create an adequate process with social, environmental, and health issues (COMPETENCE), so that we can [...], the world increasingly demands this from us, and if we do not have this concern, we will be out of the market. So, we always warn the producer; it is an important part of our work that he does these things in a sustainable way (MEANING) so that we can maintain. And I have no doubt that, increasingly, issues of animal welfare are coming up—we must adapt according to market demands. (SUP-1)
Subsupplier certified	*Certification's requirement* It has plenty of food and water. The GG [i.e., certification body] demands a lot. We take care of the temperature, so the water does not get too hot for them. My water tanks are all in the shade so as not to overheat [...]. (FAR-CE15)	*Objects (i.e., evaporative plate, exhaust fans, semi kraft paper, and control panel)* Before, you had four exhaust fans, and it was fine. Now, you must have, I think, at least 13 meters per second to get good performance, but you must have the exhaust fan and the plates for the air to be better inside the aviary. (FAR-CE12)	*Adaptability, proactivity, and technical knowledge* About six, seven years ago, I did a different procedure that the veterinarian saw, and thought was good. He asked another [farmer] to do it, and it worked. And today, most [farmers] are doing it as we do, which is to put the paper underneath, a strip of paper under the nipple. Before, we used to put it	*Meaning, material, & competence (strong direct)* The problem is the lack of exhaust fans (MATERIAL); go there and finance or pay in installments. The result is being reduced because of that reason. The tremendous heat that we had this week, for example, 46 degrees. There are producers who have low ventilation; the chicken requires high ventilation of three meters, three and a half meters per second. The producer is obliged, has a contract (MATERIAL) to follow, and is responsible for ensuring and providing the necessary equipment for a good environment for

	The auditor comes here and looks to see if there is even a loose screw that could hurt the chicken. [...] It is up to me, and sometimes the veterinarian helps me, to verify if everything is as they ask. (FAR-CE10)	[...] You can control all the equipment through a dashboard—the plates, the ventilation—everything is more modern now and has become easier for us, too. (FAR-CE5)	only by the side of the feeder, by the side of the nipple. For me, it worked. [Previously] I had a high mortality rate. From 200 to 300 on the third day. After I did this procedure, there was no more mortality. (FAR-CE 8) The dashboard does not show the real ambience as it is. Then you must go inside [the aviary] and stop because it is something that we have learned: if we feel good inside, the chick is fine. If we are not well, the chick will certainly not be well, either. (FAR-CE 20)	the birds and proper management according to external guidelines (MEANING & COMPETENCE). He is obliged by the cooperative to carry out this improvement. (FAR-CE7) *Material, competence, & meaning (strong direct)* I needed to buy the roto accelerator (MATERIAL). There are more than 100,000 chickens per batch, so it is impossible for me and my wife to compost and take care of the chickens alone. But when I bought it, I could not just throw the chickens in there and that was it (MEANING). No! Gosh, I had to call the technician here and learn how to mix the right amount of wood shavings with the chickens (COMPETENCE). Because if not, [...] the powder will not come out in the end. (FAR-CE28)
Subsupplier non-certified	*Supplier's requirement and financial outcome* […] On the issue of animal welfare, they were quite demanding—heat at the right moment, wind at the right moment, mist at the right moment—so the cooperative has a very intensive follow-up on these requirements, and in the end, it brings economic results, both for the supplier and for us. (FAR-NC12) [...] If we do not take good care, it will affect the financial result; without having a financial result, you	*Objects (i.e., dashboards and evaporative plates)* Nowadays, every aviary has evaporative plates; air enters inside the hives, and water passes through a hive, like a honeycomb. Sometimes outside, it is 37, 38 degrees Celsius, and inside the aviary, it is 22, 23, 25 degrees, so chickens have a good environment to be able to express themselves in. (FAR-NC3)	*Adaptability, proactivity, and technical knowledge* I installed all the sensors by myself. It also must be modernized to make it easier. Otherwise, it involves a lot of work for a few people. Technology helps a lot with this. (FAR-NC 6) There is no cake recipe; sometimes the other batch is already drier, so you do not need to make all that ventilation to burn that extra firewood. That also differs a lot. [...] It is no use saying that the aviary is automatic and modern. We need to get our hands dirty and use	*Material & competence (strong direct)* [...] Just by using the dashboard, you can control (COMPETENCE) the exhaust fans, the plates, the ventilation (MATERIAL)—everything is modern and became easier for us, too. (FAR-NC5)

	are not successful. (FAR-NC6)		a little experience. Otherwise, it will not work. (FAR-NC 5)	