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Multi-tier sustainable supply chain management: a case study of a global food retailer

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Abstract

Purpose – Implementing sustainable practices in multi-tier supply chains is a difficult task. This study investigates why such endeavours fail and how multi-tier supply chain partners can address them.

Design/methodology/approach – A single case study of a global food retail company was used in this study. Semi-structured interviews with the case firm and its first- and second-tier suppliers were used to collect data, which were then qualitatively analysed using thematic analysis.

Findings – Major barriers impeding the implementation of sustainability in multi-tier food supply chains were revealed such as the cost of sustainability, knowledge gap, lack of infrastructure, and supply chain complexity. Furthermore, the findings reveal five possible solutions such as multi-tier collaboration and partnership, diffusion of innovation along the chain, supply chain mapping, sustainability performance measurement, and capacity building, all of which can aid in the improvement of sustainability practices.

Research limitations/implications – Future research should investigate how specific barriers and drivers affect specific aspects of sustainability, pointing practitioners to specific links between the variables that can aid in tailoring sustainability oriented investment.

Practical implications – This research supports managerial comprehension of multi-tier supply chain sustainability, pointing out ways to improve sustainability performance despite the complex multi-tier system of food supply chains.

Originality/value – The research on multi-tier supply chain sustainability is still growing, and this research contributes to the debate about how multi-tier supply chains can become more sustainable from the perspective of the triple bottom line, particularly food supply chains which face significant sustainability challenges.

Keywords Multi-tier, Supply chain management, Sustainability, Food supply chain, Collaboration

Paper type Research paper

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1. Introduction

Despite its numerous benefits, firms struggle to integrate sustainability into multi-tier supply chains (MTSCs) in order to gain a competitive advantage (Sauer and Seuring, 2019; Khan *et al.*, 2021a; Yadav *et al.*, 2023). Sustainable practices have performed poorly at the MTSC level, owing to ambiguity in understanding, a lack of visibility beyond first-tier suppliers, a lack of trust among MTSC actors, the complexity of governing MTSCs, and its associated risks (Wilhelm *et al.*, 2016b; Villena and Gioia, 2018; Choi *et al.*, 2021). Various examples of this issue are presented in a study on sustainability practices of multinational corporations and their suppliers (Villena and Gioia, 2020).

While a considerable amount of research has been conducted on sustainable practices in supply chains (see Table 2), we found that most studies (except for a few such as Tachizawa and Yew Wong, 2014; Wilhelm *et al.*, 2016a) have focused on focal firms' interaction and practices with their immediate suppliers (i.e., the buyer–supplier dyad). With fragmented supply chains, a globalised market, and increasing pressure from multiple stakeholder groups, concerns have been raised about the impact of second- and third-tier suppliers on sustainability performance and practice (Miemczyk *et al.*, 2012; Sarkis *et al.*, 2019; Villena and Gioia, 2020). Attention has also been drawn to the need to move beyond managing dyadic relationships and to start considering the wider network in recent theoretical perspectives (Wu and Choi, 2005; Choi and Wu, 2009b; Mena *et al.*, 2013; Tachizawa and Yew Wong, 2014; Choi *et al.*, 2021). It has been found that supply chain issues involving the environment and social responsibility are frequently caused by suppliers in the second tier or further upstream (i.e., lower-tier suppliers) (Ernst and Kim, 2002) or sub-suppliers in countries with weaker regulations (Grimm *et al.*, 2011; 2014).

These upstream suppliers also have characteristics that make managing sustainability difficult for lead firms. Buyers, for example, have less information about upstream suppliers (Choi and Hong, 2002); do not have sufficient influence over them (Plambeck, 2012); and upstream suppliers have an unstable relationship with the rest of the supply chain (Ponce and Prida, 2004). All of these factors highlight the complex nature of MTSCs. This complex multi-tiered setting, which includes many stakeholders and broader performance targets (Dou *et al.*, 2018), may inherently lead to difficulties in implementing sustainable supply chain management (SSCM) practices. Despite the importance of this issue, not many studies have examined why SSCM practices at the MTSC level have proven difficult to implement, and how to overcome these challenges based on a complexity perspective. Therefore, our research aims to address this issue by asking the following questions:

RQ: Why do multi-tier sustainable supply chain management practices fail, and how can they be improved?

To address the concern, this study investigates multi-tier sustainable supply chain management (MSSCM) practices in the food supply chain. The characteristics of the food supply chain are distinct, providing a suitable and rich empirical setting for research on this topic. For example, food supply chains are complex because they involve numerous upstream suppliers at the first- and second-tier levels who are responsible for supplying essential raw materials and commodities required to transform various items into finished products (Awaysheh and Klassen, 2010). The food industry and its supply chains also have significant implications for sustainability (Zhu *et al.*, 2018). For instance, food accounts for a significant portion of modern production and consumption, and its availability has profound consequences for the dimensions of sustainability (Yakovleva *et al.*, 2012). Food supply chains have also been repeatedly called out by the media for unsustainable practices that result in significant resource depletion and unacceptable environmental impacts (Holden *et al.*, 2018). Compared to other industries, food supply chains have a variety of product types such as fresh agricultural goods (vegetables and fruits) and processed food items (convenience foods or soft drinks). These often result in a variety of product-related issues, such as shelf-life constraints, quality and quantity variability, and seasonality. In addition to food shortages, pre- and post-harvest losses, unsustainable land–water–energy use, food waste, food fraud, and climate change issues, food supply chains still struggle with other sustainability related challenges (Bhat and Jöudu, 2019; Oyedijo and Akenroye, 2023a).

We adopt the complexity theory (CT) to better understand MSSCM (Crozier and Thoenig, 1976). The CT proposes a system-based paradigm in which determining performance outcomes becomes more difficult as the number of elements and the degree to which these elements differ increases. This is relevant in the context of MSSCM, where, in addition to the numerous actors involved, complexity encompasses network structural issues and behavioural issues (Mena *et al.*, 2013; Choi *et al.*, 2021). In order to capture the essence of a supply network, Choi and Wu (2009b) recommend considering a minimum of two factors: how a node influences another node, and how a link influences another link. This complexity lens may also aid the understanding and development of sustainable practices beyond the dyadic setting (Wilhelm *et al.*, 2016ab; Villena and Gioia, 2020). As a result, this study responds to calls in the relevant literature for the development of multi-tiered sustainable supply chains (Villena and Gioia, 2020) and a shift in focus from dyads, since what happens within MTSCs is still largely unexplored (Choi *et al.*, 2021).

The findings of this study, which are based on empirical insights from MTSC actors, contribute to the SSCM literature by explaining why MTSC partners struggle to implement sustainable practices, as well as what can be done to address this challenge. Despite the fact that several studies have been conducted on this topic, the majority of them have not examined MSSCM practices through a

complexity lens. Our study has the following value: (1) it is empirical, and it incorporates perspectives from two levels beyond the focal firm; (2) it employs complexity theory to illuminate the intricacies of MTSCs and how these challenges may impede the adoption of multi-tier sustainable supply chain management (MTSSCM) practices; and (3) it offers empirical solutions that may be able to address these challenges. For practitioners, the findings provide new perspectives on how to approach the implementation of sustainable practices in complex MTSCs.

The paper is organised as follows: first, the theoretical underpinnings and a review of relevant literature are presented; second, the research design and methodology used, the data collection technique used, and the data analysis approach are discussed; and third, the study's findings and concluding remarks with implications for theory and practice that can indicate future research directions are set out.

2. Theoretical background

2.1. Complexity theory and multi-tier supply chains

According to complexity theory (CT), inter-organisational networks are formed on a complex structure of interconnectedness that necessitates a coordinated management approach (Crozier and Thoenig, 1976). This requires high-level activity coordination and communication between participants in the inter-organisational network. The structure and power relations formed between members are constantly questioned since such inter-organisational systems are reliant on dependency. As a result, firms usually struggle to plan and forecast their organisational actions (Sarkis *et al.*, 2011).

CT broadens our understanding of the mechanisms involved in multi-supply chains because they involve complex inter-organisational interactions (Sarkis *et al.*, 2011; Tachizawa and Wong, 2014). A static complexity represents the structure of an MTSC, its various components, and the strengths of interactions, whereas a dynamic complexity represents uncertainties associated with the MTSC from various perspectives (Casti, 1979). Multiple actors in MTSCs should collaborate (directly or indirectly) to share information and exchange resources and materials needed to meet customer demands. However, many exogenous and endogenous factors from various sources connected to the network, process involved, product range, suppliers, organisational level concerns, and information complexities may obstruct the administration of such complex supply chain networks (Blecker *et al.*, 2005).

Previous studies (e.g., Wilhelm *et al.*, 2016a) have demonstrated that implementing such sustainable practices is difficult due to issues associated with the complexity of the MTSC, such as a

lack of contractual relationships with sub-suppliers (Grimm et al., 2014). Similarly, within food supply chains, the nature of dependence between organisations and processes varies. Depending on the nature of their product, organisations in such complex networks can be loosely or tightly coupled (Vespignani, 2010; Oyedijo *et al.*, 2021) or vertically coordinated (Hobbs and Young, 2000). Because failure in one part will stymie sustainability implementation efforts while also exposing the MTSC to sustainability risks, the looseness may cause havoc. Many food items are also sourced globally (rather than locally) and, even when a single product is vertically coordinated, organisations in different countries rely on multiple, highly coordinated global supply chains.

As a result of a loss of access to inputs or other support functions within such multi-tier food supply chains, such a loss may cause vulnerability within the larger food network and impact sustainable practices. If one party fails to share information or perform certain sustainability-related practices, it may aggravate problems which could interfere with the system. As a system's complexity (number of elements and degree to which these elements differ) increases, determining its performance outcomes becomes more difficult for MTSC partners (Crozier and Thoenig, 1976).

2.2. How sustainable supply chain practices are affected by multi-tier complexity

Although CT does not seek to explain why firms join networks, it offers a unique perspective on how MTSC partners operate (Choi et al., 2001). One major consideration arising from this complex viewpoint is how to effectively apply sustainability strategies in such contexts.

Most studies have ignored the issue of multi-level sustainability implementation (Mena *et al.*, 2013), with previous studies being too theoretical or conceptual. Some scholars (e.g., Choi and Wu, 2009) have attempted to analyse the network's "basic building components", recognising that a link can influence another link and a node can influence a link that is not directly connected to it. Such MTSC relationships have been identified as being lengthy, with a negative impact on economic performance indicators such as cost and quality (Choi and Krause, 2006; Skilton and Robinson, 2009). Supply chain length and complexity have been shown to influence other components of the triple bottom line, such as environmental and economic (Lamming and Hampson, 1996).

Aside from structural complexity, social and behavioural issues in MTSCs can obstruct the application of SSCM practices. Nonlinear dynamics, self-organisation, emergence, and co-evolution are evident in such complex systems (Choi *et al.*, 2001; Pathak *et al.*, 2007), which may prevent sustainable practices. Furthermore, structural arrangements within the MTSC, such as buyer–supplier–supplier tiers and supplier–buyer–customer relationships that can be open, transitional, or

closed, can be difficult to manage (Mena *et al.*, 2013). In such complex networks, for example, moral hazard occurs when the supplier's supplier bypasses the middleman and supplies directly to the buyer (Rossetti and Choi, 2008). Such behavioural concerns associated with the complex multi-tier structure can impede the application of SSCM practices.

The dynamics of MTSC relationships in general are frequently influenced by power imbalances and regimes (Hingley, 2005a; Nyaga *et al.*, 2013), where one party can have and exercise greater bargaining and purchasing power than the other (Reimann and Ketchen, 2017; Huo *et al.*, 2018). If a large (focal) manufacturer has the bulk of control, this may not necessarily result in mutual benefit, and such relationships may not always depict trust (Hingley, 2005b). This problem is especially prevalent in food supply chains, which have been labelled "captive" due to large-scale rows including shared power, inclusion, and unethical purchase behaviour by more powerful parties (Glavee-Geo *et al.*, 2021). Though power should not be regarded solely in a negative light because it is useful for effective collaboration, synchronisation, and goal achievement (Nyaga *et al.*, 2013, Chicksand, 2015; Maglaras *et al.*, 2015). However, it may be difficult to implement SSCM practices in such MTSC relationships since asymmetries in power affect the distribution of outcomes (Hingley, 2005b; Oyedijo *et al.*, 2021).

Multi-tier food supply chains are also not always centralised, and SSCM practices may be challenging to deploy depending on the supply chain structure (Awaysheh and Klassen, 2010). For instance, distance, which can be measured from a variety of perspectives, including geographical, cultural, and organisational distance, leads to the engagement of several suppliers, which increases complexity and unpredictability (Awaysheh and Klassen, 2010). Although technology improves information transfer in today's supply chains, providing supply chain partners with access to a broad range of information about what happens in the supply chain, issues such as poor working conditions in suppliers' facilities are often difficult to detect with such technologies (Yang *et al.*, 2021), and may be due to distance and supply chain structure (Awaysheh and Klassen, 2010). Because stakeholders such as consumers, governments, and non-governmental organisations (NGOs) are demanding that firms be held accountable for their supply chain activities, understanding the multi-tier complexity has never been more important. As a result, determining why MSSCM practices fail and how MTSC partners can successfully implement sustainable practices remains critical.

2.3. Barriers to the implementation of SSCM practices

Sustainability practices may be affected by a variety of factors in supply chains, and several scholars have considered this issue from different perspectives. An analysis conducted by Govindan *et al.*

(2014) on barriers to implementing green supply chain management in Indian industries identified 47 barriers. However, their study emphasised the green aspect of sustainability. In another study, Luthra *et al.* (2016) assessed the barriers to implementing sustainable supply chain initiatives to determine their importance. However, the method used is perceived to be vague, uncertain, and biased. Menon and Ravi (2021) identified key barriers to sustainable supply chains in the Indian electronics industry through interpretive structural modelling. Among the barriers identified were lack of awareness about sustainable practices, lack of environmental rules and regulations, and lack of commitment from top management. Similarly, Farooque *et al.* (2019) systematically analysed the causes and effects of Chinese barriers to circular supply chains in a study. It was found that weak environmental regulations and enforcement, as well as a lack of market preferences and pressure, were the key obstacles. However, most of these studies have excluded the multi-tier setting from their examination, focusing solely on the dyadic perspective.

The complex MTSC system may be a precursor factor impeding the implementation of sustainable practices. The literature, for example, emphasises the effects of partner dependence as an overarching meta-role influencing other constructs such as commitment, trust, and other relationship constructs (Mandt, 2018). The concept of dependence has been studied in the context of buyer–supplier relationships (Barnes *et al.*, 2005; Carr *et al.*, 2008; Dabhilkar *et al.*, 2016); however, the multi-tier system may limit partners' ability to contribute to the achievement of goals, often leaving room for opportunistic actions (Sarkis *et al.*, 2019; Alghababsheh and Galleary, 2021; Oyedijo *et al.*, 2021). The current business environment is also confronted with several challenges. For example, global supply chains are facing unprecedented pressures nowadays. This is evident from disruptions (e.g., the Russia–Ukraine War; the COVID-19 Pandemic), the challenging economic environment caused by changes in market infrastructure (e.g., the UK's departure from the EU leading to a lengthening of supply chains), and the overall uncertainty of the international business environment in which supply chains operate (Cote, 2020; Slattery, 2021; Simchi-Levi and Haren, 2022; Sweeney, 2022). Consequently, these issues are rarely acknowledged within the supply chain sustainability discourse as potential factors which may hinder the implementation of sustainable practices when attention to it is distracted.

Due to the geographical-dispersed nature of supply chain partners, focal firms find it hard to map out and distinguish supplier locations (e.g., their suppliers and their suppliers' suppliers) in the supply chain system (Mubarik *et al.*, 2021). Distance is categorised into three sub dimensions: geographical, cultural, and organisational distance. Specifically, organisational distance, as measured by the total length of the supply chain, results in firms using multiple suppliers, which increases

complexity and uncertainty (Awaysheh and Klassen, 2010: 1260). Likewise, it may be difficult to demonstrate sustainable practices in the supply chain due to the interconnectedness of multiple tiers and the lack of recognition of these MTSC partners (Khan *et al.*, 2021a). Orientations of MTSC partners may differ because of differences in values, goals, visions, and financial positions. In order to integrate sustainability into an organisation's supply chain, Pagell and Wu (2009) argued that it starts with the firm's mindset. To this end, some studies (e.g., Gómez-Cedeño *et al.*, 2015) argue that firms must align their human resource practices with supply chain management to maximise the involvement of supply chain members, while others (e.g., Fawcett *et al.*, 2008) believe that people are the key to fostering collaborative innovation.

In addition to limited information about sub-suppliers and limited tools for exerting influence over them, since sub-suppliers often represent only a small percentage of a supplier's business (Tachizawa and Yew Wong, 2014), this lack of control is partly rooted in lack of control over the entire supply chain (Choi *et al.*, 2001). Sub-suppliers are increasingly located in emerging economies that are also geographically and institutionally remote, further compounding the difficulty of managing these relationships (Awaysheh and Klassen, 2010).

Insert Figure 1. A conceptual model illustrating the actors, processes, and interactions within the multi-tier supply chain, and how drivers and barriers may affect the system.

2.4. Drivers to the implementation of SSCM practices

Extensive research has been conducted on the drivers of SSCM practices (e.g., Walker and Jones, 2012; Diabat *et al.*, 2014), employing qualitative and quantitative empirical methods to construct theoretical models. Research reviews (e.g., Dubey *et al.*, 2017) have revealed that most studies take a dichotomist approach to modelling SSCM drivers, using either deductive empirical research (e.g., Markman and Krause, 2014) or case studies (e.g., Pagell and Wu, 2009).

The potential for inter-organisational supply chain collaboration to help firms reduce recycling and disposal costs has been identified as a key driver of SSCM (Lee, 2010). Collaboration can provide local and lower-tier supply chain suppliers with access to innovative technologies (Vachon and Klassen, 2008; Glover *et al.*, 2014). Collaboration with suppliers can also advance supply chain sustainability initiatives and overcome financial barriers (Attaran and Attaran, 2007).

The current business environment also creates pressure to address supply chain sustainability issues. Customers, employees, and other stakeholders are some of the sources of these pressures. Previous research has found that internal pressures, including employee pressures and demands, can

be major drivers of SSCM. For example, the importance of employee involvement and loyalty to the success of sustainable initiatives has been acknowledged (Carter and Rogers, 2008; Longoni *et al.*, 2014). The role of institutional pressures has also been highlighted, with coercive and normative pressures are said to play a significant role in SSCM adoption (Zhu *et al.*, 2007). Although an understanding of the impact of institutional pressures on SSCM is still developing (Huq and Stevenson, 2020), scholars have argued that institutional pressure is a major driver of SSCM (Dubey *et al.*, 2017). Scholars (e.g., Jabbour and Jabbour, 2009) have also suggested that, despite the pressures, change management experts lack knowledge of how to achieve sustainability. Despite the fact that SSCM drivers vary by sector, product type, and location of organisations in the supply chain (Kannan, 2021), the literature also identified drivers such as top management support and guidance (Koster *et al.*, 2017), competitive pressures (Ageron *et al.*, 2012), and government legislation (Brammer and Walker, 2011; Kannan, 2021).

From a complexity standpoint, there are other perspectives on SSCM drivers in a multi-tier context, including how different actors may have mixed sustainability motives due to varying levels of activity and influence. Accordingly, despite the fact that both instrumental and moral motivations affect compliance, moral motivations have the greatest impact on firms' commitment to sustainable practices (Chen and Chen, 2019). Additionally, culture plays an important role in facilitating the adoption of SSCM practices in MTSCs, as the extended supply chain often involves a number of lower-tier suppliers operating in different countries with different cultures, which reflects on organisational culture (Marshall *et al.*, 2015). In this view, behavioural and human factors play a significant role in influencing employees' perceptions of sustainability which, in turn, may influence their knowledge, values, and attitudes toward broader organisational sustainability strategies (Pellegrini *et al.*, 2018).

Additionally, in spite of profit maximisation, one motivating factor for portraying SSCM practices is "relational motives", where multiple stakeholders' interests can be served (Eesley and Lenox, 2006). The importance of accounting for the diverse interests not only of shareholders but also of stakeholders becomes increasingly important in an MTSC context with multiple actors, ensuring that firms act to ensure the well-being of the various groups involved in the relationship (Paulraj *et al.*, 2017). In light of the fact that sustainability is no longer the responsibility of a single firm, but rather a responsibility of supply chains, activists and the media have developed strategies for holding supply chain firms accountable for their triple bottom line impacts, even if their partners are responsible for it.

Overall, while past studies have highlighted the importance, barriers, and drivers of supply chain sustainability (see Table 1), we believe that further research is still needed. Our knowledge of

MTSCs has grown over the years, but efforts to implement triple bottom line strategies and sustainable practices are still reported to be ineffective. However, most insights on this issue fail to consider how these failures can be addressed, particularly when considering a transitional triadic MTSC. Our study fills a gap in our understanding of how SSCM practices can be implemented and managed, especially in food supply chains, which remain complex and difficult to manage. Figure 1 depicts a conceptual model demonstrating how barriers and drivers can affect a complex MTSC system.

Insert Table 1. Barriers and drivers of sustainable supply chain management practices that have
 already been mentioned in the literature

3. Research methodology

3.1. Research design

In order to empirically investigate why MSSCM practices fail, and what MTSC partners can do to address this problem, a single case design was adopted (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). We approached the study as one of “theory elaboration” (Lee *et al.*, 1999), with the primary goal of extending rather than developing the theory related to MTSCs. Lee *et al.* (1999) stated that “theory elaboration” is when pre-existing conceptual ideas drive the research design. Case study research is well suited to conducting a detailed examination of real-life (complex, unique, exploratory) phenomena (Yin, 2014). Given that there is little substantive empirical research on this issue in the multi-tier context, the single case study was useful for expanding understanding beyond the context of the buyer–supplier relationship. Based on CT’s fundamental tenant that proposes a system-based paradigm in which determining performance outcomes becomes more challenging as the number of elements and the degree to which these elements differ increases, this study illustrates how multiple factors can influence the implementation of sustainable practices, particularly in complex multi-tiered systems. As a result, we can see how multiple actors, processes, interactions, and capabilities make it more difficult to implement sustainable practices in the MTSC.

3.2. Research setting

The food supply chain typically consists of several partners, ranging from upstream activities (farmers), midstream activities (processors, manufacturers, storage, wholesalers), to downstream activities (retailers, marketers, traders, consumers), all of which increase complexity (Roth *et al.*, 2008). This complex nature of food supply chains makes it difficult for lead firms to meet sustainability targets

due to the lack of contractual relations with sub-suppliers (Choi and Linton, 2011). Furthermore, in food supply chains, power imbalances and power dependence are ever present, as power is usually skewed towards large retail buyers, while suppliers of (usually unbranded) products are dependents (Hingley, 2005). For example, the food industry in the United Kingdom (UK) has experienced concentration in most parts of the supply chain as a result of backward integration initiated by powerful buyers, allowing for unethical purchasing behaviour (Glavee-Geo *et al.*, 2021). Although several studies have addressed sustainability issues in the food supply chain context, more research is required from the standpoint of participation of multiple tiers of supply chain partners (Rajeev *et al.*, 2017; Hong *et al.*, 2019). Considering the numerous sustainability concerns associated with food supply chains (Smith and McElwee, 2021), further research into MSSCM is especially important, significant, and timely, and the UK's food industry provides a unique research context to study this important topic.

3.3. Case selection

In this study, we examine the exchange relationship between a global food retailer (buyer) and its Tier-1 and Tier-2 suppliers in other parts of the world (e.g., Africa, South America, and Australasia). Our focus is on the food supply chain context due to the proliferation of sustainability issues within this industry and the direct impact they have on daily life and the global economy (Zhu *et al.*, 2018). The case study company is a multinational fast-food chain offering special delicacies to its customers globally. They operate in more than five continents and currently have more than 1000 retail outlets. They also have established relationships with upstream (farmers) and downstream (wholesalers' distributors) supply chain partners globally due to the scale of their business operations. They have a global impact on agriculture (through the growing of chilli, poultry farming, and potato farming), processing (energy and water use), distribution (emissions), and the service offering in retail stores.

An analysis of the buyer–supplier–supplier relationship structure between the case study firm and their main suppliers in food and food materials was conducted (see Mena *et al.* (2013) for theoretical MTSC structures). In selecting the Tier-1 and 2 suppliers, we intended to reach suppliers that provided three primary categories of items to the focal case firm—i.e., items essential to the smooth operation of the food supply. In light of the importance of these identified sourcing categories to the focal case firm, we expected close collaboration and interaction with their Tier-1 suppliers (named T-1 Supplier A, T-1 Supplier B, and T-1 Supplier C) to achieve the implementation of SSCM strategies. In the same way, we expected close collaboration between Tier-1 suppliers and their own suppliers (named T-2 Suppliers A, B, and C). Nevertheless, the importance of Tier-1 suppliers to the focal firm also allowed the buyer to develop a link with their suppliers' suppliers (i.e., T-2 suppliers),

referred to as the 'Transitional Triad' (Mena *et al.*, 2013). As a result, we were able to choose suitable Tier-1 and Tier-2 suppliers to participate in this study which led to a total of 10 in-depth interviews (see Table 2).

Insert Table 2. Case and interview details

3.4. Data collection

Purposive sampling was used in this study (Saunders *et al.*, 2019). Based on the objectives of the research, the operationalisation involved identifying potential respondents in the case firm, their Tier-1 suppliers, and their Tier-2 suppliers that will participate in the research. Purposive sampling allowed the researchers to use their discretion in selecting subjects who would be best positioned to answer the research questions, meet the research objectives, and contribute new insights to the research field (Saunders *et al.*, 2019).

Our sample consisted of participants (supply chain practitioners) who responded to requests to be included in the study (see Table 2 for interview details). Participants were informed of the study's purpose through a letter explaining its goals. This was followed up by an informed consent form that described how all identifying information would be removed from the data and how a strict confidentiality policy would be followed. There were three sources of data: interviews (semi-structured), site visits, and documentation (see Table 3). Data were primarily collected from semi-structured interviews. In addition to the data collected through interviews, the other two sources were used for triangulation purposes.

Insert Figure 2. Case firm's multi-tier supply chain structure

3.4.1. The semi-structured interviews

Following initial discussions and the pilot study, three sets of questions were developed for the buyer, their Tier-1 suppliers, and their Tier-2 suppliers, respectively (see Appendix). In the single case study, three Tier-1 suppliers and three Tier-2 suppliers were interviewed, in addition to the focal firm (the buyer) (see Table 3). Because we sought information about respondents' network exchange relationships, and because we wanted to limit theoretical biases, our questions were designed to be open requests for information about the topic. To improve the reliability of the study (Yin, 2014), an interview guide was developed based upon an extensive literature review, and the interview questions consisted of three sections. The first part covered general questions, followed by questions related to the barriers influencing the implementation of sustainable practices in section 2, and section 3

covered questions relating to the drivers influencing the implementation of sustainable practices (see the appendix for interview protocol).

Respondents in each firm were selected based on their knowledge and experience of the relationship with the other company, and an understanding of SSCM practices in the supply chain context. The exercise was conducted with senior staff in each organisation responsible for procurement and supply. We conducted all interviews in English, and most of them lasted between 45 minutes and 60 minutes. The interview sessions were audio recorded and transcribed verbatim for accuracy and clarity according to the 24-hour rule (Eisenhardt, 1989). Before moving on to the next stage, transcribed interviews were validated with informants by requesting feedback, explanations of points raised during the interview, and endorsement of the closing remarks (Yin, 2009).

3.4.2. Site visits

The companies involved were virtually visited due to the restrictions associated with COVID-19. Due to safety concerns and the desire to comply with government regulations, all participating companies agreed that this was the best approach. Thus, the process began by planning how the virtual visits would actually work in collaboration with the gatekeeper in each company. The first step was to choose the most convenient dates, times, and communications technology platform (e.g., Zoom, Microsoft Teams, Skype) for each virtual visit. The research team made certain that the virtual meeting links were sent to the gatekeepers in advance, and this reminder also included a research brief that explained the study's purpose and objectives. The second step involved the actual virtual visits, which began with a brief overview of the visit's aim and what the researchers hoped to gain from it. Following that, the gatekeepers in each company were able to guide a walking tour of their company using an internet-connected device with audio–video capabilities (mainly a mobile phone or tablet), accompanied by some team members. This tour enabled the research team to visualise and improve their interpretations of various issues by making a meaningful connection to their environment. The third step involved having a debrief session between the research team and the participants, which allowed the researchers to take notes and clarify points from the walking tour (Campos-Holland *et al.*, 2016).

Without physically being present, the researchers were able to gain a better understanding of the nature of the products offered by each party as well as how information is transmitted between them. In particular, the researchers learned about the inter-organisational exchange process between the buyer and their multi-tier suppliers, which helped them to triangulate information about the structure of their relationships. The visits also created an avenue for casual conversations with other

relevant personnel associated with the buyer (focal company) or suppliers (Tier-1 or Tier-2) which allowed certain information to be clarified by the researchers and vice versa. However, virtual visits have some drawbacks. For example, they could be hampered by a variety of factors such as equipment failure, a poor internet connection, poor recording quality, workplace safety issues (e.g., some employees may not want to appear in virtual tours for privacy reasons), individuals' limited mobility, and the exclusion of un-walkable areas (Salmons, 2015).

Each visit lasted between one and three hours mainly due to the schedule and itinerary arranged with the gatekeeper, although it is important to note that these visits occurred while the respondents were still coping with the effects of COVID-19. Afterwards, the researchers provided participants with a final report for verification and feedback.

3.4.3. Documentation

Researchers gained access to relevant documents including sustainability policies, modern slavery statements, procurement policies, contracts and terms of trade, supplier selection framework, and supplier relationship management tool kit. However, not all participants were willing to share these vital documents due to confidentiality concerns, and we respected those wishes. However, viewing these documents helped the researchers better comprehend the nature of their multi-tier relationship. Beyond that, it made it possible to understand relational attributes, and how sustainability standards (such as social and environmental) are managed. It also enabled a better understanding of the contractual relationships with sub-suppliers, as well as the level of involvement of sub-suppliers in the MTSC. The documents also made it possible to assess the degree of collaboration between the parties and the efforts taken (collectively and individually) to address sustainability issues in the MTSC.

Insert Table 3. Methods used for data collection

3.5. Data analysis

A thematic analysis approach (Braun and Clarke, 2006) was used to analyse the data. To familiarise themselves with the data, the researchers transcribed the recorded interviews in the first instance, which allowed them to develop pre-codes and initial thoughts of their own. This process included condensing a significant amount of information into quotes or paragraphs that were clearly relevant to the research topics (first-order codes). Following that, we categorised the codes by similarity into subcategories (descriptive second-order) and subsequent themes (third-order). This enabled us to get a hint of the different kinds of factors that may restrain or promote the implementation of SSCM

practices between the MTSC partners. The themes were then critically assessed to ensure that they were relevant to the study's goal and objectives, as well as anchored in and deduced from relevant literature. The researchers then attempted to discover interrelationships between the subthemes and themes in order to construct a thematic map based on their connections.

Several pilot studies were undertaken to assess the style of questioning and format of the interviews in order to increase the research's reliability (Yin, 2014). This started with four academics who teach and conduct research in procurement and supply chain management. The pilot studies assisted the researchers in understanding the questioning path, ensuring that it was conversational and provided a safe space for respondents to share insights pertinent to the research. As a result, the researchers were able to examine all interview questions for clarity, simplicity, answerability, and relevance. It also allowed the researchers to get feedback on the interview questions by closely reading the interview protocol and engaging in think-aloud activities. The refined interview protocol was then piloted with two practitioners whose work experience reflected the characteristics of the actual study participants (i.e., procurement and supply managers) (Maxwell, 2013).

In order to provide structure for organising and presenting the data, the researchers established a database for the case study after the data collection ended. This method enhanced the inter-coder reliability (ICR) (O'Connor and Joffe, 2020). A coding frame was manually created, which consisted of a list of codes arranged according to higher-order categories retrieved from the data by reducing, categorising, and synthesising raw data into an analytical procedure. A coding template was then applied systematically to the data, allowing them to be segmented into smaller units and labelled with codes that index their analytical significance. Research questions and the diversity of content within the data obtained dictated the number of codes in the coding template. Following the preliminary decision-making process (e.g., number of coders, amount of data to code, threshold of acceptable reliability), the researchers conducted ICR assessments manually, using coloured highlighters and sticky notes to code as described by O'Connor and Joffe (2020). The final phase of coding resulted in the calculation of the ICR index, calculated by dividing the total number of agreements for all codes by the total number of agreements and disagreements for all codes (Campbell *et al.*, 2013). The reliability result was 84 per cent (beyond the criterion of 80 per cent), which is considered acceptable for exploratory studies (Miles and Huberman, 1994). However, ICR is not often regarded as advantageous for qualitative research since it is thought to fundamentally conflict with the interpretive purpose of qualitative research (Braun and Clarke, 2013).

4. Findings

In this section, we report why MTSSCM practices fail, and what can MTSC partners do to address this problem.

4.1. Factors impacting the failure of sustainable practices in multi-tier supply chains

The study's findings show that the path to sustainability is long and complicated, with numerous road-blocks along the way. Major themes identified as the barriers associated with the implementation of SSCM practices in multi-tier food supply chains are revealed below.

4.1.1. The cost of sustainability

In the supply chain, the idea of sustainability and its implementation come at a cost (both financially and non-financially). Supply chain firms' initial investment costs towards sustainability initiatives are a barrier hindering the implementation of SSCM practices in the multi-tiered setting. All respondents agreed that adhering to sustainability standards that tackle environmental, social, and economic issues is important. However, it is often not a straightforward endeavour, and requires systemic changes, which may have financial implications. For example, in order for certain products to meet sustainability standards, firms may also need to eliminate certain resources, materials, or ways of working. The case firm's Tier-1 supplier reflects this in the exemplary quote:

You are probably going to incur more costs in the early days if you upgrade from standard material to recyclable material, so either you accept a drop in profitability, or you raise your prices to consumers and convince them to pay for it (T-1 Supplier B- Live Stock, Supply Manager).

This study also reveals the complexity of this issue, based on the individual perspectives of the buyer, the supplier, and the supplier of the supplier. Besides the increased costs associated with implementing sustainable initiatives, respondents also revealed the perception of reluctance on the part of consumers because the product's price may be higher due to the process it has undergone. The case firm's Tier-1 supplier highlights this issue in the exemplary quote below:

Sustainability is wonderful, but it necessitates monetary investment. All of this would be factored into the price of the goods we offer, necessitating investments in regenerative agriculture and the installation of wind turbines in our factories to generate power for the building. Therefore, I am guessing this is where you start to wonder if this is truly relevant to the customer (T-1 Supplier A- Packaged Food, Distribution Manager).

Respondents also stated that bringing other supply chain partners on board through mutual financial investment is often a difficult task, as it appears that firms frequently promise and fail. Cost-benefit ratios seem vague, especially at the upstream end, as suppliers will be required to source sustainable

materials that go into producing sustainable food to be consumed in restaurants. Likewise, suppliers have to pay more for organic materials, sustainable hatcheries, and eggs. Furthermore, the costs encompass the social dimension as well, as suppliers will need to invest in fair-paid labour and constructive labour laws, all of which are inevitably more costly. This leads to a reluctance on the part of the suppliers since they believe that the buyers will not pay for it. The case firm explains this point in the exemplary quote below:

This is a costly initiative because we must invest in new ways of working. Though we have begun this process, we are realising that we have been putting more money into it on a regular basis, and now we need our suppliers to do the same. The challenge is that it must be a collaborative investment by all parties (Buyer- Focal Firm, Group Procurement Director).

Suppliers, on the other hand, argue that buyers sometimes focus excessively on buying products at the lowest feasible price, without understanding the costly sustainable process that the item may have undergone. The per unit pricing of a loaf of bread, for example, would have been estimated based on sustainable agricultural output (e.g., wheat production), sustainable grain handling with farmers, and the subsequent milling process up until the baking stage. Nevertheless, buyers are less likely to consider this rigorous procedure, prioritising sourcing at lower prices instead. A Tier-2 supplier reflects this in the following comment:

When you have that conversation with buyers, their sole objective is to get the best and cheapest price (T-2 Supplier A- Primary Processing, Supply Officer).

4.1.2. Knowledge gap among multi-tier supply chain partners

Respondents noted that the complex structure of interconnectedness in the multi-tier food supply chain often hinders the transfer of knowledge about sustainability and its implementation. All parties concur that significant knowledge gaps exist since firms often have different areas of emphasis based on what they perceive to be important to them. Suppliers may misinterpret expectations due to unclear buyer demands. In addition, there is a knowledge gap in most markets, with no end-to-end analysis of the impact of particular sustainability practices and a dearth of technical skills in research and development. Because of these knowledge gaps, it is difficult to establish sustainable practices in the relationship between SC partners. The following exemplary remark by the case firm reaffirms this point:

There is a growing social desire for people to become vegetarians or, at the very least, to try a plant-based product. As a result, our challenge is to be an organisation that meets those needs, especially since eating a plant-based diet is good for the environment. Finding the right product to meet our needs, on the other hand, is difficult because it necessitates a significant amount of research,

development, and investment, which is frequently lacking (Buyer- Focal Firm, Procurement Manager (In-country A)).

In addition, smaller suppliers often lack the knowledge or capabilities necessary to implement sustainability initiatives. Respondents generally believe that suppliers often do not have sufficient technical expertise either through investment in technology or through innovation. Firm size, location, and access to adequate resources may be contributing factors to this issue. Considering that some multi-tier suppliers are based in different countries (for example, developing markets), there may be a gap in knowledge transfer or acquisition. However, buyers can take measures to encourage sustainable practices by implementing supplier development measures. As explained by a Tier-2 supplier in the following exemplary quote:

We also face technical challenges here, because we are trying to break new ground, and as a smaller firm, we cannot keep up with the latest technological advancements (T-2 Supplier B- Rearing and Breeding, Supply Coordinator).

Another supplier emphasised the importance of sustainability knowledge and the ability to manage deliverables. Aside from a clear understanding of what supply chain partners should strive for, we discovered that there is frequently no clear approach to unpacking knowledge, which can be used to directly inform decisions, or actions made by buyers or their MTSC partners. A knowledge system model will also aid in understanding the buyer's needs from the suppliers' perspective, as well as how the buyer can assist the suppliers in meeting their needs adequately. A Tier-2 supplier in the exemplary quote below illustrates this point:

We are not the largest supplier in our sector so we do not have the resources to develop new materials. Therefore, we aim to be the first to adopt rather than the first to innovate. Being a pioneer is costly, and we do not have the scale of business to do so (T-2 Supplier C- Milling, Supply Chain Manager).

Though there has recently been a lot of desire to drive sustainability, the truth is that it would be much better if there is a clear understanding of how we will go about it, and I believe it is even more important to address the sustainability issues together rather than the 'I do mine and you do yours' style (T-1 Supplier B- Live Stock, Supply Manager).

This perspective was corroborated by the focal firm, which acknowledged the necessity for more investment in supplier development activities that substantially address sustainability concerns. Such acts, which have not been taken in the past, are thought to have caused a vacuum in the collective development of new ideas. The case firm explains this point in the following exemplary quote:

Though we have begun to do a lot of work in the area of sustainability, I believe that we should invest in research and development to help solve the problem of the best ways to approach sustainability as a buyer, as well as involving suppliers in the process. Although this is a difficult task that often

discourages the drive to implement sustainable practices, we must work on it (Buyer- Focal Firm, Group Procurement Director).

4.1.3. Power dynamics in the multi-tier supply chain

We found that the dynamics of bargaining power plays a significant role in impacts the implementation of sustainable practices in the multi-tier food supply chain. Power imbalances can influence the dynamics of supply chain partnerships in general as one party (usually the focal firm) can have and exercise stronger negotiation and purchasing power than the suppliers (usually seen as weaker parties in the relationship dynamics). If a focal firm wields the majority of the power, this may not always result in mutual advantage, which could lead to unsustainable practices. More so, food supply chains have been labelled "captive" because of large-scale issues involving shared power, inclusion, and unethical purchasing by parties that are more powerful. The following exemplary quote by a Tier-1 supplier explains this issue:

When you observe the complicated nature of the food supply chain that we are a part of, you realise that we do not have much power to affect things and must rely on our main buyer, which can limit our ability to implement sustainability standards, especially from the food angle (T-1 Supplier C- Pastry Production, Supply Chain Manager).

Because sustainability is not limited to a single link in the chain, the ability to persuade other partners to do what is morally correct for future generations is frequently determined by the value or volume of business done with the buyer. As a result, smaller suppliers lack the ability to sway large industry partners, particularly in markets where government regulations are lax or non-existent. The following exemplary quote by a Tier-2 supplier explains this perspective:

It is difficult to persuade them due to their size. Our company is only a fraction of a tenth or a fifth of their supplier account. As a result, it is difficult to influence them and ensure that they are acting in a sustainable manner (T-2 Supplier B- Rearing and Breeding, Supply Coordinator).

On the other hand, given consumer pressure for responsible consumption and production, buyers (focal companies) must continue to use their purchasing power to demand sustainable approaches while also pushing the agenda. Buyers must utilise their purchasing power to strengthen supplier relationship management and demand triple bottom line transparency. More effort with suppliers is required in order to have a long-term impact and the following exemplary quote by the focal firm explains this:

We should be able to do more to support sustainability measures by demonstrating our negotiating power. For example, we are conducting an audit of our first- and second-tier suppliers to see where we might invest in tools and technology to help us do what we do (Buyer-Focal Firm, Group Procurement Director).

The case firm also expressed frustration with their inability to influence sustainability, despite their purchasing power, due to complexities relating to their inability to change their suppliers' feed, as stated in the exemplary quotes below:

Because we are still in the early stages of development, sustainability in this region is very low. For example, when purchasing chickens, raising chickens sustainably involves reducing or removing soy from feed or using corn grown locally, so I have no ability to change the feed with my purchasing power (Buyer- Focal Firm, Procurement Manager (In-country B)).

I honestly believe that one of the largest problems we face is influencing our suppliers (primary producers) on water usage and waste but, because we are still at the introduction phase in this region, we do not have much power over them (Buyer- Focal Firm, Procurement Manager (In-country C)).

4.1.4. Poor sustainability infrastructure

Our findings emphasise the significance of sustainable infrastructure as an obstacle to the implementation of sustainable practices in multi-tier food supply chains. All MTSC partners' joint investment in sustainable infrastructure has overlapping benefits for all three dimensions of the triple bottom line. There have been projected increases in temperatures (global warming), weather patterns (e.g., flooding), and reductions in water availability due to environmental sustainability challenges in the Agri-food context. All of these may lead to a reduction in food security and availability, decreased crop yields and access to food, significant reduction in food quality, and diminished livestock productivity. We found that investment in sustainable infrastructure is yet to be considered heavily as a collective dedicated investment by all multi-tier parties, perhaps causing a hindrance to the implementation of sustainable practices in the multi-tier food supply chain. This point was highlighted by a Tier-1 supplier in the exemplary quote below:

As a major supplier in our category, we really need to start working with our buyer and our upstream partners toward building sustainable infrastructure that focuses on specific issues affecting all of us, especially from the environmental side with the need for green energy sources and water management in our production. We have not started this but I think it is affecting us (T-1 Supplier A- Packaged Food, Distribution Manager).

Suppliers also highlighted that their lack of access to sustainable technology and infrastructure hinders their ability to prepare for and manage disruptions that interrupt the food production. For example, one supplier in a developing country complained that it is not always a straightforward endeavour without the adequate sustainable infrastructure. This point was highlighted by a Tier-1 supplier in the exemplary quote below:

We are significantly large in rearing livestock such as cows, goat, sheep, and cattle. Recently, there has been a high demand for these livestock, which has significant implications for the amount of forest land

cleared to accommodate the cattle. This is going to impact the environment negatively in the long run due to the release of emissions such as methane by our cattle. However, we lack the necessary systems to address this (T-1 Supplier B- Live Stock, Supply Manager).

It was also indicated that the perceived high costs associated with carrying out such efforts may be the cause of this lack of significant investment as stated by the following exemplary quote:

We sometimes find it difficult to catch up due to low investment in sustainable breeding and rearing infrastructure systems that will adhere to sustainable livestock production standards and eliminate problems like water pollution because of the perception we have of the huge financial expenditure that is necessary (T-2 Supplier B- Rearing and Breeding, Supply Chain Coordinator).

We also found that a barrier hindering the implementation of sustainable practices in multi-tier food supply chains is the lack of growth opportunities related to sustainability. This issue is related to the economic dimension of sustainability and frequently necessitates financial commitment from all parties, particularly the chain's focal firm. A supplier emphasises how this issue is exacerbated by a lack of financial infrastructure to support suppliers' needs in meeting their sustainability pressures. This point was highlighted by a Tier-1 supplier in the exemplary quote below:

The lack of a collaborative mechanism that allows us to handle sustainability concerns jointly is a major issue we face. We frequently deal with challenges in isolation, with no dedicated infrastructure for all parties. We've told our buyer multiple times that we require a financial support infrastructure and that we'll need to collaborate with our supplier on this (T-1 Supplier C- Pastry Production, Supply Chain Manager).

The supply chain's adoption of sustainable practices has been noted as a challenge due to a lack of sustainable technology and infrastructure. Participants noted that a lack of green energy sources or enough recycling infrastructure, for example, was impeding their progress toward sustainability. This issue was emphasised in the following exemplary quote by the focal firm:

Our country's recycling system is weak. While waste is separated into distinct categories at home and at restaurants, it is all mixed up again when the municipality selects the bin for disposal. As a result, in this country, the ability to fully recycle and convert them into something new through circular economy infrastructure is relatively limited (Buyer- Focal Firm, Procurement Manager (In-country C)).

Government attitudes, legislation, and regulations can also stymie the successful implementation of sustainable practices. Countries that lack strict laws or government guidance and infrastructure on the requirements for sustainable development have a lower focus and drive toward sustainability.

This can be deduced from the following exemplary quote by the focal firm:

Sustainable infrastructure can be assessed from a variety of perspectives, including what we do as an industry leader and what our suppliers and their suppliers do to address social, environmental, and economic concerns. However, we frequently overlook the critical role of government and policymakers in providing a holistic development approach. This is still lacking or in the works in some of the regions where we operate (Buyer- Focal Firm, Group Procurement Director).

4.1.5. Multi-tier complexity

The complicated nature of the food MTSC inherently hinders the implementation of sustainable initiatives, since it is more difficult for supply chain partners to navigate the complex supply chain system, as indicated by our data. The efficient coordination and flow of critical information, as well as the harmonisation of sustainability criteria, are frequently hampered by this complexity. This has an impact on collaborative planning and development for the introduction and development of new food options. The complexity that arises when a product's packaging is converted to recyclable packaging, or the social dimension of reducing salt for health and well-being, for example, could be enormous and have varying effects if not properly managed. This increased complexity manifests itself in shortened shelf life of food products, and batch production, among other things. This point is expressed in the following exemplary quote by the focal firm:

Looking at health and nutrition from a social standpoint, potential challenges include cost and shelf life, which means you may have to write off more stock. If you reduce shelf life by reformulating a product, such as removing salts, this adds complexity to the supply chain—you need different suppliers, more frequent production, and possibly higher costs, all of which have an indirect impact on the supply chain (Buyer- Focal Firm, Group Procurement Director).

We also found that the complexities may be related to the type of products being transformed in the food supply chain. Some of the complexities' broader effects are related to the business impact for the focal firm or their suppliers. For example, switching from packaging material A to packaging material B may affect how your product appears on the shelf or in point of consumption (restaurants). This could influence how consumers perceive the product—whether they like it or dislike it. As a result, they may purchase more or fewer of your products, so any type of product portfolio evolution involves both a commercial opportunity and a commercial risk. This point is also illustrated in the following exemplary quote:

Our supply chain is complicated since it ranges from having several tiers of suppliers. Using our soy supply as an example, soy originates from co-ops and individual farmers, as well as crushers, cultural mills, and personal traders. As a result, the tracing of all that soy back to its source might be rather complicated, limiting our capacity to quickly apply sustainable solutions (Buyer- Focal Firm, Procurement Manager (In-country C)).

In addition to the foregoing, our research suggests that complexity may also be increased due to traits exhibited by lower-tier suppliers, making it challenging for focal firms to manage sustainability farther down the supply chain. For instance, information asymmetry may arise due to the complexity of the supply chain structure beyond the first-tier supplier, with one party (often the focal firm) knowing more about sustainable standards than lower-tier suppliers (e.g., second-tier suppliers). Likewise, suppliers beyond the first-tier are often responsible for significant sustainability issues, such as using

hazardous agricultural chemicals that are harmful to the environment. The complexity of lower-tier suppliers' relationships with the rest of the supply chain impedes sustainability efforts. This point was highlighted in the following exemplary quote by Tier-1 and Tier-2 suppliers:

Our immediate buyer recently notified us that their own buyer had recently complained about their inability to oversee sustainability in relation to our milling practices. However, how could such complaints be made when they never had an idea who we were until very recently, and how could they manage sustainability if there had never been a strong connection with them? (T-2 Supplier C- Milling, Supply Chain Manager).

We have always struggled to establish a strong relationship that goes beyond the one with our immediate buyers and suppliers, and until recently, the larger buyer never made this a priority. This may be related to the complexity of food supply chains in general (T-1 Supplier A- Packaged Food, Distribution Manager).

This complexity issue also contributes to a knowledge gap related to sustainability among MTSC partners. The interconnectedness between the focal firm and their extended supply chain partners beyond the first-tier level, for example, frequently lacks a collaborative relationship management approach. This is especially true in the food supply chain, where the nature of dependence varies and focal firms lack contractual relationships with their direct suppliers. As a result, the potential of developing a sustainability infrastructure in which MTSC actors can collaborate and maximise value is reduced.

4.2. How multi-tier supply chain partners can improve sustainable practices

Based on the barriers identified by the respondents, we asked them to provide possible solutions to the issues. Major themes identified as potential drivers associated with the successful implementation of SSCM practices in multi-tier food supply chains are revealed below.

4.2.1. Multi-tier collaboration and partnership

In our analysis, we discovered that a high level of collaboration and partnership on matters relating to sustainable initiatives among MTSC partners can aid in the long-term resolution of sustainability issues. This allows all partners to share ideas that have both collective and individual implications. The collaborative approach can also help focal firms plan for specific issues that may jeopardise the consistent supply of their commodities from their suppliers. Such plans may include mutual agreements on how to jointly address climate change threats, as well as specific approaches to addressing the intensification of droughts, flooding, wildfires, soil loss, and land degradation, among

other economic and social issues. In the end, the collaboration serves to protect the interests and needs of all parties. This point was highlighted by a Tier-1 supplier in the exemplary quote below:

Considering the complex nature of food supply, collaboration will always be an effective approach. We need more open collaboration in which we are willing to share knowledge about this major issue with one another rather than working on it individually. I also believe that our buyer should push for this collaborative approach and involve us more (T-1 Supplier B- Live Stock, Supply Manager).

Our data also show that MTSC collaboration and partnership can assist partners in better understanding each other's expectations when defining what is fair, acceptable, and tolerable. This is an important point because it reduces the likelihood of the more powerful party's (buyers) behaviour being perceived as unethical or opportunistic by suppliers, or vice versa. A Tier-2 supplier addresses this important social dimension in the following exemplary quote:

Prices in major categories have recently risen significantly, and we must reflect this in our quotes. So, we need to collaborate not only with our direct buyer but also with the focal firm, so that they can gain a better understanding of our issues, particularly with quotes, which we believe they don't always regard fairly (T-2 Supplier A- Primary Processing, Supply Officer).

In addition, our findings highlight the importance of collaborative activities such as information sharing and dedicated investment to research and development to help create long-term solutions. Such a collaborative approach of managing the multi-tier food supply chain can also give the entire supply chain a competitive edge in times of uncertainty but also increasing market share as they can collectively show how their supply chain is improving sustainable practices together. This point can be deduced from the following exemplary quotes by the focal firm:

To be able to put ourselves in a stronger position moving forward, we will need to think critically about our collaborative approach with our first- and second-tier suppliers, as well as possibly having shared R&D (Buyer- Focal Firm, Group Procurement Director).

If we want to see suppliers transition to things like regenerative agriculture, I believe we will need to think about longer-term partnerships with suppliers, longer contracts, and more investment (Buyer- Focal Firm, Procurement Manager (In-country A)).

4.2.2. Diffusion of sustainable innovation along the chain

Our findings indicate that, if MTSC partners are to address sustainability issues, they must communicate and share innovative approaches. However, for this to occur, innovation is required at every stage of the supply chain, from raw materials to the delivery point. Currently, it appears that MTSC partners continue to struggle to develop innovative solutions, or perhaps hoard them, as a result of the loosely coupled system in which firms are separate entities but rely on each other for certain

functions (Weick, 1976; Orton and Weick, 1990). This point is explained in the following exemplary quote by a Tier-1 supplier:

To be honest, it often feels like we're competing against one another, particularly in the last two years owing to the various disruptions we've all experienced. We must be able to trust one another and exchange information on some of these difficulties, which appear to be beyond the scope of any single individual or firm (T-1 Supplier A- Packaged Food, Distribution Manager).

Our findings also show that specific sustainability-oriented innovation is needed to address key issues in the food industry, such as crop yield and livestock productivity reductions, quality of food, livestock emission reductions, improved soil management, farming techniques, and overall changes to how food is produced and distributed in the supply chain. This perspective was shared by the first-tier supplier and focal firm and highlighted in the exemplary quotes below:

We frequently discuss the best available options for sustainability with our focal firm, and aside from budgetary restrictions, we frequently seek out sustainable solutions in a variety of areas, including how we source materials from upstream suppliers (T-1 Supplier C- Pastry Production, Supply Chain Manager).

There are numerous approaches to some of the issues we face as a sustainable business and supply chain, but we have been in discussions with our first-tier supplier about the dissemination of specific types of solutions, particularly related to the packaging of certain product categories due to recycling issues (Buyer- Focal Firm, Procurement Manager (In-country C)).

Considering this at a multi-tiered or network level would be a long-term solution, focusing on sustainable innovation that meets all needs because sustainable innovation can be both economically and environmentally beneficial, yet have negative social consequences (Buyer- Focal Firm, Procurement Manager (In-country A))

Furthermore, we discovered that the MTSC structure can obstruct knowledge and innovation along the chain, and that for innovation diffusion to be effective along the chain, a string link between the supplier's supplier and the buyer is required. This way, regardless of geographical distance or technological proximity, the buyer (focal firm) can receive direct feedback and understand potential opportunities and risks related to sustainability. This important point is explained in the following exemplary quote by a Tier-2 supplier:

Our proximity to the focal firm may hamper value creation, as it often feels as if we're left out of decisions, only to be told by our direct buyer (T-2 Supplier C- Milling, Supply Chain Manager).

4.2.3. Supply chain mapping

Our data show that members of the multi-tier food supply chain continue to lack a comprehensive understanding of the sustainability impacts of their supply chain and the activities that occur at each

point along the chain. This is the case in the transitional triad studied in this research, where the buyer only has a solid understanding of their first- and second-tier suppliers due to the importance of the commodities sourced from them, with little understanding of what happens beyond. We discovered that it is common for one party (usually the focal firm) to expect their first-tier suppliers to adhere to sustainability ideals, and that their suppliers, in turn, ask their own suppliers to do the same. Sometimes, it seems that there are many instructions passed on from one party to the next in the chain without a full understanding of how the receiver at the other end will follow them. It is impossible to create a stream of sustainable practices that flows smoothly across the supply chain without an adequate mapping and understanding of each upstream actor and identifying the most significant sustainability issues they face, then prioritising efforts to resolve them individually. This viewpoint was shared by the focal firm and first-tier supplier in the exemplary quotes below:

For a more complete picture, we must invest more time, effort, and resources into understanding the upstream part of our supply chain beyond the three main tiers we focus on right now (Buyer- Focal Firm, Group Procurement Director).

Mapping out the supply chain is very important toward getting a comprehensive understanding of problems and our buyer relies on us to supply them vital information; thus, it requires a collaborative approach (T-1 Supplier B- Live Stock, Supply Manager).

A thorough awareness of our supply chain is necessary for our food processing business, which goes beyond the typical one-layer concentration and certainly necessitates capturing all additional upstream actors and our buyers mid- and downstream (T-2 Supplier A- Primary Food Processing, Supply Officer).

The focal firm may also need to reduce the number of existing actors in their supply network to develop stronger partnerships with performance criteria that are agreed upon from the first layer upstream all the way down. By doing so, buyers are able to hold their multi-tier suppliers accountable, especially beyond the first-tier where there are numerous social sustainability issues involving labour conditions, worker exploitation, health and safety, and fairness, among others. This is explained by the focal firm in the following exemplary quote:

The supply base will need to be reduced so that we can focus on suppliers who have committed to meeting our sustainability standards. We need to conduct a proper mapping exercise and our first-tier suppliers can be of assistance in this process (Buyer- Focal Firm, Procurement Manager (In-country B)).

There is also a need for downstream initiatives, especially when it comes to food supply, due to the proliferation of food waste, carbon emissions, and footprints (including logistics and transportation).

What happens after our buyer receives the commodities based on the purchase orders? Remember that it still moves on to the next point in the chain, especially for items going to retailers and consumers. As a result, the entire picture must be considered from a long-term perspective if we are to be sustainable (T-1 Supplier C- Pastry Production, Supply Chain Manager).

4.2.4. Sustainability performance measurement

In addition to mapping the supply chain, our findings highlight the importance of establishing compliance standards and establishing a benchmark to which all members of the supply network can subscribe. This exercise may include a series of evaluations and appraisals that review suppliers based on various parameters. This will include elements such as a code of conduct or practice, as well as questions about how specific activities such as food production or labour conditions adhere to sustainable standards. In order to identify, assess, manage, and disclose supply chain sustainability risks, these performance measures can be prepared in accordance with the Global Standards for Sustainability Reporting (GRI Standards) and the Supplier Self-Assessment Questionnaire (SAQ). The focal firm explains this point in the illustrative quote below:

Aside from mapping, we must implement measures to sustain sustainability initiatives with our first- and second-tier suppliers and beyond (Buyer- Focal Firm, Procurement Manager (In-country B)).

Our findings also show that these performance measurement templates can help top-tier suppliers determine how well they are tackling the set standards in accordance with the GRI and SAQ and how to improve on important aspects such as environmental performance (e.g., energy and water usage, greenhouse gas emissions). A Tier-1 supplier explains this point in the illustrative quote below:

I believe that, as suppliers, measuring sustainability performance can help us perform better in accordance with triple bottom line standards and identify opportunities and threats affecting the whole supply chain (T-1 Supplier B- Live Stock, Supply Manager).

Our findings indicate that an appropriate communication of these sustainability results in a constructive manner can build future collaboration based on feedback, and motivate suppliers to improve in weak areas. The following exemplary quote by a Tier-2 supplier explains this point:

As well as establishing performance standards for sustainable practices, it is also crucial to follow them through to ensure that there is a continuous improvement in the way we process our food, rather than taking a one-time approach and expecting sudden changes (T-2 Supplier A- Primary Food Processing, Supply Officer).

4.2.5. Capacity building on sustainability

We also discovered that developing training and capacity-building programmes that specifically focus on sustainability issues from the environmental, economic, and social perspectives is an important step toward overcoming sustainability issues in the multi-tier food supply chain context. Given that human beings make decisions and take actions regarding sustainability in the supply chain, such programmes could improve how sustainability is regarded not only at the firm level, but also at the

individual level, ultimately driving behavioural changes throughout the MTSC. A Tier-2 supplier explains this point in the illustrative quote below:

Given our position in the chain and how much we push down the chain, I believe we would benefit from regular training rather than having the buyer make all of the demands (T-2 Supplier C- Milling, Supply Chain Manager).

An intriguing discovery is the requirement for constant re-orientation of the value of sustainability throughout the supply chain. We discovered that this initiative—which includes developing capacity-building campaigns, implementing mandatory training (either physically, virtually, or through pre-recorded e-Learning), and holding annual conferences—will provide adequate knowledge and awareness across the chain, allowing for the use of best practices to be leveraged. Such initiatives will also open up opportunities for mutual investment and knowledge transfer between buyers and their top-tier suppliers. The following exemplary quotes by the focal firm and a Tier-1 supplier illustrate this point:

We have previously invested in internal training and development, which has resulted in a high level of awareness about sustainability standards in the industry currently. I am actively working with external providers to determine how we can push this with our suppliers in order to create a shared understanding of what we should all be working towards (Buyer- Focal Firm, Group Procurement Director).

I strongly believe in continuous development, and because the FMCG sector moves at such a rapid pace, we require regular knowledge updates on sustainability requirements so that we adhere to them, as do our suppliers (T-1 Supplier A- Packaged Food, Distribution Manager).

Insert Table 4. Categories of exemplary quotes linked to the barriers and driving forces of multi-tier sustainable practices in the global food supply chain

5. Discussion

Complexity theory was adopted in the study to help unravel specific factors that specifically hinder the implementation of sustainable practices in multi-tier food supply chains. A fundamental tenet of CT contends that, as the number of elements and their differences increase, determining performance outcomes becomes more difficult. This is especially true in MTSCs, where focal firms frequently lack control over their immediate suppliers, and the number of those suppliers further up the chain may gradually grow. This poses challenges in maintaining SSCM practices because the dynamic nature of the interactions is constantly changing and frequently unpredictable. Using the CT lens, we can see how the multiple actors in the chain, along with processes, interactions, and capabilities of the MTSC

actors, makes it harder to implement sustainable practices. This helped us gain insight into the reasons why MTSSCM practices fail, as well as the methods that MTSC partners can use to improve sustainable practices.

In the literature, there is a division of barriers to sustainability into various categories, such as technological, economic and financial, regulatory, institutional, social and cultural, organisational, and market-based (see Gupta *et al.*, 2020). Our results demonstrate that specific issues such as sustainability costs, knowledge gaps between MTSC partners, power dynamics in MTSCs, and dealing with multi-tier complexity in food supply chains constitute barriers that apply to all multi-tier actors rather than just one supply chain firm. For example, regardless of the power and influence that individual actors may hold in the MTSC, the cost of sustainability remains an issue for all parties. Because performance outcomes become more difficult to determine as the number of elements and their differences increase, a focal firm may even find it more expensive to implement sustainability initiatives beyond their immediate first-tier suppliers. The non-financial implications of such investments include technical know-how and the implementation of the appropriate strategy to ensure that the sustainability plans work. Similarly, a smaller farmer upstream in the supply chain may lack the financial capability to implement the sustainability initiatives required to truly address environmental challenges and meet the performance targets expected by the buyer or focal firm three tiers above them. The cost of sustainability is seen from the point of view of who will actually bear the majority of the financial and non-financial burden associated with introducing sustainability initiatives. Our research revealed that MTSC partners considered this to be an expensive and time-consuming endeavour that needed adequate resources to be successful. The findings of this study are consistent with previous studies (e.g., Abbasi and Nilsson, 2012; Narayanan *et al.*, 2018; Zhu *et al.*, 2018). Past studies have also revealed how these investments, which may include obtaining certifications, can ease coordination and reduce information asymmetry and transactions costs (Ciliberti *et al.*, 2009).

The same is true for another barrier; that is, a knowledge gap in an MTSC. Because of their size, focal firms in food supply chains typically have significant access to capital and are frequently exposed to new innovations. On the other hand, because they are more visible in the chain, they are frequently subjected to greater scrutiny when it comes to implementing sustainable practices. Such firms will typically be more knowledgeable about current sustainability requirements and trends. However, disseminating this further down the chain may be difficult due to the complexity of the MTSC and the fact that the necessary sustainability infrastructure may not be existent in the first place. Due to the nature of the complex MTSC network, these barriers frequently result in poor visibility and transparency issues. However, the identified drivers, such as supply chain mapping, could aid in a

better understanding of the complex nature of MTSCs. Diffusion of innovation along the chain could be a useful mechanism for addressing the current knowledge gap issues that MTSC partners are experiencing. A collaborative and partnership approach to managing MTSCs may also help to change the perception of one party not having control and influence over decision making (Kumar *et al.*, 1995; Zhu *et al.*, 2008; Touboullic *et al.*, 2014). A good sustainability performance measurement can also assist with assessing the cost implications of sustainability and how to direct efforts towards meeting those performance measures. Based on all of this, the CT lens enables us to see the interrelationships between these barriers and drivers.

Furthermore, the literature calls for SC sustainability learning (Pereira *et al.*, 2021; Santos *et al.*, 2023), in which supply chain partners can bridge knowledge gaps and learn new capabilities together to address sustainability issues. CT explains why knowledge gaps may exist in MTSCs due to the complex structure of interconnectedness between chain partners (Wilding, 1998) or the multi-tier structure (Wilding, 1998; Mena *et al.*, 2013). As a result, our research supports the need for better coordination of supply chain learning requirements and knowledge transfer aimed at driving sustainability among MTSC partners (Silvestre *et al.*, 2020). Similarly, adequate governance mechanisms are required to aid in the balanced development of economic, environmental, and social aspects across the entire multi-tier system (Gong *et al.*, 2021). A CT lens not only offers a better understanding of why MTSSCM practices fail, but also emphasises how complex the movement of goods and the types of products moving through the MTSC from upstream suppliers are, as well as the complications associated with their shelf life. Since actors at different levels have different capabilities and levels of interaction, the sequence of processes in food supply chains—from farms to manufacturers to points of consumption (including restaurants)—could create unsustainable practices at any one of the stages. We conclude with propositions that explain barriers and drivers influencing the implementation of MTSC practices under the complexity lens (see Figure 3).

Insert Figure 3. Barriers and drivers influencing the implementation of multi-tier sustainable supply chain practices under the complexity lens.

6. Conclusion, limitations, and future research

This study investigated why the MTSSCM practices fail, and what approaches MTSC partners can use to improve them. Literature on SSCM has focused on a range of issues, such as defining SSCM and building related frameworks (e.g., Carter and Rodger, 2008; Seuring and Muller, 2008); how it is

implemented (Walker and Jones, 2012; Brockhaus *et al.*, 2013; Beske and Seuring, 2014); barriers and enablers (Walker and Jones, 2012; Gupta *et al.*, 2020); and driving sustainability in complex settings (Wu and Pagell, 2011). Our research builds on previous work on barriers and enablers, as well as how to develop sustainable practices in complex supply chain systems. In answering the research question set at the beginning of this study, we contribute to the sustainable supply chain management in the following ways.

6.1. Theoretical contributions

This research adds to the relatively new and still developing empirical setting of MTSC management (e.g., Jabbour *et al.*, 2019) which has provided a rich backdrop for theory application and re-examination of existing perspectives.

Our first theoretical contribution is based on the application of complexity theory to the MTSC phenomenon, which is yet to be adequately understood and explained theoretically. This CT lens was used to systematise and explain our empirical data, which led us to conclude that the configuration of MTSCs themselves is a significant barrier to the implementation of sustainable practices. Borrowing this theoretical lens, we can better understand MTSCs as complex systems, where the implementation of sustainable practices is a challenge across the board. This perspective also improved our understanding of how MTSC members often have varying perceptions, predispositions, and understandings of the sustainability issue, leading to inconsistent and ineffective approaches. It broadens our horizons and helps us understand how these barriers, some of which have already been identified in the literature, hinder sustainable practices in MTSCs. Based on the positions and assessments of supply chain members at different levels, we see how sustainability issues are treated differently at each tier of the supply chain, often resulting in differences in how the concept is discussed and managed. By extending the reach of SSCM practices to the multi-tier level, we broaden the unit of analysis where several authors have challenged the fundamental assumptions of supply chain structure and boundary. For example, Choi *et al.* (2001), Bai and Sarkis (2018), Carter *et al.* (2015), and Wieland (2020) have demonstrated that it can be better understood as a complex adaptive supply network rather than a simple chain.

Although research on sustainability in MTSCs is gaining traction, only a few studies are based on empirical insights (e.g., Mena *et al.*, 2013; Villena and Gioia, 2018; Jia *et al.*, 2019; Chand and Tarei, 2021; Kannan, 2021; Marttinen and Kähkönen, 2022). Many studies on this topic have relied heavily on systematic literature reviews or meta-analysis (e.g., Tachizawa and Yew Wong, 2014; Govindan *et*

et al., 2021; Senyo and Osabutey, 2021), implying that there is still a need to validate the claims made by some of these studies. Therefore, our second theoretical contribution is based on an incremental extension of existing knowledge where we address calls for deepening our understanding of sustainability challenges and solutions beyond first-tier suppliers (Gong *et al.*, 2018; Sauer and Seuring, 2019; Villena and Gioia, 2020; Choi *et al.*, 2021). In this study, we expand on previous assumptions about why sustainability programmes at MTSCs fail and outline a five-step process to tackle these barriers. These solutions can help buyer–supplier–supplier structures to overcome barriers such as sustainability-related knowledge gaps due to information asymmetry, which may arise as a result of MTSC complexity. Therefore, we also respond to calls for greater insight into MTSC sustainability challenges that affect triple bottom line performance (Jia *et al.*, 2019; Gong *et al.*, 2021; Khan *et al.*, 2021a; 2021b; Senyo and Osabutey, 2021). The findings add to the existing literature in three key areas: [sustainable supply chain, food supply chain, and sustainable food supply chain](#) (Zhu *et al.*, 2018). In this study, we discovered that a knowledge gap among MTSC partners hampered sustainability targets, which is consistent with recent calls in the literature for specific actions such as collective supply chain learning (e.g., Jia *et al.*, 2019) and sustainability learning (e.g., Roy *et al.*, 2020).

A third meaningful contribution of this study is its relevance and ability to be translated beyond the confines of academia to relevant audiences. Our study provides novel insights into how multi-tiered food supply chains that cross geographical boundaries can become more sustainable, potentially preventing other issues such as food shortages which are caused by traceability and rising supply chain costs. Besides the known challenges of managing food supply chains and ensuring sustainable food production, this study reveals an “*elephant and blind men conundrum*”. In this case, the elephant is the implementation of sustainable practices, while the blind men are the supply chain members at various tiers of the food chain. For example, a lack of knowledge about sustainability, especially beyond the first-tier level, leads to disparate approaches based on knowledge gaps and insufficient sustainability infrastructure. These factors may lead to inadequate communication between multi-supply chain partners and increase the cost of implementing sustainability measures, necessitating capacity building, innovation diffusion, and a collaborative and partnership approach. It is possible to minimise the exacerbation of sustainability issues through an extended analysis of these barriers and drivers in a multi-tier food supply chain context (Beske-Janssen *et al.*, 2015).

6.2. Practical implications

This research has several managerial implications for practitioners in addition to its theoretical implications. To address sustainability challenges, MTSC partners must focus on collaboration and

partnership. This may seem obvious given the substantial work undertaken on collaboration in the literature (Blome *et al.*, 2014; Chen *et al.*, 2017; Oyedijo *et al.*, 2022), but we discovered that the idea of collaboration is not well incorporated between parties. As a result, for sustainability to work, buyers are urged to invest significant efforts in developing collaborative platforms that will develop the right attitudes and behaviours with first- and second-tier suppliers, as this can create space for the diffusion of innovation along the chain, knowledge sharing, and innovative ideas on how best to address sustainability issues (Silvestre *et al.*, 2020). The first and second drivers (multi-tier collaboration and partnership and diffusion of innovation down the chain) are inextricably linked, as the former can help the latter. A stronger collaboration among multi-tier partners, possibly through a closed triad (Mena *et al.*, 2013), in which the buyer and the supplier's supplier have established a formal link and are directly connected to each other, may aid in addressing the "cost of sustainability" issue, which MTSC partners appeared to struggle with, particularly in terms of "who takes responsibility or ownership" for certain things.

Managers are also encouraged to conduct a sophisticated supply chain mapping exercise to better understand the current supply chain environment, simplify the complex relationships in the multi-tier system, and create a macrographic representation of the supply chain's current sustainability status (Mubarik *et al.*, 2021). A supply chain or network view could be used to map out the supply chain from a process perspective, where process visualisation can aid in understanding unique integration challenges between buyers and their multi-tier partners. This can assist buyers and their first- and second-tier suppliers in providing timely information and managing sustainability targets. It can also assist in other areas such as visualising the flow of materials from primary upstream suppliers all the way to the point of consumption, identifying areas for improvement from social (e.g., upstream farmer education and poverty reduction), economic (e.g., payment standards in inter-organisational transactions), and environmental (e.g., environmental impact assessment, reduction of greenhouse gas emissions, and understanding the implications of logistical activities) perspectives. This endeavour necessitates tight coordination or a partnership-like approach from the majority of actors involved.

Our findings suggest that practitioners reassess their compliance standards, particularly the focal firm (buyer), which typically wields more influence over other members of the supply network. Given that food supply chains span multiple markets (both developed and developing economies), and that the level of competition in today's market is increasingly shifting to 'my supply chain versus your supply chain', managers are encouraged to invest in their own unique sustainable supply chain compliance standards in addition to those used by industry. This step will aid in achieving high

performance on all sustainability targets. This, in turn, can help supply chains compete with other supply chains based on their sustainability performance in a market that is already competitive. Such tailored sustainability performance measures can also assist in identifying areas for capacity building and allocating adequate resources to specific aspects.

We have developed a conceptual model that sheds light on the forces that influence the implementation of sustainable MTSC practices. This framework will help in addressing economic, environmental, and social sustainability issues by first identifying the impediments to sustainable practices and then providing practical solutions such as capacity building to help explicate the issues (see Figure 3). In the end, one crucial question that we must address is: What are we expecting to happen differently in multi-tier food supply chains based on the findings of this study? With our findings, we hope that practitioners will take a closer look at the complexities of MTSCs, where activities at one node affect other nodes (e.g., Party A can affect Party B or Party C) or one link can affect another (e.g., Party AB can affect Party BC). As a result of identifying the barriers and drivers in this study, firms embedded in a SC network may be better able to manage their interactions and improve their sustainability practices in areas such as water usage, food waste, fair practices, sustainable production, and so on (Mena et al., 2014; Ghadge et al., 2020).

6.3. Future research directions

Despite our best efforts to provide a comprehensive study encompassing a multi-tier narrative, there are still some opportunities for future research. It is important to emphasise that conducting a multi-tiered study is difficult, owing primarily to access constraints associated with the supply network. Our analysis of the topic was broad in the multi-tier context and failed to capture how the barriers, for example, interacted in the relationship between specific node-to-node or link-to-link relationships based on the complexity of the triad. This viewpoint is also important and contributes to our research by providing a means to better understand MTSC structures and how they influence sustainable practices.

Similarly, while our research revealed intriguing factors related to the barriers (e.g., the cost of sustainability) and drivers (e.g., supply chain mapping), these factors were not linked to any specific dimension of sustainability (i.e., environmental, economic, and social). As a result, we propose that future studies investigate how the specific factors identified in this research influence specific dimensions of sustainability, thereby pointing practitioners to specific links between the variables for investment purposes. One intriguing angle to consider is how sustainable practices (e.g., tackling

specific issues such as food waste) influence reputation at the firm and MTSC levels (Oyedijo *et al.*, 2018). Future research may also consider how disruption affects sustainable practices, particularly responsible and ethical procurement and supply chain management practices, by investigating issues such as supply chain fraud, supply chain opportunism, and unfair behaviour (Oyedijo and Akenroye, 2023b; Oyedijo, 2023).

While providing intriguing insights into multi-tier sustainable food supply chains, this research was conducted using a single case study. This has some limitations, particularly in terms of generalisation. The research is also constrained by context, as what works in the food industry may not necessarily work in another industry. As a result, it would be useful to expand the research on MTSC via quantitative statistical analysis with a larger sample size that is more representative of the target population. Because many studies on MTSC sustainability have used qualitative methodologies such as case studies, quantitative analyses or mixed-methods are required. These methods could aid in establishing if the factors identified in this study indeed limit or promote sustainable practices. One could also argue that several studies have been conducted to investigate the barriers to and facilitators of sustainability in supply chains. However, we argue that, due to the complexity of MTSCs and the growing demand for more sustainable supply chains, this topic remains prominent from a multi-tier perspective and requires additional research. Therefore, we encourage future studies to employ other theories beyond the complexity lens to improve our understanding of MTSC sustainability.

Finally, it is necessary to highlight the limitations of this research in terms of validity, how such limitations can influence the results presented, and what precautions were taken to avoid this limitation. In the interviews, the Tier-1 and Tier-2 suppliers, for example, mentioned how the focal firm had only recently begun to drive sustainability initiatives across the supply chain and beyond the buyer–supplier level. Such an event outside the study, which had just begun prior to the study, could have influenced the attitudes and potential responses of Tier-1 and Tier-2 suppliers to buyer questions about sustainability. To address these threats to validity, we considered validity early in the research process, ensuring the appropriateness of the research method chosen as well as the data collection and analysis process.

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Appendix. Interview protocol (making connections with theoretical concepts and supporting literature)

Interview questions	Background information	Sustainability in multi-tier supply chains	Research question related to the barriers	Research question related to the drivers	Related theoretical concepts	Some authors
1. Can you please describe the nature and structure of the relationship with your multi-tier supply chain partner?	X				<i>Nature and structure of multi-tier supply chain relationships</i>	(Choi <i>et al.</i> , 2001; Choi and Wu, 2009; Mena <i>et al.</i> , 2013; Tachizawa and Wong, 2014; Wiedmer and Griffis, 2021)
2. What is the length of your dealings with them as multi-tier supply chain partners? Please specify each party.	X					
3. What is the nature of the products you sell to or buy from them?	X					
4. What region are you located and where are your multi-tier supply chain partners located?	X					
5. What is the nature of the business environment where you carry out your supply chain activities?	X					
6. Can you please explain the idea of sustainability in the context of your multi-tier supply chain relationship?		X			<i>Multi-tier sustainable supply chain management</i>	(Sauer and Seuring, 2019; Jia <i>et al.</i> , 2019; Sarkis <i>et al.</i> , 2019; Dai <i>et al.</i> , 2021; Govindan <i>et al.</i> , 2021; Gong <i>et al.</i> , 2021; Oyedijo <i>et al.</i> , 2021)

7. How important is the idea of sustainability for your organisation?		X				
8. In your opinion as a buyer/tier-one supplier/tier-two supplier, what are some of the benefits of a sustainable multi-tier supply chain?		X				
9. Can you please describe the barriers influencing the implementation of sustainable supply chain practices in your multi-tier relationship?			X		Barriers to supply chain sustainability	(Fawcett <i>et al.</i> , 2008; Walker <i>et al.</i> , 2008; Govindan <i>et al.</i> , 2014; Rauer and Kaufmann, 2015; Li <i>et al.</i> , 2015; Luthra <i>et al.</i> , 2016; Bhat and Jödu, 2019; Gupta <i>et al.</i> , 2020; Menon and Ravi, 2021; Govindan <i>et al.</i> , 2021; Khan <i>et al.</i> , 2021a)
10. In what ways do these identified barriers impact your multi-tier supply chain relationship?			X			
12. What have you been doing to address these problems in the multi-tier supply chain?			X			
13. Can you please describe the drivers that can promote multi-tier sustainable supply chain practices?				X	Drivers to supply chain sustainability	(Walker <i>et al.</i> , 2008; Walker and Jones, 2012; Grimm <i>et al.</i> , 2014; Foerstl <i>et al.</i> , 2015; Li <i>et al.</i> , 2015; Dou <i>et al.</i> , 2018; Gupta <i>et al.</i> , 2020; Venkatesh <i>et al.</i> , 2020; Kannan, 2021; Khan <i>et al.</i> , 2021a)

14. How can these drivers be implemented in the multi-tier supply chain and effectively communicated?				X		
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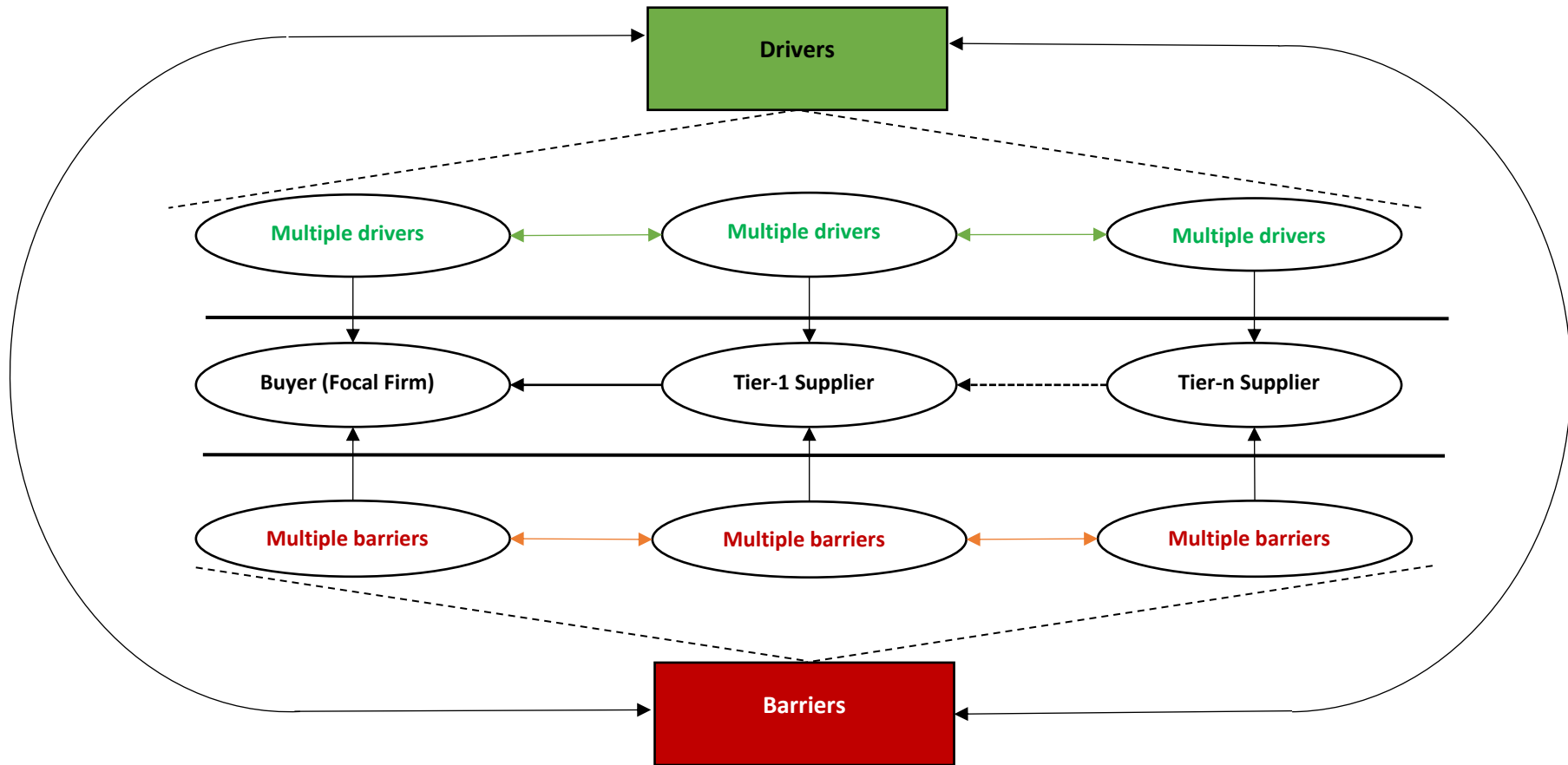
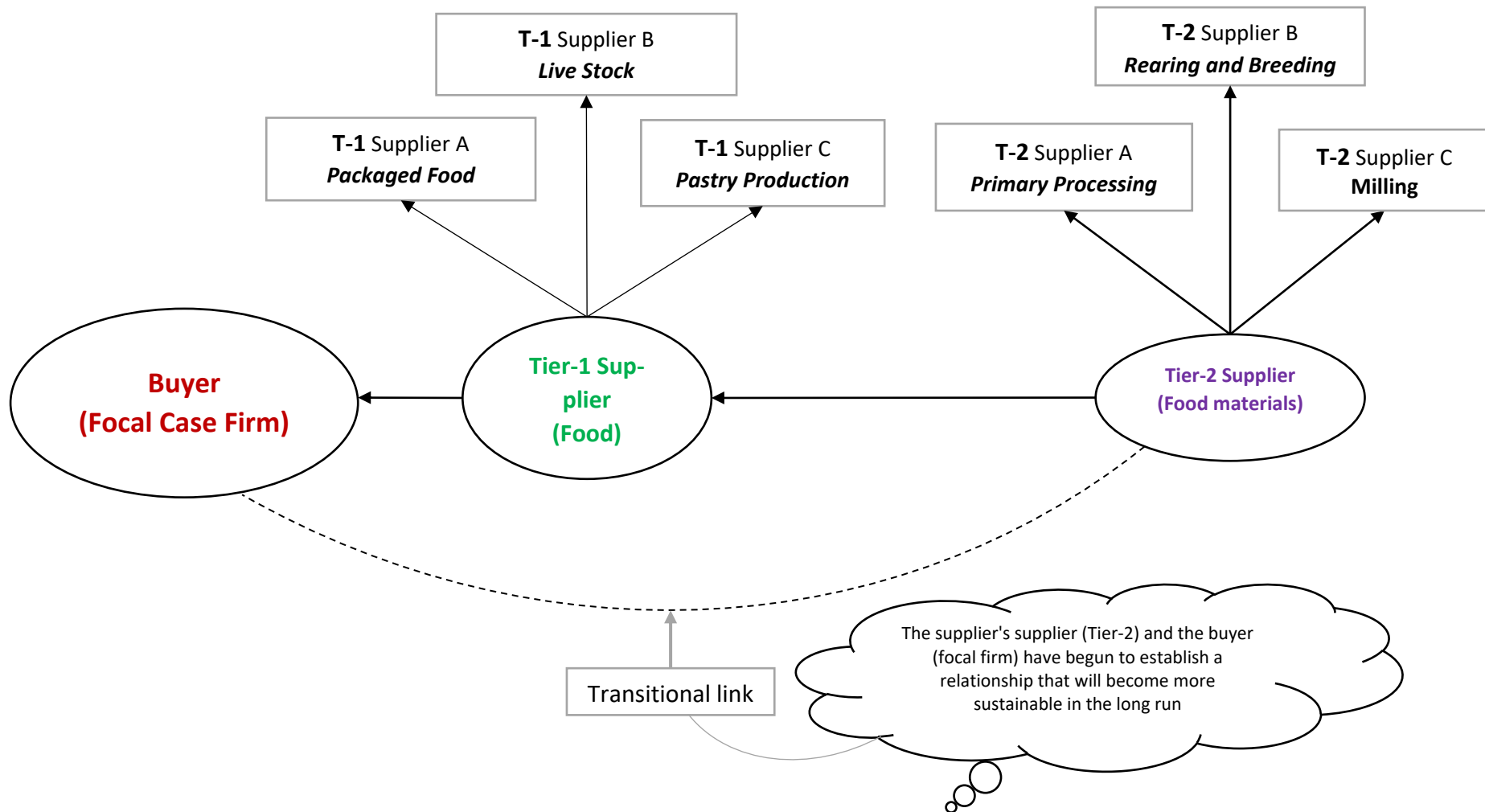


Figure 1 A conceptual model illustrating the actors, processes, and interactions within the multi-tier supply chain, and how drivers and barriers may affect the system.

Figure 2 Case firm's multi-tier supply chain structure



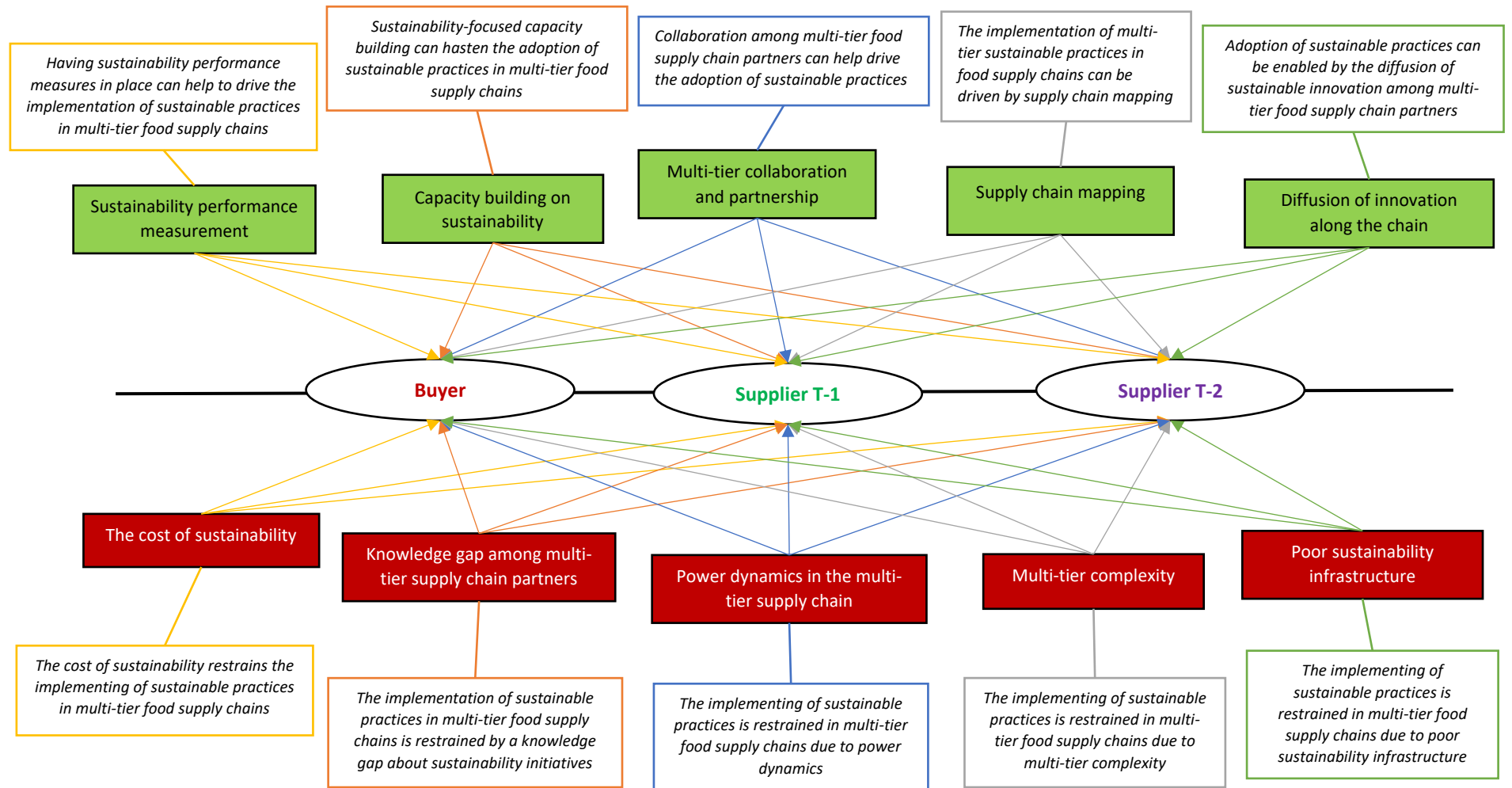


Figure 3 Barrier and drivers influencing the implementation of multi-tier sustainable supply chain practices under the complexity lens

Table 1. Barriers and drivers to sustainable supply chain management practices that have already been mentioned in the literature

Barriers	Description	Classification	Some supporting literature
Lack of top management commitment	Commitment should begin at the highest level of management, and top management support of leadership in, as well as commitment to sustainability, are critical ingredients for the success of SSCM. This could also indicate top management's unwillingness to change existing systems.	Policy	(Zhu et al., 2007; Sajjad et al., 2015; Delmonico et al., 2018; Kitsis and Chen, 2021)
Economic and financial constraints	Finance is important in meeting SSCM targets, and financial constraints can prevent investments needed to develop sustainability programmes.	Policy	(Walker et al., 2008; Govindan et al., 2014; Narayanan et al., 2019)
Organisation's sustainability culture	The importance and emphasis that an organization's culture and values place on sustainability initiatives.	Human resources	(Pagell and Wu, 2009; Marshall et al., 2015; Paulraj et al., 2017; Delmonico et al., 2018; Sajjad et al., 2020)
Technology to support sustainability	Technology to support processes related to material production and waste reduction procedures, as well as other approaches to increase efficiency and reduce pollution levels.	Technology	(Govindan et al., 2014; Narayanan et al., 2019; Gupta et al., 2020)
Regulatory and institutional barriers	Inadequate institutional framework, lack of incentives, and failure from regulatory bodies to create necessary pressure on organisations to implement sustainable initiatives.	Policy	(Li et al., 2015; Delmonico et al., 2018; Moktadir et al., 2018; Kazancoglu et al., 2021)
Research and development related to sustainability	Lack of awareness about environmental, social, and economic sustainable practices and methods to improve sustainability.	Innovation	(Walker et al., 2008; Gupta et al., 2020; Menon and Ravi, 2021)
Lack of performance evaluation metrics for sustainability standards	Sustainability standards are difficult to quantify and measure. The methods used to verify sustainability performance are not uniform.	Performance measurement	(Hervani et al., 2005; Bai et al., 2012; Beske-Janssen et al., 2015; Pachar et al., 2022)
Lack of green purchasing behaviour	Placing emphasis on procurement, purchasing, and sourcing activities. Organisations must focus on engaging in activities and gathering resources that generate, reproduce, and achieve sustainability.	Policy	(Delmonico et al., 2018; Menon and Ravi, 2021; Yang et al., 2021)
Cultural differences and geographical distance	Differences in culture and language make SSCM more difficult and necessitate more effort to reach a common understanding. These disparities may also be due to geographical distance, which may impede the implementation of auditing programmes, the establishment of sub-supplier practises, and the adoption of sustainability standards.	Culture	(Ciliberti et al., 2008; Awaysheh and Klassen, 2010; Tachizawa and Wong, 2014; Wilhelm et al., 2016)

Drivers	Description	Classification	Some supporting literature
Strategic supplier collaboration	Collaboration helps local and lower-tier supply chain suppliers commercialise and gain access to innovative technologies, which can aid in the adoption of sustainable initiatives.	Collaboration	(Attaran and Attaran, 2007; Vachon and Klassen, 2008; Dubey et al., 2017)
Green warehousing	The importance of recycling facilities in warehouses, the use of standard reusable containers as a solution to reduce costs and waste, and a proper warehouse management system for sustainability performance.	Technology and innovation	(Wu and Dunn, 1995; Srivastava, 2007; Ageron et al., 2012; Dubey et al., 2017)
Pressure from NGOs	External pressures from various stakeholder groups can drive organisational sustainability implementation. This is especially important in an era when dedicated sustainability pressure groups serve as watchdogs for the development of sustainable goals.	External forces	(Seuring and Müller, 2008; Tate et al., 2010; Ageron et al., 2012; Foerstl et al., 2015; Kumar et al., 2020; Kannan, 2021)
Competitor pressure	Competitors are an external stakeholder group with the ability to indirectly influence what a company does by influencing the institutional environment in which they operate through public opinion on legitimate sustainability practises. Companies that are proactive about sustainability may pay more attention to competitive pressures when developing their response to sustainability concerns.	External forces	(Zhu et al., 2005; Vasileiou and Morris, 2006; Zhu et al., 2007; Sarkis et al., 2011; Foerstl et al., 2015; Zeng et al., 2017; Graham, 2020; Kumar et al., 2020; Dai et al., 2021)
Sustainability capabilities	Firms' adoption of SSCM practises is influenced by their sustainability capabilities, which include top management leadership for corporate social responsibility and technical capability related to the environment.	Capabilities	(Pagell and Wu, 2009; Beske et al., 2014; Kähkönen et al., 2018; Dai et al., 2021)
Learning associated to sustainability	A continuous process that companies go through as they develop their sustainability initiatives. The learning associated with sustainability initiatives is critical for the successful implementation of supply chain sustainability. This can occur at the individual, organisational, and supply chain levels.	Supply chain sustainability learning	(Gong et al., 2018; Pereira et al., 2021; Sarkis, 2021)
Sustainability innovation	Organisations seeking to achieve sustainable supply chains must innovate in order to respond to negative impacts, particularly from a socio-environmental standpoint. Sustainable innovation can be defined as changes to products or manufacturing processes that aim to reduce socio-environmental impact while increasing the triple bottom line.	Innovation	(Costantini et al., 2017; Silva et al., 2019; Kusi-Sarpong et al., 2019; Gupta et al., 2020)

Table 2. Case and interview details

Company	Position of interviewee	Length of interview (minutes)	Category
Buyer (Focal Case Firm)	Group Procurement Director	70	Food Retail
Buyer (Focal Case Firm)	Procurement Manager (In-country A)	60	
Buyer (Focal Case Firm)	Procurement Manager (In-country B)	55	
Buyer (Focal Case Firm)	Procurement Manager (In-country C)	60	
Tier-1 Supplier A	Distribution Manager	60	Packaged Food
Tier-1 Supplier B	Supply Manager	55	Live Stock
Tier-1 Supplier C	Supply Chain Manager	60	Pastry Production
Tier-2 Supplier A	Supply Officer	55	Primary Food Processing
Tier-2 Supplier B	Supply Coordinator	60	Rearing and Breeding
Tier-2 Supplier C	Supply Chain Manager	45	Milling

Table 3. Methods used for data collection

	Interview with each member of the multi-tier supply chain	Virtual site visits	Documents
Buyer (Focal Case Firm)	4	3	Contracts and terms of trade; Sustainability policies; Modern slavery statement; Supplier selection framework; Supplier relationship management tool kit
Tier-1 Supplier A, B, C	3	3	Contracts and terms of trade; Sustainability policies; Standard terms and conditions; Quality assurance documents; Supply risk criteria
Tier-2 Supplier A, B, C	3	3	Contracts and terms of trade; Sustainability policies; Standard terms and conditions; Quality assurance documents; Supply risk criteria

Table 4. Categories of exemplary quotes linked to the restraining and driving forces of multi-tier sustainable practices in the global food supply chain

Restraining forces	Buyer (Focal case firm)	Tier-1 Supplier	Tier-2 Supplier
The cost of sustainability	“This is a costly initiative because we must invest in new ways of working. Though we have begun this process, we are realising that we have been putting more money into it on a regular basis, and now we need our suppliers to do the same. The challenge is that it must be a collaborative investment by all parties”	“You are probably going to incur more costs in the early days if you upgrade from standard material to recyclable material, so either you accept a drop in profitability, or you raise your prices to consumers and convince them to pay for it”	“When you have that conversation with buyers, their sole objective is to get the best and cheapest price ”
Knowledge gap among multi-tier supply chain partners	“There is a growing social desire for people to become vegetarians or, at the very least, to try a plant-based product. As a result, our challenge is to be an organisation that meets those needs, especially since eating a plant-based diet is good for the environment. Finding the right product to meet our needs, on the other hand, is difficult because it necessitates a significant amount of research, development, and investment , which is frequently lacking”	“Though there has recently been a lot of desire to drive sustainability, the truth is that it would be much better if there is a clear understanding of how we will go about it , and I believe it is even more important to address the sustainability issues together rather than the ‘I do mine and you do yours’ style”	“We also face technical challenges here, because we are trying to break new ground, and as a smaller firm, we cannot keep up with the latest technological advancements”
	“Though we have begun to do a lot of work in the area of sustainability, I believe that we should invest in research and development to help solve the problem of the best ways to approach sustainability as a buyer, as well as involving suppliers in the process. Although this is a difficult task that often discourages the drive to implement sustainable practices, we must work on it”		
Power dynamics in the multi-tier supply chain	“We should be able to do more to support sustainability measures by demonstrating our negotiating power . For example, we are conducting an audit of our first and second-tier suppliers to see where we might invest in tools and technology to help us do what we do”	“When you observe the complicated nature of the food supply chain that we are a part of, you realise that we do not have much power to affect things and must rely on our main buyer, which can limit our ability to implement sustainability standards, especially from the food angle”	“It is difficult to persuade them due to their size . Our company is only a fraction of a tenth or a fifth of their supplier account. As a result, it is difficult to influence them and ensure that they are acting in a sustainable manner”

	<p>“Because we are still in the early stages of development, sustainability in this region is very low. For example, when purchasing chickens, raising chickens sustainably involves reducing or removing soy from feed or using corn grown locally, so I have no ability to change the feed with my purchasing power”</p> <p>“I honestly believe that one of the largest problems we face is influencing our suppliers (primary producers) on water usage and waste, but because we are still at the introduction phase in this region and we do not have much power over them”</p>		
Poor sustainability infrastructure	<p>“Our country's recycling system is weak. While waste is separated into distinct categories at home and at restaurants, it is all mixed up again when the municipality selects the bin for disposal. As a result, in this country, the ability to fully recycle and convert them into something new through circular economy infrastructure is relatively limited”</p> <p>“Sustainable infrastructure can be assessed from a variety of perspectives, including what we do as an industry leader and what our suppliers and their suppliers do to address social, environmental, and economic concerns. However, we frequently overlook the critical role of government and policymakers in providing a holistic development approach. This is still lacking or in the works in some of the regions where we operate”</p>	<p>“As a major supplier in our category, we really need to start working with our buyer and our upstream partners toward building sustainable infrastructure that focuses on specific issues affecting all of us especially from the environmental side with the need for green energy sources and water management in our production. We have not started this but I think it is affecting us”</p> <p>“We are significantly large in rearing livestock such as cows, goat, sheep, and cattle. Recently, there has been a high demand for these livestock, which has significant implications for the amount of forest land cleared to accommodate the cattle. This is going to impact the environment negatively in the long run due to the release of emissions such as methane by our cattle. However, we lack the necessary systems to address this”</p> <p>“The lack of a collaborative mechanism that allows us to handle</p>	<p>“We sometimes find it difficult to catch up due to low investment in sustainable breeding and rearing infrastructure systems that will adhere to sustainable livestock production standards and eliminate problems like water pollution because of the perception we have of the huge financial expenditure that is necessary”</p>

		<p>sustainability concerns jointly is a major issue we face. We frequently deal with challenges in isolation, with no dedicated infrastructure for all parties. We've told our buyer multiple times that we require a financial support infrastructure and that we'll need to collaborate with our supplier on this"</p>	
Multi-tier complexity	<p>"Looking at health and nutrition from a social standpoint, potential challenges include cost and shelf life, which means you may have to write off more stock. If you reduce shelf life by reformulating a product, such as removing salts, this adds complexity to the supply chain - you need different suppliers, more frequent production, and possibly higher costs, all of which have an indirect impact on the supply chain"</p>	<p>"We have always struggled to establish a strong relationship that goes beyond the one with our immediate buyers and suppliers, and until recently, the larger buyer never made this a priority. This may be related to the complexity of food supply chains in general"</p>	<p>"Our immediate buyer recently notified us that their own buyer had recently complained about their inability to oversee sustainability in relation to our milling practices. However, how could such complaints be made when they never had an idea who we were until very recently, and how could they manage sustainability if there had never been a strong connection with them?"</p>
	<p>"Our supply chain is complicated since it ranges from having several tiers of suppliers. Using our soy supply as an example, soy originates from co-ops and individual farmers, as well as crushers, cultural mills, and personal traders. As a result, the tracing of all that soy back to its source might be rather complicated, limiting our capacity to quickly apply sustainable solutions"</p>		
Driving forces	Buyer (Focal case firm)	Tier-1 Supplier	Tier-2 Supplier
Multi-tier collaboration and partnership	<p>"To be able to put ourselves in a stronger position moving forward, we will need to think critically about our collaborative approach with our first and second tier suppliers, as well as possibly having shared R&D"</p>	<p>"Considering the complex nature of food supply, collaboration will always be an effective approach. We need more open collaboration in which we are willing to share knowledge about this major issue with one another rather than working on it individually. I also believe that our buyer should push</p>	<p>"Prices in major categories have recently risen significantly, and we must reflect this in our quotes. So we need to collaborate not only with our direct buyer, but also with the focal firm, so that they can gain a better understanding of our issues, particularly with quotes, which we believe they don't always regard fairly"</p>

		for this collaborative approach and involve us more”	
	“If we want to see suppliers transition to things like regenerative agriculture, I believe we will need to think about longer-term partnerships with suppliers , longer contracts, and more investment”		
Diffusion of sustainable innovation along the chain	“There are numerous approaches to some of the issues we face as a sustainable business and supply chain, but we have been in discussions with our first-tier supplier about the dissemination of specific types of solutions , particularly related to the packaging of certain product categories due to recycling issues”	“To be honest, it often feels like we’re competing against one another, particularly in the last two years owing to the various disruptions we’ve all experienced. We must be able to trust one another and exchange information on some of these difficulties , which appear to be beyond the scope of any single individual or firm”	“Our proximity to the focal firm may hamper value creation , as it often feels as if we’re left out of decisions, only to be told by our direct buyer”
	“Considering this at a multi-tiered or network level would be a long-term solution, focusing on sustainable innovation that meets all needs because sustainable innovation can be both economically and environmentally beneficial, yet have negative social consequences”	“We frequently discuss the best available options for sustainability with our focal firm , and aside from budgetary restrictions, we frequently seek out sustainable solutions in a variety of areas, including how we source materials from upstream suppliers”	
Supply chain mapping	“For a more complete picture, we must invest more time, effort and resources into understanding the upstream part of our supply chain beyond the three main tiers we focus on right now”	“ Mapping out the supply chain is very important toward getting a comprehensive understanding of problems and our buyer relies on us to supply them vital information, thus it requires a collaborative approach”	“A thorough awareness of our supply chain is necessary for our food processing business, which goes beyond the typical one-layer concentration and certainly necessitates capturing all additional upstream actors and our buyers in mid and downstream”
	“The supply base will need to be reduced so that we can focus on suppliers who have committed to meeting our sustainability standards. We need to conduct a proper mapping exercise and our first-tier suppliers can be of assistance in this process”	“What happens after our buyer receives the commodities based on the purchase orders? Remember that it still moves on to the next point in the chain, especially for items going	

		to retailers and consumers. As a result, the entire picture must be considered from a long-term perspective if we are to be sustainable	
Sustainability performance measurement	<i>“Aside from mapping, we must implement measures to sustain sustainability initiatives with our first and second tier suppliers and beyond”</i>	<i>“I believe that as suppliers, measuring sustainability performance can help us perform better in accordance with triple bottom line standards and identify opportunities and threats affecting the whole supply chain”</i>	<i>“As well as establishing performance standards for sustainable practices, it is also crucial to follow them through to ensure that there is a continuous improvement in the way we process our food, rather than taking a one-time approach and expecting sudden changes”</i>
Capacity building on sustainability	<i>“We have previously invested in internal training and development, which has resulted in a high level of awareness about sustainability standards in the industry currently. I am actively working with external providers to determine how we can push this with our suppliers in order to create a shared understanding of what we should all be working towards”</i>	<i>“Given our position in the chain and how much we push down the chain, I believe we would benefit from regular training rather than having the buyer make all of the demands”</i>	<i>“I strongly believe in continuous development, and because the FMCG sector moves at such a rapid pace, we require regular knowledge updates on sustainability requirements so that we adhere to them, as do our suppliers”</i>