From the few to the many: Scaling up sustainability-oriented supplier development projects

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Abstract

Purpose: To understand how sustainability-oriented supplier development (SSD) can be translated from a small-scale pilot project into a large-scale implementation across the supply base.

Design/methodology/approach: The research studies an exploratory single case of a social SSD project on occupational health and safety (OHS) management. The pilot involved four suppliers, expanding to 100 suppliers (and up to 400 factories) in the scale-up phase. The research applies actor-network theory (ANT), focusing on translation (problematisation, interessement, enrolment), and integrates three medical science scale-up frameworks: the mechanistic, complexity-informed, and social science-driven approaches.

Findings: Scaling up SSD project implementation requires a process view and a systemic approach that integrates elements of all three scale-up frameworks. Meanwhile, both the pilot and scale-up stages go through a translation process of (re-)problematisation, (re-)interessement, and (re-)enrolment, whereby roles, responsibilities, and implementation actions are refined. A strong and sufficient interessement strategy is essential for aligning and engaging key actors throughout the project. To ensure long-term commitment and sustainability, inscription and irreversibility mechanisms must also be established.

Research implications: The research furthers our understanding of how sustainability practices can be cascaded to the supply base. By investigating a two-stage SSD project, the research substantiates the translation process that is central to ANT, demonstrating how it can recursively occur across stages. Meanwhile, the research highlights the need for a comprehensive approach that integrates both direct and indirect SSD practices.

Practical implications: Focal firms in supply chains should follow a processual and systemic approach to cascading sustainability practices whilst carefully selecting the most appropriate intermediary partner for delivering an SSD initiative. Moreover, a tailored strategy for engaging workers at different organisational levels of factories is needed.

Originality/value: The research contributes to the ANT literature by providing empirical evidence on how different groups of actors interact with and collectively affect project implementation. Moreover, the research sheds new light on the scale-up process for SSD projects that seek to engage with and impact the entire supply base, introducing scale-up frameworks that support a more process-oriented and systemic approach.

Keywords: Sustainability-oriented supplier development, actor-network theory, scale-up frameworks

Paper type: Research paper

1. Introduction

Focal firms in supply chains are under increasing pressure to ensure their supply base operates sustainably (Marttinen and Kähkönen, 2022). This has contributed to the implementation of sustainability-oriented supplier development (SSD) projects that disseminate sustainability knowledge and improve the sustainability performance of supply chain partners (Sancha et al., 2015; Silvestre et al., 2020). This, however, is a considerable task in complex, globally dispersed supply chains comprised of multiple tiers, where each tier can contain hundreds of suppliers (Choi and Hong, 2002; Choi and Krause, 2005). Although some focal firms have made strides towards cascading sustainability requirements via SSD project to the supply base, this is far from being institutionalised, which hinders the potential to generate long-term, sustained impacts on suppliers (Wilhelm and Villena, 2021).

Extant research has identified a range of practices that develop the social sustainability of suppliers such as training, site visits, and certification-based schemes, and the challenges associated with their implementation (Jia et al., 2021; Busse et al., 2016). Most SSD initiatives target only a few suppliers, limiting their impact on the broader supply base. For example, Jia et al. (2022) studied an SSD project implemented by a fast fashion brand with just four key suppliers. Given focal firms' resource constraints and the need to maintain SSD quality and consistency, it is unclear how such a projects can scale from a few to many suppliers. As a result, how to go about scaling up SSD to encapsulate a large number of suppliers remains a significant challenge (Marttinen and Kähkönen, 2022).

SSD projects often involve collaborating with intermediaries, including (i) consultants with sustainability expertise and project management skills, and (ii) sourcing agents who connect focal firms with upstream suppliers (Powell and Coughlan, 2020; Soundararajan et al. 2018). Sourcing agents can help facilitate trade deal negotiations and adapt social sustainability standards to local contexts in emerging economies (Soundararajan et al., 2018). Intermediaries also develop tools such as mobile phone apps and design interventions at supplier sites to enhance the implementation and scalability of sustainability initiatives in global supply chains (Wilhelm et al., 2024). However, these tools alone do not guarantee acceptance or scalability, and research has not examined intermediaries's role when an SSD project is scaled to the entire supply base.

There is a need to adopt a more systemic approach to research on SSD initiatives in global supply chains to capture the full dynamics of sustainability initiatives, engage multiple actor groups, and position the focal firm as a facilitator rather than the sole focal point (Soundararajan et al., 2025). Towards this end, this research employs actor network theory (ANT) to examine

the complex interplay between multiple actors and tools that collectively shape SSD project outcomes. ANT emphasises how both human actors (e.g. suppliers and consultants) and non-human actors (e.g. infrastructure and toolkits) collectively influence network configurations and outcomes by unpacking the differences, interactions, and interconnectedness (Hald and Spring, 2023).

Research has also called for an evolutionary perspective where sustainability initiatives are adapted to meet local supplier needs and facilitate genuine change (Soundararajan et al., 2025). Relational factors, such as social capital between various actor groups, also need to be considered as cascading sustainability across supply chains faces multi-faceted barriers (Jia et al., 2021). Prior literature has identified three approaches for scaling improvement interventions: *mechanistic* (structured and programmatic), *complexity-informed* (flexible and adaptive), and *social science-driven* (emphasizing relational factors when replicating interventions across settings) (Greenhalgh and Papoutsi, 2019; Papoutsi et al., 2024). Yet, there is a relative lack of fine-grained analyses of how sustainability improvement interventions like SSD projects can be designed for different actor groups to improve overall global supply chain sustainability performance (Wilhelm et al., 2024), .

Against this backdrop, this research explores the scale-up process of an SSD project by combining ANT with the aforementioned scale-up frameworks, an approach recommended by Greenhalgh and Papoutsi (2019) for understanding improvement interventions. The scale-up frameworks identify what needs scaling and how to replicate the crucial aspect of SSD efforts large-scale, while ANT reveals how interactions between actor groups shape the scale-up process. Overall, this research addresses the following research question:

RQ: *How do actor-network dynamics influence the scaling of SSD projects to cascade sustainability across supply chains?*

To address the research question, we studied the single case of a two-phased SSD project focused on occupational health and safety (OHS) that was deployed by a fast fashion brand. OHS issues continue to pose a significant reputational risk, especially in apparel supply chains (Soundararajan et al., 2018), making this an important focus for investigation. The pilot stage involved four suppliers before this was extended to its key supply base of 100 suppliers (and up to 400 factories). The research contributes to ANT by providing empirical evidence on the interactions between diverse actor groups and their collective influence during multiple rounds of translation that take place in SSD projects. Meanwhile, it advances understanding of how to cascade sustainability practices across supply chains by highlighting the need to adopt a more

systemic and process-oriented approach. Overall, the research provides insights into the scale-up process for SSD projects that aim to engage the entire supply base and generate long-lasting impact.

2. Theoretical Background

2.1 (Sustainability-oriented) supplier development (SSD)

Over the past two decades, supply chain research has shifted from managing flows to an emphasis on building capabilities (Powell and Coughlan, 2020). Supplier development (SD), an approach to building supplier capabilities to enhance supply chain performance, has received significant attention. For example, Modi and Mabert's (2007) seminal study examined how SD activities, such as site visits and training sessions, contribute to maintaining capable and high-performing supply bases. SD activities can be categorised as indirect or direct. Indirect SD includes supplier audits and performance-based incentives, while direct SD involves more hands-on support and the transfer of practical know-how through training, on-site assistance, and financial investment (Modi and Mabert, 2007). Extensive research has subsequently been conducted into how various SD activities can benefit the operational performance of both the supply base and the focal firm (e.g., Noshad and Awasthi, 2015).

Sustainability-oriented supplier development (SSD), as an extension of SD, provides a platform for transferring sustainability knowledge to the supply base via collaborative knowledge and experience sharing (Rodríguez et al., 2016; Silvestre et al., 2020; Jia et al., 2022). While traditional SD projects prioritise operational efficiency, such as quality improvement or on-time delivery (e.g. Modi and Mabert, 2007; Noshad and Awasthi, 2015), SSD emphasises ethical and environmental performance. As a result, SSD faces additional challenges including misaligned understandings of 'sustainability' and divergent stakeholder priorities (Busse et al., 2016).

Moreover, SSD projects do not always deliver the anticipated benefits as outcomes are influenced by multiple factors and constraints. Sancha et al. (2015) showed that SSD activities are more likely to pay off when suppliers internalise sustainability knowledge and practices. Moreover, Marttinen and Kähkönen (2022) concluded that the ability to cascade sustainability is affected by the strength of inter-firm relationships between the focal firm and the different tiers of the supply chain. This raises questions about how and under what conditions the benefits of SSD can be realised and calls for research unpacking the dynamics of SSD processes.

2.2 Challenges in scaling up SSD projects

Most SSD projects involve only a limited number of suppliers (e.g., Marttinen and Kähkönen, 2022). Jia et al. (2022) investigated an apparel brand's SSD project with just four key suppliers, while the majority of the brands' suppliers remained managed through standard audit compliance processes with minimal indirect SSD and no direct SSD involvement. It may therefore not be surprising that research has found that sustainability integration is typically well-established only among a few first-tier suppliers (Wilhelm and Villena 2021; Jia et al., 2021). This highlights the insufficient coverage and institutionalisation of SSD efforts across the supply base. Since supply chain sustainability requires all suppliers' involvement and engagement (Villena and Gioia, 2020), it is necessary to unpack how SSD projects can be fully institutionalised at supplier firms for long-lasting impact and scaled up to cover the entire supply base.

Institutionalising sustainability requirements across the entire supply base via SSD projects faces at least two challenges. The first challenge is to develop a unified approach with replicable practices and tools while maintaining sufficient flexibility for supplier-specific customization (Norlyk Jørgensen et al., 2023). Universally applicable and scalable practices, such as standards supplier audits, expect strict adherence to a narrowly defined set of issues. These practices, however, overlook the complexities associated with various contexts and actor groups involved in sustainability improvements (Soudararajan et al., 2025). Implementing tailored practices, such as on-site consultations on an *ad-hoc* basis, however, is resource-intensive for the focal firm, even with just a small number of suppliers (Jia et al., 2021). One way to overcome these resource constraints is to collaborate with intermediaries, such as sourcing agencies and consultants, who can localise SSD projects using their contextual expertise to facilitate scalability and legitimacy (Rodríguez et al., 2016; Soundararajan et al., 2018). Sourcing agencies can play an important role in achieving the sustainability-related goals set by focal firms in the factories they manage directly (Soundararajan et al., 2018). Additionally, research has highlighted how suppliers work as intermediaries to cascade small-scale SSD projects across focal firm-supplier-factory boundaries (Jia et al., 2021). However, these research separately examined the roles of human actors as boundary spanners and non-human actors, thereby ignoring their interactions and their possible joint impact on cascading sustainability across the wider supply base.

The second challenge is to implement an effective roll-out process. For example, SD projects aimed at continuous improvement through the adoption of a lean culture typically unfold through multiple iterative cycles, even with a limited number of suppliers, where each

stage requires engagement and support (Powell and Coughlan, 2020). While Distelhorst et al. (2017) examined a large-scale lean supplier development project across Nike's supply chain; they focused primarily on audit performance outcomes rather than the supplier development process itself. Moreover, SSD projects aim to empower suppliers by helping them develop capabilities to manage sustainability challenges autonomously through knowledge dissemination and a learning-by-doing culture (Jia et al., 2022). Such projects often involve new practices, tools, and actor groups and emphasise experimentation and adaptation (Soundararajan et al., 2025). Therefore, a pilot stage that can provide structured space for experimentation, feedback and iterative refinement is critical before large-scale implementation (Liu et al., 2023). However, current research on SSD lacks a systemic perspective that unpacks the different stages of the SSD process, the interdependencies, and how each stage contributes to large-scale changes in the supply base. Scholars have therefore advocated for processual approaches to explore mechanisms and dynamics for achieving sustainability (Grimm et al., 2024). A process-view could illiuminate how SSD projects unfold at scale.

2.3 Scale-up frameworks for improvement interventions

Both supply chain management practice and research on the scaling of innovative sustainability initiatives, including SSD, remain at a nascent stage of development (Pagell and Wilhelm, 2025). For this reason, we turn to literature from medical science that has examined various types of improvement interventions from a processual perspective (Barker et al., 2016; Greenhalgh and Papoutsi, 2019; Papoutsi et al., 2024). Many successful improvement-oriented scale-up projects were found to have drawn predominantly on one of three approaches whilst including elements of the other two, i.e., the *mechanistic*, *complexity-informed*, and/or the *social science-driven* approach (Greenhalgh and Papoutsi, 2019). The *mechanistic* approach focuses on evidence-based and uncertainty reduction mechanisms, suggesting the use of structured and programmatic approaches to replicate interventions; the *complexity-informed* approach focuses on the evolving and emerging nature of the scale-up process, suggesting the use of multiple methods to flexibly and adaptively scale-up interventions; and the *social science-driven* approach focuses on the study of individuals, groups and organisations, suggesting the use of an approach that captures the impact of relational factors on actors' behaviours and actions (Greenhalgh and Papoutsi, 2019; Papoutsi et al., 2024).

Applying this framework on prior sustainable supply chain management research, reveals a strong focus on *mechanistic* approaches, i.e., compliance-oriented interventions based on

standards and audits, as well as audit-preparation trainings (Wilhelm and Villena, 2021). However, in order to cascade sustainability across the supply base, a *complexity-informed* approach is needed to build an adaptive infrastructure that enhances knowledge management capabilities (Zacharia et al., 2011) and reflects the complexity of the scale-up process (Grimm et al., 2024). Meanwhile, relational factors, such as social capital between actors within a supply chain, influence how sustainability practices are disseminated across multi-tier suppliers (Jia et al., 2021), suggesting the need for a *social science-driven* perspective. Therefore, it is necessary to investigate how the three approaches could be used jointly to support the effective scale-up of SSD projects.

Moreover, the literature has highlighted the importance of collaboration between supply chain actors for maximising the benefits of SD efforts (Powell and Coughlan, 2020). Sustainability initiatives require the active engagement of diverse groups of actors to achieve genuine improvements (Soundararajan et al., 2025). Therefore, the next subsection explores actor-network theory (ANT) as a lens to understand how different actor groups interact to shape the process and outcome of SSD projects aimed at large-scale implementation.

2.4 Actor-network theory

Actor-network theory (ANT) highlights the dynamic and evolving nature of networks between human and non-human entities and the relationships within them (Latour, 1987; Hald and Spring, 2023; Li et al., 2024). There are three main ontological assumptions of ANT, i.e., heterogeneity, relationality, and performativity (Hald and Spring, 2023). *Heterogeneity* assumes both human and non-human actors can be influential and can exert agency in various contexts; *relationality* emphasises the relationships between actors within a network; and *performativity* highlights the dynamic nature of actors and their relationships within a particular network. The ontological assumptions of ANT reflect an adaptive and dynamic view, making ANT an appropriate lens for examining supply chain phenomena (Hald and Spring, 2023).

Based on its three ontological assumptions, the central component of operationalising ANT is the 'translation process' – aligning diverse actors' interests with the focal actor's interests (Sarker et al., 2006; Li et al., 2024). This process connects previously unrelated actors (establishing networks) and aligns their interests (configuring networks) (Sarker et al., 2006; Hald and Spring, 2023; Li et al., 2024). The translation process consists of three sequential stages: (i) *problematisation*: identifying the actors to involve, defining the boundary of the network, and clarifying the goal of the project; (ii) *interessement*: assigning each actor specific roles and responsibilities within the network; and, (iii) *enrolment*: operationalising the defined

roles and responsibilities from interessement and ensuring actors maintain interests aligned with the overarching goal (Callon, 1984; Sarker et al., 2006; Li et al., 2024). As part of the enrolment stage, *inscription* usually takes place to codify and stabilise interests and practices (Sarker et al., 2006). Moreover, a stable network usually displays the feature of *irreversibility,* i.e., the degree to which the network's trajectory cannot revert to previous states or alternative paths (Sarker et al., 2006).

ANT has widely been used in research on supply chain digitalisation (e.g., Sarker et al., 2006), supply network establishment (e.g., Li et al., 2024), and sustainability transition processes (Marcon Nora et al., 2022). Similarly, SSD projects often involve multiple actor groups, including the focal firm, suppliers, factories, and external knowledge providers, making interest aligning both complex and crucial (Jia et al., 2022). With its focus on the translation process between actors, including non-human actors such as development tools, ANT provides a useful framework for studying SSD as it explains how relationships are formed, negotiated, and sustained (Sarker et al., 2006). Moreover, as ANT highlights the continuous adaptation and configuration of supply chains (Hald and Spring, 2023), it supports a processual perspective on sustainability improvements.

In conclusion, given the challenges associated with institutionalising large-scale SSD projects and the need to take a dynamic and processual perspective, this research aims to explore the challenge of SSD projects by drawing on both ANT and the three identified approaches to scale-up.

3. Research Method

To address our research question, we undertook an in-depth single-case study of an SSD project. To capture the dynamic and evolving features of the project's scale-up, we collected data at three different points of the project over a four-year period, including the pilot stage, the reflection stage and the scale-up stage. This enabled us to unpack how scale-up and its underlying processes change over time, following a developmental course of interest (Yin, 2018). A single case study with data collected across multiple time points enables the researcher to capture rich details of the dynamics, unpacking the complexities involved and identifying the evolving nature of sustainability capability development (Carter and Rogers, 2008; Grimm et al., 2024).

3.1 Research context and case selection

When designing case study research, it is important to choose a case that enables representativeness and exhibits useful variation on theoretically relevant dimensions (Seawright and Gerring, 2008; Barratt et al., 2011). We followed a multi-step sampling process to select our single case with embedded units of analysis. As the scale-up of SSD projects is a novel phenomenon, we intended to select a case that is representative case that would allow us to explore how such initiatives evolve across multiple stages (Barratt et al., 2011). We applied the following three criteria. First, we focused on an industry – textile and apparel – where substantial SSD efforts have been undertaken (Soundararajan et al., 2018; Jia et al., 2022) and chose a case that reflects common features of an SSD project. This includes the involvement of multiple geographically dispersed suppliers and various internal and external actor groups, including the internal sustainability department and external knowledge providers (e.g. Jia et al., 2021). Second, we identified an SSD project that follows a multi-stage design and could grant us sustained access to their processes and documents. More specifically, our case follows a two-phase SSD project design: a pilot stage involving four suppliers, followed by a scale-up stage involving the top 100 suppliers from the supply base in China. The two embedded units of the chosen case, i.e., the pilot phase and the scale-up phase, are expected to exhibit differences that further our understanding of the dynamics and evolution of scaling up SSD projects. Third, we chose a project that focuses on one of the most persistent and widely recognised sustainability challenges in global supply chains: suppliers' occupational health and safety (OHS) performance (Soundararajan et al., 2018; Jia et al., 2022). More specifically, the focal firm (FF) designed both the project and the implementation procedure to improve OHS outcomes for the entire supply base, highlighting the need for a scalable solution.

The unit of analysis is the SSD project, consisting of two embedded units of analysis, i.e., the two stages of the project. The pilot stage involved four factories (1 factory per supplier) and lasted for one year; whereas the scale-up stage aims to roll out the project to as many as 400 factories (1-4 factories supplying to FF for each of the 100 suppliers) over a period of two years. The 'suppliers' involved in the project are either acting solely as sourcing agencies or in a dual role as both the owners of the factories and the sourcing agencies. The 'factories' involved in the project either supply to FF through the supplier or are owned by the supplier. Their contractual relationship with FF is indirect, and they are contracted and managed by the supplier.

There was a one-year gap between the pilot and scale-up stages. Lessons learned from the pilot stage informed the design and implementation of the scale-up stage. During the scale-up,

factories were divided into four non-concurrent batches, each replicating the same 6-month implementation procedure. We secured access to both stages and adopted various data collection methods, including semi-structured interviews with key informants and observations of key events. Figure 1 presents the project timeline while further details on the two stages are shown in Table I. Data collected for this research includes the implementation of the pilot stage and the first three batches of the scale-up stage, offering sufficient insights into the design and implementation of SSD at scale. The final batch remains ongoing at the time of writing.

[Take in Figure 1 and Table I]

3.2 Data collection

Data collection was guided by a case study protocol (Yin, 2018). Since 2019, i.e., prior to the launch of the pilot stage in November 2020, the research team maintained ongoing dialogue with key actors to understand the project's development and the timeline. During these conversations, it was confirmed that the research team would have access to observe the implementation of the entire project. The inclusion of the focal firm, suppliers or sourcing agencies, factories, and consultancies enabled a multiple-stakeholder perspective. Data collection primarily relied on interviews, conducted both in-person during field trips and remotely over the course of the project. The field trips also presented opportunities for gathering observational data and collecting relevant documents, enriching the overall dataset and thus adding to data triangulation (Yin, 2018).

We conducted a total of 25 interviews with six key informants involved in the pilot stage and three key informants involved in the scale-up stage. In addition, we observed three types of events, including project update meetings at the pilot stage, the training events and refresher webinars, and site visits at the scale-up stage. We also collected documents, including the toolkit, training materials for the pilot and scale-up stages, and project monitoring forms for the scale-up stage. Lastly, data collection continued between the two stages, where four interviews and observations of two project review meetings were conducted. Table II summarises the three main data sources.

[Take in Table II]

3.3 Data analysis procedure

An abductive reasoning approach was adopted to analyse the data. We moved back and forth between inductive reasoning of emerging themes from the empirical data and deductive reasoning of themes derived from the theory, i.e., ANT and scale-up frameworks (Ketokivi and

Choi, 2014). The coding process followed a two-step approach. In the first step, open coding was conducted inductively allowing themes to emerge directly from the data. In the second step, these initial codes were refined using theoretical constructs. More specifically, established constructs, such as '*problematisation*' of the translation process, were generated from the ANT literature. Meanwhile, new codes such as 'negotiate flexibility under constraints' emerged inductively from the empirical data. Moreover, each stage of the project was first analysed individually, i.e., the two embedded units, followed by integration and code refinement. Such an abductive and iterative approach allowed us to gain a sufficient understanding of both the empirical data and theoretical constructs to achieve our aim of theory elaboration and development (Ketokivi and Choi, 2014). The coding process was supported by qualitative data analysis software, *Nvivo*. Figure 2 presents the coding structure derived from the data analysis process. Table III provides example evidence for each code.

[Take in Figure 2 and Table III]

Overall, this process is aligned with the methodological principles recommended for ANT research (e.g., Hald and Spring, 2023) as we collected data on both human and non-human actors, observed actions and changes, analysed the connections and translation process amongst relevant actors.

4. Findings

Before the project, more than 70% of sustainability audit noncompliances in FF's supply chain involved OHS issues (FF_PM1). FF has attempted to tackle this through increased audit frequency and co-developing corrective action plans with suppliers' audit managers; however, these reactive measures have had little impact. Drawing from other social sustainability projects, FF's team proposed engaging workers across factory levels to make OHS everyone's responsibility. They developed a two-stage SSD project to enhance factories' OHS knowledge and self-management capabilities. The ultimate goal was transferring risk management ownership from FF to the supply chain by involving and empowering multiple actor groups, including dedicated staff from both suppliers and factories. The project functioned as a process of network formation and configuration to strengthen suppliers' and factories' capability to handle sustainability challenges.

The findings are organised along the two stages of the project. Section 4.1 describes the key events that took place, how different actor groups interacted and the challenges encountered in

the pilot stage. Section 4.2 describes the key events and changes made in the scale-up stage. Both sections apply the theoretical constructs from ANT to explain the network formation and configuration process.

4.1 The pilot stage

The project was initially designed following a highly structured and phased approach, reflective of a *mechanistic* approach to scaling. FF tightly structured the network of actors with clearly defined roles and processes.

Step 1 – Network formation – Mechanistic identification of the problem and actors to involve

Starting in 2019, FF began identifying key actors to involve in the pilot stage of the project. FF contracted the delivery of the project to Consultancy Firm 1 (C1), which specialises in OHS knowledge training for factories. Four factories, each supplying one of FF's suppliers were involved. Four consultants from C1 (C1_1 to C1_4) were each assigned a factory to work with. At this stage, the suppliers were not assigned any particular tasks but acted as gatekeepers between FF/C1 and the factories. The human actors from the factories in the project were OHS working group members, which had to include shopfloor workers including at least one female worker.

In addition, FF also developed a structured toolkit comprised of four main elements: *OHS training material, OHS working group concept, OHS self-inspection checklist,* and *OHS self-inspection routine*. The toolkit functioned as non-human actors within the network. This toolkit stemmed from a previous project FF had implemented for their own staff five years beforehand. The goal of the pilot stage was mainly to test the robustness of the toolkit before disseminating it to the wider supply base in the scale-up stage. FF handed over the toolkit to C1's consultants who were then expected to pass it on to the factories, observe and provide feedback on its use, and support its integration based on their expertise.

This *mechanistic* approach led to a *problematisation challenge,* however, as FF viewed the OHS capability gap being relevant only to the factories but not to the suppliers located between FF and the factories. This framing led FF to form a network mainly around actor groups from the factories with consultants as delivery experts. FF defined the toolkit, the tasks and their sequence, aiming to apply a uniform procedure to each pilot factory, aiming at consistent inputs and, eventually, controlled outputs.

Step 2 – Network strengthening – Insufficient alignment of the roles and responsibilities

The pilot stage kicked off with a baseline survey visit to the four factories by C1. At this point, it became clear that each individual's responsibility and the purpose of key activities were unclear. For example, factory workers interpreted consultants' visits as a form of audit, as the consultants used the baseline survey to identify non-compliance issues, whereas their actual intention by FF was to uncover gaps in achieving effective implementation of the SSD project.

To align interests and expectations, FF and C1 held several discussion rounds during project updates, revisiting implementation details at each factory before the second site visit. For example, to facilitate participation and reduce the top-down nature of the approach, FF suggested that the factory owner or general manager be included in the OHS group as a member rather than the leader. However, the consultants disagreed, arguing this would go against the organisational cultural norms in most, if not all, factories. FF_PM2 mentioned that 'There's ongoing discussion within the factories about who should be group leader and deputy and how to allocate the responsibility to the two. We now have different practices across different factories…'. There were also misalignments between FF and C1 regarding other aspects. For example, FF prioritised simplicity and standardisation of the toolkit to ensure scalability and minimise extra work for factory OHS working group members, expecting C1 to follow a set process. In contrast, consultants from C1 found it necessary to adapt and refine the toolkit, drawing on their expertise rather than simply delivering FF's design. For example, C1_2 mentioned, 'if [FF] just want to hand over the toolkit and have factories implement it, our involvement is not necessary. I thought they expect us to contribute, not just deliver instructions…'.

The newly established OHS working group also lacked clarity regarding member roles. Since OHS should matter most to shopfloor workers, their participation in the OHS working group was made compulsory. However, shopfloor workers were reluctant to join, viewing the additional responsibilities as conflicting with their daily tasks. For example, C1_3 mentioned that, 'I tried very hard to persuade the female worker to join the group as she was really concerned that this might negatively affect her productivity…'. This shows the challenge of obtaining genuine engagement from shopfloor workers in the project.

The *mechanistic* approach, furthermore, revealed, *interessement challenges* in the pilot stage: assigning roles alone was insufficient as they must also align with actors' daily work contexts, existing duties, and expectations. For example, while involving shopfloor workers in OHS issues could expand engagement, reconciling OHS working group participation with their daily production responsibilities proved difficult since shopfloor workers are paid based on

productivity and quality rather than OHS engagement. Besides, FF and C1 have different mutual expectations.

Step 3 – Assigning ownership – Rigid principles allow little room for flexibility

Several challenges emerged when operationalising actions in the pilot stage. FF still saw the toolkit as fundamental for ensuring consistent input across factories, and thus only allowed *ad-hoc* amendments with FF's approval. For example, while the requirement to include female workers in the group was retained, some factories struggled to meet this criterion due to the low share of female workers and their limited educational background. This resulted in unstable participation as illustrated by the factory that C1_4 worked with, where the female worker recruited and trained for the OHS working group left shortly before project completion.

FF and C1 still held opposing views about the use of the toolkit and the consultants' expertise. Some consultants found FF's requirements and specification of practices too rigid. For example, C1_3 said, 'FF_PM2 mentioned that this is not an audit, so we need to stick to the 50 checklist items. If the factory we work with has less than 50 items applicable, we can remove irrelevant items depending on the factory situation, but we couldn't add any, even if important risks arise…'. This limited flexibility led to frustration among consultants about their role in the project. For example, C1_2 mentioned that 'The OHS working group members of the factory I support speak very highly of my expertise and my professional knowledge. I've actually done more than what FF required, but they never acknowledge my efforts beyond their outlined steps…'. This clashed with the project managers' view. Tensions therefore persisted between FF and C1.

The *mechanistic* approach also created *enrolment challenges*, largely due to insufficient *interessement*. The two leading actor groups, i.e., the project managers and consultants, went through several rounds of discussion to align their interests and define standard operating actions for cascading the project to the factory level during the implementation process. Meanwhile, other actor groups, such as the OHS working groups at the factory level, struggled with unstable membership, further complicating consistent engagement.

Step 4 – Solidifying progress - Insufficient guidelines and metrics

The pilot stage lacked clearly defined KPIs as FF intentionally avoided traditional audit-based metrics, instead promoting behavioural and awareness changes through supportive actions. However, this made it difficult to assess and compare factory performance. Consultants, for example, struggled to collect data for final reports, despite factories reporting improved awareness and self-inspection skills by the end of the pilot.

FF and C1 held five project update meetings throughout the project. Beyond progress updates on the four pilot factories, considerable time was spent reporting emerging issues and aligning understanding between the two parties. The first two meetings focused on factory visit reporting formats and terminology, while later meetings shifted to resolving field issues, sharing consultant best practices, and documenting these practices. For example, during the third meeting, C1_3 shared a practical checklist adaptation: a single sheet with checklist items on the front and a follow-up table on the back, significantly reducing completion time. However, this came too late in the pilot stage for other factories to adopt. This highlighted the need for continuous best practice collection and sharing among project team members.

As the pilot stage concluded, FF and C1 recognised that the toolkit needed additional written guidance. They identified key areas requiring clarification including OHS group member selection criteria, entry and exit mechanisms, and new member training strategies. These changes would help to address high shopfloor worker turnover that was disrupting newly established working groups and self-inspection routines.

The above makes clear that the *mechanistic* approach furthermore lead to *inscription challenges.* Still, the pilot stage revealed valuable opportunities for future improvement during the scale-up stage in terms of codification and *inscription*.

4.2 The scale-up stage

For the scale-up stage, FF changed to a more comprehensive approach, primarily built on the *complexity-informed* and *social science-driven* approach whilst retaining elements of the *mechanistic* approach to scaling.

Step 1 – Network formation – More actor groups included in the project

The list of actors for the scale-up stage was revised after the pilot stage. A key change to the human actors was the involvement of dedicated staff from each supplier. Based on the experience of the pilot stage, the project managers found that relying solely on external consultants was insufficient as they lacked familiarity with factory contexts, making early site visits less effective and delaying implementation due to the time needed to build rapport with factories. In contrast, suppliers whose daily responsibilities involved managing the factories were much better positioned to carry out regular visits and support implementation effectively. Furthermore, staff from suppliers could collect best practices and apply them across other sites based on their knowledge of the similarities and differences between the factories they manage. For example, during the site visit to S1, the OHS manager spoke about using reusable notice boards and plans to promote this to other factories. Meanwhile, the toolkit was updated to

become more comprehensive and practical, providing tools and guidance for both supplier staff and factory OHS working groups.

The OHS working group remained the key human element in the factories, with only minor changes from the pilot to account for the frequent turnover rate of shopfloor workers when selecting group members. For example, FF_PM2 mentioned that, 'we slightly adjusted our OHS group member selection criteria for scale-up, making shopfloor worker inclusion optional and prioritising shopfloor manager inclusion instead, due to a high staff turnover rate revealed during the pilot…'. This adjustment effectively addressed both the issue of high staff turnover and the challenge of an oversized OHS working group encountered in one large factory during the pilot stage.

In the scale-up stage, the problem was *reproblematised* as a broader capability-building project involving both suppliers and factories, recognising suppliers as the critical actor group to scaling. This shift positioned suppliers rather than the consultants as the key actor group given their established relationship with both the factories and FF. This change also highlighted the role of not only the toolkit but also various groups of individuals across different levels, aligning with the *social science-driven* logic of distributed responsibility and relational dynamics.

Step 2 – Network strengthening – Clearly-defined roles and aligned responsibilities

In the scale-up stage, dedicated staff from suppliers were appointed as leaders of project implementation and monitoring, aligning with their existing role in managing the OHS performance of their factories. At the factory level, the responsibilities of each OHS working group member were refined and specified. For example, since shopfloor managers rather than shopfloor workers are selected as the group members, it is easier for them to engage with OHS as managing the shopfloor is already their responsibility. Meanwhile, the group members are taught to integrate their knowledge about the project and OHS into their daily meetings to better engage shopfloor workers. The toolkit was further developed into two sets, one for supplier staff and one for the factory OHS group, and regular interactions between different groups of actors were made compulsory.

More importantly, audit performance, which was intentionally avoided during the pilot stage was introduced in the scale-up stage. While the project managers from FF continued to offer active support to C2, the suppliers, and the factories, they also made it clear that poor audit performance would result in paused orders until the supplier could demonstrate the proper implementation of the SSD project in the factory. This was a major change from the pilot stage,

as explained by FF_PM3, ‘previously, we avoided linking project performance to business relationships to not make it appear like another form of audit rather than a real supplier development project. However, we realised that it didn’t work well, especially in getting the buy-in from the suppliers and factories…’. The change highlights the need for a combined use of supportive and performance enforcement measures to drive implementation.

The scale-up stage saw major improvements in terms of both more appropriate responsibility allocation and better alignment between the newly-added OHS responsibilities and existing daily responsibilities of actors to enact interessement. The *re-interessement* followed a *social science-driven* logic, emphasising the importance of aligning roles and motivations with actors’ situated contexts and relational dynamics. For example, shopfloor managers, rather than shopfloor workers, were involved. Since workers are typically evaluated on productivity, OHS tasks could conflict with their daily work, whereas managers already oversee the shopfloor, making it easier to integrate OHS responsibilities. Moreover, interest alignment was enhanced by linking audit performance partially to business relationships, providing more motivation for better engagement.

Step 3 – Assigning ownership – Commitment facilitation and tailored support provision

In the scale-up stage, emphasis shifted to adapting the project to diverse actor groups, prioritising flexibility and effective tool utilisation. For instance, the third batch's supplier training was redesigned based on earlier lessons, focusing on project dissemination skills rather than the mere transfer of OHS knowledge. In addition, routine monthly meetings and supplementary meetings between FF and C2 captured progress data, identified emerging issues, and fed the adaptations back into the scale-up process. Besides, local adaptations and modifications were allowed according to the needs of each factory.

Moreover, FF and C2 implemented different approaches to empower actor groups during the scale-up stage, complementing training sessions with follow-up support on both OHS knowledge and project management skills. For example, C2 visited at least one factory per supplier in the presence of the supplier to provide tailored support in addition to monitoring progress. This included training suppliers to complete monitoring forms and use them for evaluations. During a site visit, S2 mentioned that, ‘at first I struggled with the forms, but after discussions with [C2_1], I now understand that it is actually a tool for me to assess the progress…’. It was found that S2 used the form to not only track correction progress but also identify opportunities for improvement. Meanwhile, the timely submission of the monitoring

forms enabled the project team to actively track and assess the level of engagement from suppliers and flag suppliers needing extra support.

Factory working group members were trained in relevant OHS knowledge and inspection skills to conduct regular self-inspections. The self-inspection routine was reinforced through monthly meetings where group members exchange viewpoints and review progress collectively. For shopfloor workers, raising OHS awareness was the key, so they were organised by the OHS group members to watch OHS accident videos during spare time. For example, C2 mentioned that, 'we share short OHS accident videos with suppliers, who were asked to pass them to working groups and then shopfloor workers in the factories. We think videos are easier to understand than written materials for shopfloor workers …'. This approach proved effective, as reflected in a comment from a worker at S5: 'After watching the video on electrical accidents caused by shortcuts, I now regularly check if charging cables are unplugged – both at work and at home…'. These examples highlight the importance of flexible and tailored support in engaging diverse actor groups effectively.

Re-enrolment in the scale-up stage followed a *complexity-informed* approach, which emphasises the evolving and emergent nature of the process and advocates for adaptive, context-sensitive strategies. Rather than strictly following the original designs and principles which emphasised knowledge dissemination as the core, tailored support and adaptation were central to this process, enabling more meaningful engagement across actor groups. Suppliers, for example, received support for both OHS knowledge and project management skills that enabled them to lead the implementation of the project more effectively. At the factory level, OHS working group members received training and were encouraged to engage in collective reflection through monthly meetings that reinforced newly established self-inspection routines. Moreover, for shopfloor workers, *enrolment* focused on awareness-building through accessible materials. These differentiated, context-sensitive strategies worked more effectively in enrolling a diverse group of actors and facilitated ongoing commitment.

Step 4 – Solidifying progress – Institutionalised procedures and solutions

The scale-up stage benefited from the written guidance developed during the pilot stage, the reflection period between pilot and scale-up, and the timely codification of practices and procedures over the course of the scale-up phase. To support the delivery of training sessions by suppliers, the project team developed complementary instructions on how to apply the knowledge and facilitate self-inspections at factories. This included a video produced by FF_PM_3 and C2 demonstrating training delivery techniques and OHS working group

establishment guidelines. The project team also produced a set of written templates including templates for interim and final project reviews and a project monitoring form with a set of key performance indicators (KPIs) that suppliers needed to submit to the project managers for review. In the project monitoring form, for example, suppliers had to record the number of non-compliances identified and resolved each month, which allowed for benchmarking them later.

The project implementation procedure specified monthly tasks for suppliers and factory OHS working groups in both training materials and monitoring forms. The first three months focused on disseminating general OHS knowledge and establishing infrastructure, including forming OHS working groups and developing self-inspection routines. The latter half of the project addressed specific OHS themes and capability gaps to embed continuous improvement in OHS management practices. In addition to the original KPIs set at the start of the scale-up stage, audit results were incorporated to assess the progress. More specifically, audit performance was used to verify the effectiveness of the project, as mentioned by FF_PM1, 'we believe if the OHS working group is effective, major issues such as locked doors shouldn't occur. If audit results reveal such problems, the factory cannot proceed with corrective actions until it proves its OHS working group and the self-inspection routine are working properly…'. The KPIs made tracking supplier and factory progress and determining whether additional support was needed easier.

Finally, multiple measures were put in place to maintain suppliers' and factories' long-term commitment and embed OHS practices. FF required all suppliers to establish the necessary infrastructure to help embed OHS practices into the daily routines of group members, i.e., the OHS working group and the self-inspection routine at the factories they manage. For example, S3 mentioned that, 'before this project, it was just me and another colleague handling everything on our own, often forcefully. But after the project started, when an audit is announced, the group takes initiative by increasing the frequency of the inspections and training shopfloor workers…' Establishing this infrastructure became a prerequisite for adding new factories to FF's supply base. Meanwhile, factories that are blocked due to OHS non-compliance must demonstrate engagement with the project before corrective actions can proceed. In addition, suppliers were required to submit monthly monitoring forms even after the six-month project period, ensuring sustained commitment.

Building on the pilot stage, *inscription* became an ongoing process, with new tools, templates, and procedures continuously developed and adapted. For example, the monitoring form developed during the scale-up stage enabled both progress tracking and reflection so suppliers could make more informed judgements and take ownership of the project.

Irreversibility measures, such as the compulsory establishment of the OHS group and the self-inspection routine as infrastructures related to OHS, further inscribe OHS practices into daily factory operations, reinforcing their institutionalisation and ensuring lasting integration. *Re-inscription* in the scale-up stage reflected a combination of *mechanistic* logic and *complexity-informed* logic. Codification and standardisation provided consistency and supported replicability across different factories, while the flexible adaptation of guidance and tools enabled the project to respond effectively to evolving needs and diverse local contexts.

5. Discussion

Our research investigates the design and implementation process for a two-phased SSD project focusing on how key activities, actor interactions, and network configurations evolved from the pilot stage to the scale-up stage, leading to the scaling of sustainability improvements across the supply base. Our findings reveals that implementing scale-up projects is an evolving and dynamic process requiring both a structured overall design and distinct pilot and scale-up stages, each with different logics and procedures – as illustrated in Figure 3. Responding to calls for more process-oriented studies for sustainability research (Grimm et al., 2024), our study offers insights into how sustainability practices can be integrated and embedded into suppliers' and factories' daily routines.

[Take in Figure 3]

More specifically, by breaking down the implementation process of both the pilot and scale-up stages, we add further granularity to the scale-up framework literature (e.g. Papoutsi et al., 2024). In doing so, we also reinforce previous findings on the critical role of the pilot stage for testing and assessing the improvement intervention design, enabling continuous learning, and identifying the potential for future scaling (e.g. Liu et al., 2023). Prior research suggests that a comprehensive design that makes use of elements from all three scale-up frameworks is necessary to tackle the challenges of scale-up for complex improvement interventions (Barker et al., 2016; Greenhalgh and Papoutsi, 2019). Our findings add to the prior literature by examining the respective approaches adopted in both the pilot and scale-up stages using an evolutionary perspective. More specifically, our findings show that a comprehensive design drawing on the *social science-driven* perspective to map out the interconnectedness between actor groups, the *complexity-informed* perspective to adapt to emerging features, and the *mechanistic* perspective to codify and standardise progress, can collectively support the large-scale rollout of the SSD project across factories.

The ANT literature suggests that network establishment follows a translation process from *problematisation*, *interessement*, and *enrolment*, until an alignment of interests between actors is reached, leading to network stabilisation (Sarker et al., 2006; Li et al., 2024). Our findings add further granularity to the literature by tracing the network establishment process during an SSD project across the pilot and scale-up stages. More specifically, our research reveals that large-scale SSD projects require multiple rounds of translation processes, as shown by the reiteration of translation cycles occurring in both the pilot and scale-up phases. This iterative translation approach is crucial because it allows for the progressive refinement of human and nonhuman actors and key activities to test and adapt the SSD project during large-scale implementation while ensuring broader stakeholder buy-in at each stage of the project expansion. In doing so, it also adds to discussions on the learning trajectory of sustainability initiatives in supply chains (e.g. Silvestre et al., 2020) by unpacking how diverse actor groups involved in SSD projects learn and adjust their actions.

Literature suggests that in the *problematisation* stage, the focal actor needs to frame the problem and identify relevant actors and how these are related (Sarker et al., 2006). Our research extends this by showing that a diverse group of actors, both human actors and non-human actors, need to be engaged and their specific roles and responsibilities to achieving the project goals need to be defined. This distributed responsibility shown in our research aligns with ANT as well as the *social science-driven logic* which both advocate that agency is distributed across multiple actor groups in the network where their interactions jointly affect performance (Hald and Spring, 2023; Papoutsi et al., 2024). More specifically, our findings show that cascading SSD down to the supply base requires the engagement of various actors across multiple organisational levels and roles. For instance, both internal intermediaries such as suppliers who have established relations with focal firm and factories, and external intermediaries like specialised consultants who bring technical expertise and ongoing support are required. Moreover, engagement from multiple hierarchical levels within the factories including management and shopfloor, is also necessary. In addition, non-human actors such as tools need to be developed based on different actor groups' roles and responsibilities. In doing so, our research extends prior research examining boundary-spanning actors in supply chains (Soundararajan et al., 2018; Jia et al., 2021) by demonstrating how diverse actor groups from different organisations collaborate to cascade SSD projects.

Proposition 1. *Effective problematisation in large-scale SSD projects requires engaging diverse human and non-human actors across multiple hierarchical levels with clear articulation of their distributed responsibilities and contributions to project goals.*

Prior research suggests that an appropriate *interessement* strategy needs to be in place to convince all actors involved in the network (Sarker et al., 2006). Our research adds to this by showing the criticality of aligning the interests of diverse actor groups, especially in the context of the SSD project. More specifically, our findings show that effective *interessement* strategies – that ensure newly-added SSD responsibilities are compatible with the existing roles and priorities of actors – are a prerequisite for sustained commitment. For example, during the scale-up stage, the project addressed misalignments by reassigning OHS tasks from shopfloor workers to shopfloor managers. This also extends prior literature (e.g., Jia et al., 2022) by showing that institutionalising sustainability practices at the supply base requires not only supportive infrastructure, such as dedicated teams in factories, but also careful alignment of the responsibilities of the actor groups. This is reflective of a *social science-driven* logic that emphasises an understanding of how actors' motivations and behaviours are influenced by their contexts and relationships (Papoutsi et al., 2024). Moreover, Our findings reinforce and extend findings from prior literature on the challenges of reconciling different priorities and concept interpretations in sustainability initiatives (e.g. Busse et al., 2016) by revealing how repeated alignment efforts among diverse actor groups can slow down progress of the *enrolment* process in the pilot stage. Meanwhile, tying audit results to the SSD project performance emerged as an effective strategy to enact *interessement*, as it helped to align the interests of suppliers, factories and the focal firm. It is noteworthy that audits were not introduced as a mere compliance tool by the focal firm but became a constructive tool for collaboration and problem-solving. This aligns with recent calls to view compliance practices as complementary to collaborative practices (e.g. Soundararajan et al., 2025), and can enhance SSD practices such as tailored training sessions to actively support, rather than hinder, long-term commitment to sustainability initiatives.

Proposition 2. *Effective interessement in large-scale SSD projects requires aligning newly added sustainability responsibilities with actors' existing roles and priorities, while integrating compliance practices with collaborative practices to create shared incentives between involved actor groups.*

Our findings are furthermore consistent with the view that the *enrolment* stage will face significant challenges if interests of diverse actor groups are not adequately aligned (Sarker et al., 2006). This became particularly obvious during the pilot stage, where insufficient *interessement* led to repeated cycles of revisiting and renegotiating roles and responsibilities. Our findings also show the need for a *complexity-informed* approach to *enrolment*. The *re-enrolment* in the scale-up stage was ultimately more successful once it moved away from rigid adherence to predefined procedures and principles towards context-sensitive strategies tailored to each actor group. This complements Jia et al. (2022) who emphasise the learning-by-doing process of focal firms in empowering suppliers and factories via SSD projects. More specifically, our findings show that beyond knowledge transfer, *enrolment* must actively support suppliers and factories in developing capabilities by aligning responsibilities with their operational realities and providing ongoing, tailored support.

Proposition 3. *Effective enrolment in large-scale SSD projects requires moving away from rigid adherence to predefined procedures and principles toward context-sensitive strategies that align responsibilities with actors' operational realities and provide tailored support to develop supplier capabilities.*

Our research, furthermore expands previous insights on the significance of *inscription* in facilitating actors to better understand how they are related to each other, leading to a more stable network (Sarker et al., 2006; Hald and Spring, 2023). More specifically, we show that *inscription* relies on the codification and sharing of best practices, effective monitoring mechanisms, and a suitable set of KPIs, through which *inscription* evolved into an ongoing, adaptive process from pilot to scale-up stage. For example, the introduction of the monitoring form, KPIs and guidance led to a more routinised and standardised approach at suppliers and factories to managing OHS challenges, facilitating the irreversibility of the SSD project changes and avoiding a return to the previous audit compliance-focused approach. In doing so, our research adds to the discussion on how sustainability requirements can be cascaded and institutionalised at the supply base (e.g., Sancha et al., 2015; Wilhelm and Villena, 2021). Furthermore, our findings also extend ANT by showing that *inscription* does not only take place towards the end of *enrolment*, as stated by prior research (e.g., Sarker et al., 2006), but rather it should take place continuously over the course of a project.

Proposition 4. *Effective inscription in large-scale SSD projects requires ongoing codification of best practices and guidance, monitoring mechanisms, and clearly defined KPIs to ensure routinisation and ensure the irreversibility of sustainability changes.*

6. Contributions

This research contributes to the literature in three ways. First, it provides insights into the evolutionary dynamics of SSD projects, showing how the network of actors involved progressively changes throughout the implementation process. The research unpacks the process of a large-scale SSD project to show that a comprehensive approach combining direct and indirect SSD practices is necessary. This responds to recent calls for more systemic perspectives on sustainability initiatives in supply chains (Soundararajan et al., 2025) and process-oriented views to further our understanding of the evolving nature of supply chain phenomena (Grimm et al., 2024).

Second, the research contributes to actor-network theory (Sarker et al., 2006; Hald and Spring, 2023) by adding granularity to the process of network formation and configuration. By focusing on the interactions between actors involved in SSD projects and how sustainability practices within the supply base become embedded, the research improves our understanding of how diverse groups of actors jointly shape processes and outcomes. Moreover, the research provides a substantiated version of the translation process that is central to actor-network theory, showing that multiple rounds of translation, each with a different focus, can take place as a project develops and expands in scale.

Third, this research contributes to the discussion on cascading sustainability in supply chains (Wilhelm and Villena, 2021; Jia et al., 2022) by introducing scale-up frameworks from the medical science literature (Papoutsi et al., 2024). To the best of our knowledge, this is the first paper to introduce such frameworks to provide new insights into how SSD projects can be effectively implemented to create lasting impacts across a broad supplier base. More specifically, our findings have shown that scaling up SSD projects relies on a systemic framework that combines key elements of all three scale-up frameworks, including the *mechanistic*, *complexity-informed*, and *social science-driven* approaches. Such a combination helps to develop a structured implementation procedure while allowing for flexibility and the incorporation of relational factors.

6.1 Managerial implications

Focal firms face significant risks and challenges in managing a geographically dispersed supply

base and embedding sustainability practices across multiple tiers, moving beyond mere compliance. The complexity of supply chains and the resource constraints of focal firms highlight the need for a scalable approach to SSD. To achieve a broader and sustained impact across the entire supply base, supply chain focal firms should consider adopting a phased approach to implementing large-scale SSD projects. Meanwhile, the selection of intermediaries to work with when delivering SSD projects needs to be based on the relevance of their expertise as well as their relationships with the supply base. For example, consultancies may be more competent at providing professional sustainability knowledge and project management expertise, whereas suppliers positioned between the focal firm and lower-tier suppliers and factories are better suited to lead and oversee project implementation. Moreover, different strategies may be needed to engage and develop actors at different levels of an organisation. For example, it may be most effective to raise shopfloor-level workers' awareness by sharing OHS videos with them rather than by assigning them additional roles beyond their daily tasks. In contrast, shopfloor managers may be better suited for inclusion in a dedicated working group to manage OHS issues as this can be more easily integrated into their daily responsibilities. Lastly, allowing for necessary configurations and adaptations, together with effective monitoring mechanisms and clearly-defined KPIs, is essential for ensuring long-lasting effects.

6.2 Limitations and future research

Our research furthers understanding of SSD scale-up projects; however, our data came from only one particular project implemented by one focal firm in the textile and apparel industry. Future research could extend this to enable the different scale-up frameworks to be compared and contrasted across cases leading to richer insights into how scale-up processes can be most effective. It would also be interesting to further investigate the performance outcomes of the scale-up process to build on the emphasis of this paper, which was primarily focused on design and implementation. Such a focus would also enable a deeper understanding of the effectiveness of large-scale SSD projects from the supplier perspective. Finally, zooming into specific focal firm-supplier-factory triadic relationships would provide a more granular insight into relationship dynamics and network configurations during SSD projects.

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Table I. The design and implementation of the two SSD project stages

(Source: Authors own work)

	Pilot stage	Scale-up stage
Number of suppliers/factories involved	4 suppliers, each involving 1 factory	100 suppliers; each involving 1-4 factories depending on their supply base
Timescale	Initially 6 months, extended to 1 year due to Covid-19	6 months per batch (25 suppliers), two years for the top 100 suppliers (4 batches)
Training approach	One training session delivered by the consultant to the factories' OHS group members only	Training delivered by the consultant and Project Manager from the brand to each batch of supplier representatives, who then delivered the training to the factories' OHS group members
Supplier (Sourcing agency) involvement	No	Yes
Shop floor worker involvement	Recommended	Compulsory
Monthly tasks	First half: establish the OHS group at the factories (first two factory visits); second half (3rd, 4th and 5th factory visits): run the self-inspection routines	Month 1: establish OHS group; Month 2: training delivery; Month 3: themed training and inspection; Month 4: interim review; Month 5: themed training and inspection; Month 6: themed training and inspection; (Month 7/8: post-project, final review and closeup)
Project assessment	No formal review; the project is reviewed at the end by the project team and the consultants	Interim review and final review by each supplier, the project team, and the consultant
Third-party consultant contribution	Consultancy 1 – four consultants, with each one in charge of one factory. Main contributions include the on-site delivery of training and five follow-up factory visits to provide tailored support as needed to establish the self-inspection routine	Consultancy 2 – one consultant. Main contributions include the delivery of training to supplier representatives on both OHS knowledge and training delivery skills; follow-up on-site and remote visits to each factory within the six-month time; refresher training as needed; interim review and final review; provision of other support as needed.

Table II. Summary of the three main sources of data (Source: Authors own work)

Data source		Data collection time	
		Pilot stage: 2020.11-2022.05	Scale-up stage: 2023.05-2024.05
Interviews (25, in total 20 hours, 525 pages of transcripts)	With the project team from FF	FF_PM1, project advisor (2)	FF_PM2, project manager (2)
		FF_PM2, Project manager (2)	FF_PM3, Project manager (5)
	With the consultants	C1_1, C1_2, C1_3, C1_4, Consultancy 1 (9)	C2_1, Consultancy 2 (5)
Observations (67.5 hours in total)	Project update meetings	6 hours	5.5 hours
	Observation of training events and webinars	-	2-day onsite training (15.5h) 2 webinars (3h)
	Observation of site-visits to 6 factories	-	Site visits to S1 (7h), S2 (6.5h), S3 (6.5h), S4 (7h), S5 (4h), S6 (6.5h)
Documents (503 pages in total)	The toolkit	5 documents, (94 pages)	23 documents (243 pages)
	Factory visit reprots	20 documents (83 pages)	6 documents (15 pages)
	Project summary reports	2 documents (21 pages)	3 documents (47 pages)
Addtional data	Review stage (2022.05-2023.05): Interviews with the project team (4 interviews) and project review meetings (2 meetings, 3 hours in total)		

Table III. Theoretical constructs, themes, codes and sample quotes (Source: Authors own work)

Translation process	Themes and codes		Sample of key quotes and supporting evidence
(re-) Problematisation	Mechanistic identification of the problem and actors to involve in the pilot stage	Design the project purely based on previous experience and evidence	"In fact, we conducted this project with our internal project management team about five years ago, we found that this model [project] worked, the tools are useful and shopfloor workers were engaged. Since we'd like to scale this up [to the entire supply base], we contracted a third party to help us roll this out with a professional perspective" (FF_PM1) "as she [FF_PM1] we have piloted the project by ourselves a few years ago, we tested and refined each step of the implementation procedure based on that" (FF_PM2)
		Adopt structured toolkit to reduce uncertainty and the strict replication in multiple suppliers	"We insist that the inclusion of shopfloor workers is mandatory for each and every factory in the OH&S working groups. This aligns with our initial design of this project, which was to establish a 'OHS responsibility area system' in which each shopfloor worker is in charge of his or her area" (FF_PM1) "we are given a list of documents that we need to use when we work with the factories. They have even specified the time for the training slides, and how long it should take for each step to ensure consistent input" (C1_2)
	More actor groups included in the scale-up stage	Take into consideration the role of human actors in addition to the toolkit	"With a supply chain of over 350 suppliers and 500 factories, we can only do the scale-up via the suppliers, where in the process, our role is supporting rather than leading. So we decided to work with not only C2 [the consultancy], but also the suppliers who are supposed to support and manage their factories anyway" (FF_PM2) "We have observed the first training session with the 25 supplier representatives and made a list of potential supplier representatives and their factories that we would like to pay more attention to, based on their involvement and performance during the training session" (C2_1)
		Take into consideration the existing organisation routines and structures	"We allow shopfloor managers to take on the OHS working group member role. One of the reasons for this was because that managing and checking shopfloor situation is their responsibility, and adding a little extra work specifically about this [OHS] wouldn't require them to invest in too much more time" (FF_PM2) "We would like to help them to develop their ability to deliver training sessions as well. This is because we would like them to apply these skills continuously even when the project is completed. The impact will go beyond just about this particular project if this can be achieved as well" (C2_1)

(re-) Interessement	Insufficient alignment of the roles and responsibilities in the pilot stage	Lack of aligned understanding of the scope	"We had a meeting with him [FF_PM2] yesterday to clarify the scope of the project as it appears to be a lot more things that we need to do compare to when we initially signed the contract. This is not acceptable for us" (C1_1) "I think we also bear some responsibility here – we didn't communicate clearly enough with them maybe. I told FF_PM2 that too, that perhaps we weren't clear enough. So we ended up redefining the purpose of the activities such as the baseline survey." (FF_PM1)
		Lack of aligned understanding of the responsibilities of each actor group	"At this stage, we would like everyone to make use of the toolkit in the same way as we would like to control the input to be as consistent as possible so as to control the output as much as possible" (FF_PM2) "I think the idea of having the factory owner or general manager as part of the OHS working group is a good idea; however, I don't think it could work if they are group member rather than the group leader. Imagine how can this work when a group leader who is the subordinate of the group member who is a superior?" (C1_3)
	Clearly-defined roles and aligned responsibilities in the scale-up stage	Refine the roles and responsibilities of all relevant human and nonhuman actors	"We've now split the responsibilities even further. So for example, we divided the toolkit to two categories, one for suppliers and one for factories" (FF_PM2) "We are now developing a further guidance on the respective responsibilities of group leader and group members to further clarify who's responsible of what in addition to the documents that are already in the toolkit." (C2_1)
		Connect OHS responsibilities with business relationships	In one of the toolkit documents, i.e. the tracking form, information regarding the recent audit performance was documented and used as a benchmark to remind the suppliers that their performance for this project will partially be assessed by audit results, which will affect their business relationship with FF. (Toolkit documents) "We've now made it very clear that audit performance will be used as a way to verify their effort on this project, as well as to help determine whether they can continue supplying to us. We are not evaluating their performance in this project based on the audit results; instead, we are using the audit results to encourage them to stay committed and meet the project requirements" [FF_PM3]
(re-) Enrolment	Rigid principles allow little room for flexibilities in the pilot stage	Challenges in operationalising certain criteria emerge	"Currently, we are struggling with applying some criteria. For example, the inclusion of female worker is compulsory, but there is no specific role or responsibility description for that specific female worker that we need to include. So in the factory I work with, we have a female group member who is the deputy lead of the group, but I'm not sure if this aligns with the criteria" (C1_2)

			"In the second site visit, we are asked to teach the factory OHS group members to make use of the inspection checklist for a maximum of 10 minutes. But actually, in practice, we found that the group members have thousands of questions, and it is not realistic to just briefly introduce it for 10 mins" (C1_4)
		Negotiate flexibility under constraints	"We were not allowed much flexibility as the project team made it very clear that they want consistent input with all the factories. However, we encountered some issues such as the inappropriate size of the OHS group that I'm in charge of. Then, the project team was happy for us to adapt the tool to some extent since then." (C1_2) "I think C1_4 gave us a great example of applying our principles in a flexible way, while still sticking to our core ideas. On one hand, we don't want to rigidly impose our principles, but on the other hand, we do believe that our core principles make sense, so we would like the consultants to creatively apply them in different types of factories. The case for C1_2 needs further investigation, and more creative solutions are needed to address the issues of low attendance and lack of engagement." (FF_PM1)
	Commitment facilitation and tailored support provision	Handle emerging issues proactively and adaptively	"I got in touch with those suppliers that didn't perform very well during the on-site trainings with them here in Shanghai, asking if them need any support to implement the project with their factories" (C2_1) "In terms of how we should use audit performance, we've had a few discussions with FF_PM2 in the past few weeks. We agreed that we may need to pay more attention to those factories that reported increased issues after the project started; this is because we need to identify whether new issues were raised simply because we started paying attention to things we hadn't before or whether the project was ineffective." (FF_PM3)
		Develop different strategies to engage different groups of actors	"We [FF_PM3 and C2_1] now have revised our strategy to engage shopfloor workers. Instead of educating them with knowledge-heavy training sessions, we decided to share short videos to them to get them more engaged" (FF_PM3) "Regarding the issue that people don't actively engage in the WeChat group chat, me and FF_PM3 have discussed and decided to initiate some conversations by us to start with. For example, we will be sharing some best practices from our site visits and encourage the supplier representatives to talk and share their thoughts." (C2_1)
(re-) Inscription	Insufficient guidelines and metrics in the pilot stage	No KPIs in place	"From the very beginning, I was not sure what our role is and what we are going to achieve towards the end of the project because the project team told us that they don't have any specific KPIs for the project" (C1_4)

			"Since we are here to empower the workers to be able to spot the OHS related issues by themselves rather than identifying and sorting the problems for them, I understand that it is quite tricky to assess our work as this kind of capability building or you say empowerment is quite difficult to measure, isn't it?" (C1_1)
		Insufficient written guidance	Most of the solutions to emerging issues were discussed in the project update meetings but were not codified in papers or guidance, leading to different interpretations and recollections among the four consultants when it comes to implementing those changes on-site. (Observation notes) The terminologies such as the name of the OHS group established in the factories was not finalised until the third project update meeting where two site visits had been carried out by the consultants already. (Observation notes)
	Institutionalised procedures and solutions for emerging issues in the scale-up stage	Provide written guidance as needed	There are clear instructions as to what needs to be done every month and by whom. (Toolkit documents) "In addition to the refreshing training sessions, we provided written guidance about a few key points we covered in the training sessions too." (C2_1)
		Develop a set of solid KPIs	The KPIs of the project were set at the beginning of the project and well documented as one of the toolkit documents. (Toolkit documents) "We've refined a few of the KPIs based on the original version. For example, we have broken down the indicator related to work-related injury into two sub indicators to make it easier to assess. We've also provided detailed definition of the two sub indicators too. This change, we believe, will be much easier for the suppliers and factories to understand and operationalise it in practice" (FF_PM3)
		Develop measures to ensure irreversibility	"The suppliers who are usually responsible for managing their factories OHS performance were told that their performance of this project will affect whether they can enrol new factories or allocate orders to a specific factory" (FF_PM3) "The suppliers are required to submit the tracking form on a monthly basis and this doesn't have an end date. We think that this can encourage their sustained commitment to the project to some extent" (C2_1)

Figure 1. Key actors included in the two project stages and their relationships (Source: Authors own work)

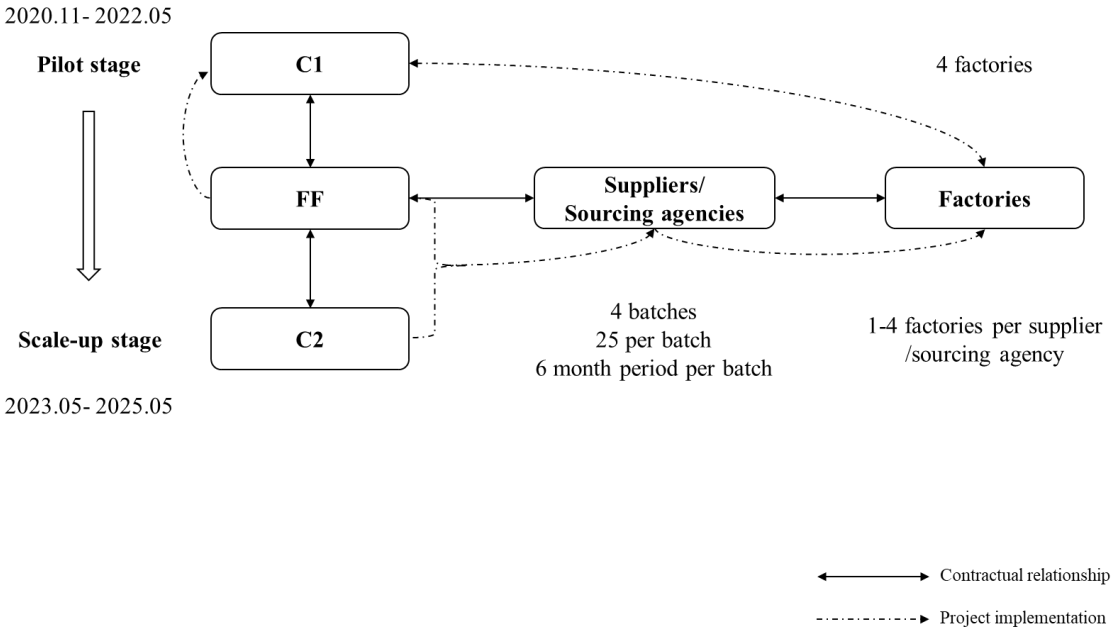

Figure 2. Coding structure (Source: Authors own work)

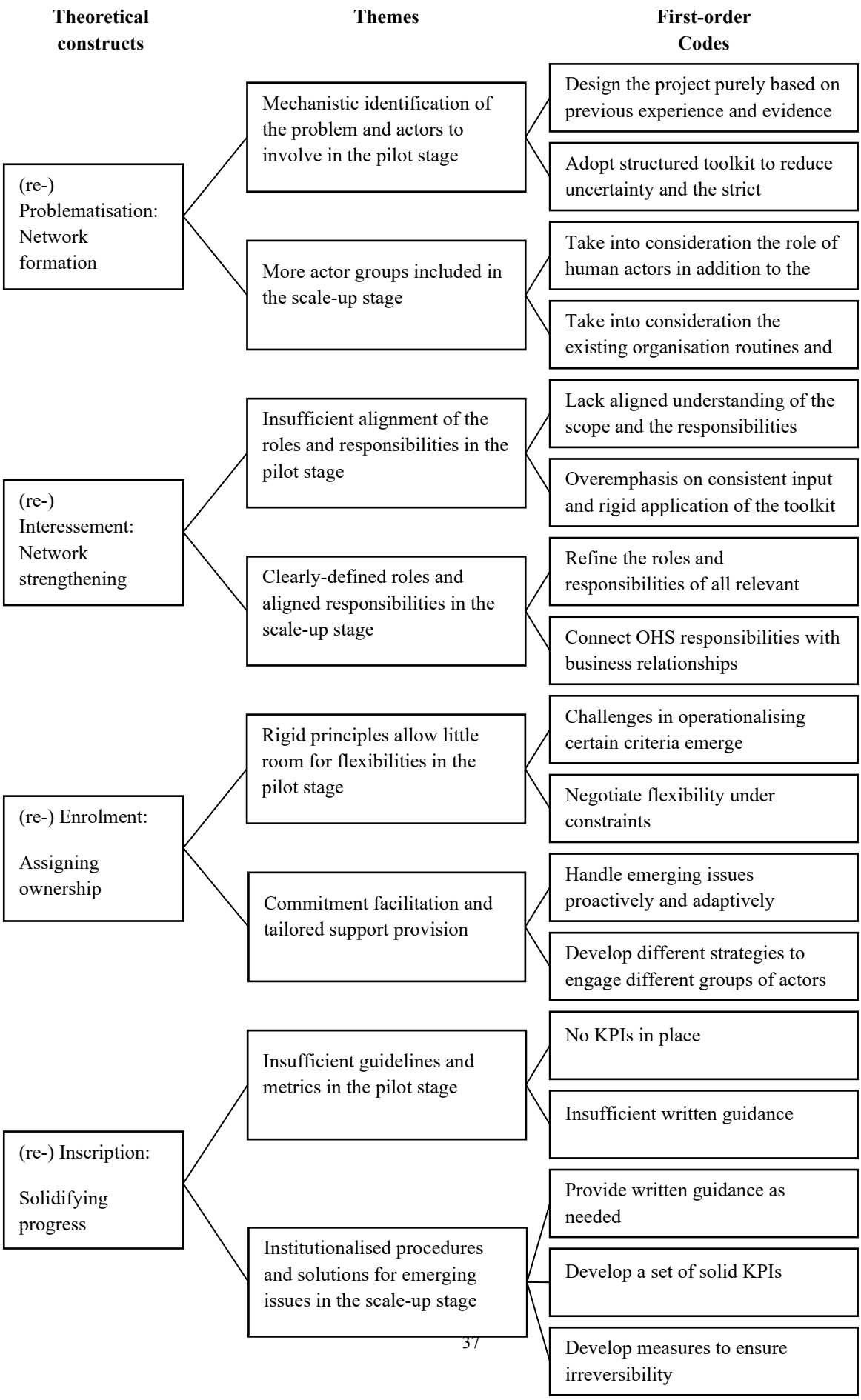

Figure 3. The scale-up process of large-scale SSD projects (Source: Authors own work)