Embracing change in tandem: Resilience and sustainability together transforming supply chains

Abstract

Purpose: This article investigates how micro-foundations of sustainability can build supply chain resilience (SCRes). Specifically, by defining supply chains as social-ecological systems, this article explores how sustainability as a supplier capability leads to the transformative development of SCRes capabilities.

Design/methodology/approach: Longitudinal multi-case studies were developed over the first year of the COVID-19 outbreak. A total of 52 interviews were conducted with managers and employees of 12 global supplier firms as well as associated local cooperative and consultancy managers. Secondary data were also used for triangulation. An inductive approach was used for data analysis to elaborate theory through a metaphor.

Findings: Nine micro-foundations of sustainability were identified and categorised using the dynamic capabilities steps: *sensing*, *seizing* and *reconfiguring*. They were found to move together with the *preparing*, *responding* and *transforming* steps of SCRes, respectively, and thus to perform as dance partners using our dance performance metaphor. Moreover, ten supplier cases were found to be adopting a transformative social-ecological perspective as they performed all key stages of our dance performance metaphor. The transformations all resulted from either institutional or social sustainability, and the associated micro-foundations generated six main SCRes capabilities, most commonly linking *visibility* and *organisation* with institutional and social sustainability respectively.

Practical implications: A deeper understanding of sustainability micro-foundations is provided for supply chain managers to enhance the development of SCRes strategies in preparation for future sustainability-related crises.

Originality: Unlike previous research, this article explores an intertwined understanding of SCRes and sustainability during a crisis. Through the micro-foundations of sustainability we explain how sustainability capability builds transformative SCRes using a supplier perspective.

Keywords: Supply chain resilience, social-ecological perspective, sustainability capability, micro-foundations, COVID-19 outbreak

Article classification: Research Paper

1. Introduction

Supply chain resilience (SCRes) has become a particularly pertinent topic in recent years due to the COVID-19 outbreak (Chowdhury et al., 2021). Thus, firms have been looking for opportunities to create more reliable and resilient supply chains (World Economic Forum, 2021). Definitions of resilience vary considerably between disciplines (Gunderson, 2003). Whilst often related to bouncing back to a previous equilibrium (Holling, 1996), new definitions refer to SCRes as "the capacity of a supply chain to persist, adapt, or transform in the face of change" (Wieland and Durach, 2021, p. 316). By following this cutting-edge definition, we assume that a social-ecological transformative perspective (Wieland, 2021) should guide SCRes studies within changing environments.

In response to the changing environment related to the COVID-19 outbreak, there has also been a parallel increased emphasis on environmental, social and economic sustainability for both scholars and practitioners (Sarkis, 2021). Whilst SCRes and sustainability have been researched together (Chowdhury et al., 2021; Negri et al., 2021), the extant literature simply identifies a positive relationship without explaining the nature of this relationship (Eggert and Hartmann, 2022; Sauer et al., 2022; Negri et al., 2022). Further, Wieland (2021) claims that new resilience-related narratives need to be introduced within the 'new normal' that is emerging in the wake of the pandemic, which includes reflections on the climate and biodiversity crisis, themes that are interchangeable with the sustainability narrative (Kennedy et al., 2022). It is therefore argued here that there is a research gap for SCRes studies to develop new insights to elaborate theory that more closely explains how sustainability capability leads to social-ecological resilience and specifically follows a transformative approach.

This perspective suggests that to reach SCRes, firms need to constantly learn and adapt resources using dynamic capabilities (DCs) when facing instable environments (Hendry et al., 2019; Sauer et al., 2022; Wieland and Durach, 2021). Therefore, to address the research gap, we present empirical research to provide new insights that link SCRes with sustainability capability for organisations and supply chains using a DC theoretical framework (Bianchi et al., 2022; Amui et al., 2017). Thus micro-foundations of sustainability are identified and categorised using the DC steps of sensing, seizing and reconfiguring (Teece et al., 1997; Teece, 2007). We then show how specific micro-foundations of sustainability are connected

to the SCRes steps of preparing, responding and transforming (Adobor and McMullen, 2018; Hendry et al., 2019), as well as to the development of SCRes capabilities.

To increase our understanding of the relationship between SCRes and sustainability, we explore the dancing the supply chain metaphor developed by Wieland (2021), as it supports our metaphorical imagination of a dance performance (see Stephens et al., 2022). Grounded in the extant literature, we consider supply chains to be social-ecological systems that should be analysed through an organic movement (Wieland, 2021). Therefore, more than focusing on supply chain members, although we are particularly interested in supplier activities, this article assumes resilience and sustainability as *dance partners*. As such, we suggest that both constructs constantly should learn and adapt effectively in tandem, due to their DC characteristics. Hence, we explore both dance partners not limited to the traditional supply chain recovery perspective, but moving to the next level of a more transformative perspective. Therefore, by recognising a need for a more in-depth understanding of how capabilities are created, we aim to answer the following research questions:

RQ1: How does sustainability emerge as a capability to build SCRes?
RQ2: How does sustainability as a capability lead to the transformative development of SCRes capabilities?

To explore these questions, a longitudinal multi-case study design was applied during one year of the COVID-19 pandemic to gather data and understand the link between SCRes and sustainability capability. In doing so, we explore the COVID-19 dynamic environment to demonstrate how Brazilian coffee global suppliers have coped with the outbreak. In this context, the Brazilian coffee suppliers were studied due to their importance in the global market as producers of 32% of the total coffee consumed worldwide and hence Brazil is the largest coffee producing country in the world (International Coffee Organization, 2021).

The contributions of this article are threefold. First, we elaborate theory to understand the impact of sustainability on resilience in supply chains (Negri et al., 2021; Sauer et al., 2022; Scholten et al., 2020). By exploring the dance performance metaphor, we place a spotlight on these two dance partners (sustainability and resilience) using the social-ecological supply chain as the dance floor. In doing so, we re-invigorate a previous metaphor (i.e., dancing the supply chain; Stephens et al., 2022; Wieland, 2021) to demonstrate how suppliers

can embrace change. Second, we present the first article to empirically identify the micro-foundations of sustainability capability for SCRes. Finally, our empirical findings show that the DC dimensions are key to creating a transformative social-ecological perspective of SCRes. Therefore, we move away from a narrow focus on recovery and put emphasis on the transformative SCRes step.

2. Theoretical background

To explore connections between SCRes and sustainability, we first discuss the extant literature related to SCRes. Secondly, we shed light on the understanding of sustainability as a capability. Finally, we link the two to provide an analytical framework for our study.

2.1 Supply chain resilience: towards a social-ecological perspective

To be resilient while managing supply chains, managers need to develop techniques to anticipate, mitigate and overcome disruptions (Dabhilkar et al., 2016; Pettit et al., 2010). For instance, Tukamuhabwa et al. (2015, p. 13) found that SCRes "involves increasing flexibility, creating redundancy, forming collaborative supply chain relationships and improving supply chain agility." Thus, SCRes is formed by lower-order supply chain capabilities (Teece, 2007). Commonly used key capabilities that emerged as being of particular relevance to our study have been defined by Pettit et al. (2010, p. 12):

- *Visibility*: "Knowledge of the status of operating assets and the environment";
- *Adaptability*: "Ability to modify operations in response to challenges or opportunities";
- *Anticipation*: "Ability to discern potential future events or situations";
- *Collaboration*: "Ability to work effectively with other entities for mutual benefit";
- *Market Position*: "Status of a company or its products in specific markets" and;
- *Organisation*: referring to the ability to manage "[h]uman resource structures, policies, skills and culture."

Further understanding of SCRes relates to the steps undertaken by firms when overcoming disruptions, which have been commonly labelled as follows:

- *Prepare* refers to how firms mobilise resources to develop supply chain tools and methods in advance of a crisis (Adobor and McMullen, 2018; Hendry et al., 2019).

- *Respond* addresses actions following the crisis (Hendry et al. 2019; van Hoek, 2020). For example, COVID-19 has affected the management of human resources (e.g., more requirements for safety; Chowdhury et al., 2021) and intensified the use of machines and robots in food production processes to reduce risks of infections (Paul et al., 2021).
- *Recover* involves firms' capacity to return to its original state by assuming the possibility of bouncing back to a previous equilibrium (see Holling, 1996).

These steps are linked to engineering and ecological resilience (Wieland and Durach, 2021). While an engineering approach to resilience relates to bouncing-back to previous production patterns (Holling, 1996), ecological resilience allows for new capabilities to emerge (Gunderson, 2003).

Beyond this understanding of SCRes, Folke (2006) has developed a social-ecological system perspective, which recently has emerged within the supply chain management literature (Adobor and McMullen, 2018; Sauer et al., 2022; Wieland, 2021). Building on engineering and ecological resilience approaches, social-ecological resilience calls firms to distinguish between 'being' and 'becoming' (Wieland, 2021). Defining supply chains not as static systems, but as essentially dynamic systems (i.e., a social-ecological system; Wieland, 2021), this approach values growth and renewal (Adobor and McMullen, 2018). Therefore, the social-ecological perspective is central for building a new level of SCRes given the role of human actors in 'becoming' and hence in carrying out transformation (Aboah et al., 2019; Sauer et al., 2022; Wieland, 2021).

To represent social-ecological resilience, a new SCRes step has emerged: transform (Adobor and McMullen, 2018; Tukamuhabwa et al., 2015; Wieland and Durach, 2021). *Transform* concerns the new position that firms can reach due to growth and renewal. As supply chains are interpreted as social-ecological systems limited and influenced by political-economical contexts and planetary boundaries (Wieland, 2021), in which learning and transformation targeted at a higher level of performance are key, there is no desire to return to pre-disruption stability. More than just adapting the existing processes, supply chains will perform transformative moves by leveraging sources of innovation (Gunderson, 2003; Wieland, 2021). For example, new technologies can generate new levels of visibility to manage both supply and demand risks (van Hoek, 2020). Thus using a social-ecological

perspective, we propose that the terminology of *preparing*, *responding* and *transforming* more appropriately describe the three steps of SCRes. It is therefore this terminology that we adopt in this article.

However, we know little about how social-ecological SCRes connects to other supply chain objectives such as quality, lean and sustainability, with prior authors acknowledging this research gap only in the context of more traditional definitions of SCRes (Scholten et al., 2020). This is corroborated by other authors who argue that there are potential links between sustainability and SCRes which are not yet fully investigated (Jabbarzadeh et al. 2018; Rajesh, 2018; Fahimnia et al., 2019; Negri et al., 2021; 2022; Sauer et al., 2022). To address this research gap, we first define sustainability as a capability (Pettit et al., 2013).

2.2 Sustainability as a supply chain capability

Over time the understanding of sustainability as applied to firms and supply chains has also been developed. The most commonly used definition involves the triple bottom line (TBL) framework concerning economic, environmental and social sustainability. However, Elkington (2018) has argued for a need to rethink sustainability using a broader framework, including elements such as governance and institutional issues; where institutional sustainability involves incorporating elements relevant to the local context into management practices (e.g., by reducing corrupt behaviours or improving stakeholder engagement; Fritz and Silva, 2018). Thus it is argued that scholars and practitioners should re-focus their understanding of sustainability from being primarily based on performance indicators to define it instead in terms of practices. Moreover, Silva and Figueiredo (2020) proposed the use of a sustainability-practice approach as a means of spreading sustainability among multiple supply chain members. This perspective is challenging because firms need to mobilise their main resources.

Silvestre et al. (2020) argue that a transition to sustainability is necessary and supply chains play a key role in this process. Therefore, adopting a sustainability-practice approach has led to a variety of applications within a supply chain context. For example, Silva and Figueiredo (2020) claim that intra- and inter-organisational engagement is essential for sustainability practice. In this context, sustainability can drive firms to develop new capabilities in the market. Additionally, Amui et al. (2017) define sustainability as a capability related to the constant creation, extension and modification of resources for firms to

become increasingly competitive in the market. Thus the concept of sustainability as a capability is closely linked to the sustainability as a practice approach. According to Beske et al. (2014), to tackle unsustainable issues in industry, firms need to better define strategies particularly when facing instability and the dynamic nature of the business environment. Amui et al. (2017) further claim that sustainability has changed and become more amenable to adaptation over time. Therefore, in this article, we define sustainability capability as dynamic and oriented towards constant transformation.

Examples of studies that explored sustainability capability are Gruchmann et al. (2021) who name ten different capabilities in the food industry in Germany using a multi-level approach and Bianchi et al. (2022) who explore environmental capabilities to support life cycle assessment implementation. To this end, both studies explored the so-called micro-foundations which are understood as the representation of broad capabilities (Felin et al., 2012; Santa-Maria et al., 2022), and thereby apply a sustainability capability perspective. According to Felin et al. (2012), these micro-foundations are used to explain macro elements such as capabilities, thus by understanding them we can better value the contributions of suppliers to the supply chain level as a whole. Here, we argue that these micro-foundations of sustainability can be categorised using the DC steps as follows:

- *Sensing*: the ability of firms to scan, create, learn and interpret the dynamic nature of the environment in terms of opportunities and threats (Teece, 2007). This can involve internal and external environments (e.g., communication and sensitizing capabilities as defined by Gruchmann et al., 2021), and also be linked to technological innovations (e.g., external sensitivity; Santa-Maria et al., 2022).
- *Seizing*: refers to the ability to respond to 'sensed' opportunities (Teece, 2007). This micro-foundation can relate to processes and structures developed for a new capability (Felin et al., 2012). According to Gruchmann et al. (2021), examples include relational capital building and sense-making capabilities. In addition, Santa-Maria et al. (2022) refer to stakeholder engagement and collaboration.
- *Reconfiguring*: the ability to enhance, combine or protect existing capabilities (Teece, 2007). The reconfiguration mobilises different resources (intangible or tangible) to ensure strategic alignment (Santa-Maria et al., 2022), for example, through the co-specialisation of assets and organisational flexibility (Santa-Maria et al., 2022) or re-conceptualisation and supplier development capabilities (Gruchmann et al., 2021).

Prior research has studied supply chain sustainability through the lens of DCs, but has not sought to explore the micro-foundations of sustainability as linked to SCRes. For instance, Siems et al. (2021), building on the prior conceptual understanding of Beske et al. (2014), used a systematic literature review to analyse the DCs and supply chain sustainability practices as relevant to the context of the food and automotive industries. They provide interesting comparative insights into how DCs have enabled these practices to evolve over time for these two industries. Other studies have explored learning capabilities for supply chain sustainability. Examples of such extant studies include Silvestre et al. (2020), who suggest both exploration and exploitation capabilities to implement sustainability initiatives following specific trajectories. In addition, Pereira et al. (2021) ratify the need for learning capabilities mainly during turbulent environments like the COVID-19 pandemic. These two studies make important contributions, but they overlook the study of sustainability practices that represent such capabilities. Therefore there is a theoretical gap to explain sustainability capability, as understood through micro-foundations, using the DC lens. Specifically, there is a research gap to explore the micro-foundations of sustainability capability that are linked to SCRes.

2.3 The resilience and sustainability interface: a dance performance framework

Examples of studies connecting both concepts (i) identify both synergies and trade-offs; (ii) identify specific links between sustainability and SCRes capabilities; and (iii) discuss some specific SCRes steps. Firstly, in terms of synergies, Jabbarzadeh et al. (2018) suggest that two phases (sustainability assessment and resilience enhancement) are vital to SCRes, whilst Ivanov (2018) found positive impacts on sustainability in terms of the resilience strategies of single sourcing, inventory reductions and labour market stability. In terms of trade-offs, Ivanov (2018) also found that less inventory may negatively affect SCRes design; whilst Negri et al. (2022) show among other practices that a social sustainability-related supplier relationship does not necessarily reduce SCRes related risks. Secondly, Shen and Sun (2021) provide an example of a study that links SCRes capabilities to sustainability, revealing that flexibility and collaboration are key advantages for a firm's non-commercial social sustainability actions. Thirdly, Eggert and Hartmann (2022) explored the SCRes steps of *preparing* and *recovering* during COVID-19 from a buying firm perspective. Although they

found positive impacts of sustainability on SCRes related to transparency, situational awareness, social capital and collaboration, they did not consider the responding step, nor did they consider transformative SCRes. Thus, within the extant literature exploring the resilience and sustainability interface (Negri et al., 2021), the use of a social-ecological perspective is still nascent (Sauer et al., 2022). In a rare example, Sauer et al. (2022) explored the interplay between SCRes and sustainability represented by learning trajectories. By using the three approaches of SCRes (i.e., engineering, ecological and social-ecological) they found that prior emphasis on sustainability affects the SCRes approach adopted in turbulent environments. However, this existing theoretical debate provides little information concerning the way in which a broader set of micro-foundations of sustainability build transformative SCRes, and thus this research gap remains.

We therefore build on this prior research to theorise that the combination of SCRes steps with sustainability capability should be represented by a dance performance, with the two acting together as *dance partners* when they are able to work in tandem, thereby complementing each other well. It could be argued that all SCRes steps (i.e., preparing, responding, and recovering or transforming) are relevant to build resilience (Adobor and McMullen, 2018). However, in this article we assume that recovery is not desirable because there is no way to effectively return to a previous state of equilibrium. We thus follow Adobor and McMullen (2018, p. 967) who claim that "the notion of a single equilibrium is rejected in favor of uncertainty, adaptability, transformation and how these intertwine in a dance of continuous change and instability."

Figure 1 illustrates such a dance performance metaphor by showing sustainability and resilience as being intertwined and claiming that sustainability is an evolving capability that builds transformative SCRes.

-- Figure 1 --

Thus this figure suggests that sustainability (black line) and resilience (red line) can act as effective dance partners according to three dance performance stages: (1) rehearsing ("sensing-preparing"), (2) acting ("seizing-responding") and (3) transforming ("reconfiguring-transforming"). To achieve social-ecological resilience the supply chain should perform all three dance performance stages (see Adobor and McMullen, 2018).

Starting from the idea that supply chains (as social-ecological systems) are the dance floors, it is suggested that firms facing turbulence will perform differently depending on which stage of the dance they target. We note that firms with a strong sustainability orientation start the dance performance in a better position than others (Eggert and Hartmann, 2022; Sauer et al., 2022); however, this does not hamper others to embrace change. Each dance performance stage is described as follows:

Rehearsing ("*sensing-preparing*"): The first stage refers to the rehearsing in which firms are sensing sustainability-related opportunities and challenges to increase SCRes-related preparedness for the emerging crisis. We understand that more rehearsing leads to more success when acting, therefore firms which build sustainability micro-foundations during this stage are likely to better respond to the crisis during the next stage. For Eggert and Hartmann (2022), SCRes preparedness (which they call readiness) is an antecedent for sustainability activities. Similarly, Stone and Rahimifard (2018) state that it is impossible to have sustainability without resilience. However, for Rajesh (2018) sustainability precedes resilience; hence identifying specific management practices (Ivanov, 2018), proposed here as micro-foundations of sustainability, is essential to enhance SCRes and thereby prepare for the crisis ahead, even though trade-offs and synergies can emerge at this early stage (Fahimnia et al., 2019; Negri et al., 2022). In our framework, we allow either activity of sensing or preparing to precede the other, or indeed for both to happen concurrently. Thus the rehearsing involves the sensing step of sustainability in tandem with the preparation step of resilience, as by sensing the opportunities and threats, supply chains are able to appropriately prepare – and vice versa.

Acting ("*seizing-responding*"): In the second stage of the dance performance, the dance partners will act (i.e., make decisions to seize opportunities related to sustainability) which then constitutes a resilient response during the crisis, thereby providing (or not) opportunities for transformative movements based on their strategies. This follows Negri et al. (2021), who claim that firms should seize opportunities related to sustainability to increase SCRes. For example, Tukamuhabwa et al. (2015) suggest 'sustainability compliance' to be considered an important SCRes strategy used by firms to seize opportunities, while Pettit et al. (2019) claim that 'product stewardship' related to sustainable business practices through life cycle assessment is an appropriate seizing approach. Following this perspective, adaptive actions can emerge as a response targeting a renewal (Adobor and McMullen, 2018; Ivanov,

2018; Sarkis, 2021). Thus, the acting stage defines whether firms bounce back or advance towards improved SCRes with sustainability capability integrated. At this stage of the dance, we understand both partners to be working in tandem, and thus seizing and responding occur concurrently.

Transforming (*"reconfiguring-transforming"*): In this final stage, the dance partners demonstrate their learning by re-positioning themselves for the next dance performance. Van Hoek (2020) claims that firms can go beyond risk mitigation and create de-risked supply chains that are also sustainable when firms target benefits for both business and society. For example, Tukamuhabwa et al. (2015) claim that new capabilities (here related to sustainability) can enhance SCRes in future and ongoing disruptions (e.g., the climate crisis; Wieland, 2021). In addition, Silva and Ruel (2022) explored the impact of inclusive purchasing as a means of social sustainability on SCRes and identified five enhanced capabilities in a global cosmetics supply chain: visibility, adaptability, collaboration, financial strength and empowerment. Thus again, the dance partners can each take the lead in the dance, with each being a potential antecedent for the other in our framework. However, in this article, we limit our exploration to the instance when new sustainability capabilities drive the transformative development of SCRes capabilities.

This research model has no similarity with previous research, because we use sustainability micro-foundations and SCRes as complementary concepts. Additionally, in this research, we use the perspective of emerging country suppliers during the COVID-19 outbreak to consider the impact of the suppliers on the resilience/sustainability of global supply chains through an empirical study, as justified in the following section.

3. Research method

This research applies a qualitative multiple-case study research design to elaborate theory (Ketokivi and Choi, 2014) through metaphorical imagination (Stephens et al., 2022). The case study method was used due to its potential to enable rich and in-depth data (Eisenhardt and Graebner, 2007). Therefore, our data collection approach was developed to provide a detailed understanding of the supplier's perspective of how sustainability capability strengthens and connects with SCRes.

3.1 Case selection criteria and research protocol

The research sample is composed of Brazilian coffee producing firms and associated local institutions (i.e., cooperatives and consultancy organisations). All of them are located in the Cerrado Mineiro region, in the Minas Gerais state, which is an important region in terms of the coffee plantation area, production quantity and export volume. There are around 4,500 producers operating in 55 municipalities (Região do Cerrado Mineiro, 2020), supplying global supply chains for popular brands such as Illy and Nespresso. The coffee production in this region has a tradition of being innovative and sustainable and it is certified according to its origin (Coffee from the Cerrado Mineiro region).

In total, 12 case studies were conducted. The participating coffee producers were selected based on two criteria: (i) being export-oriented and (ii) being a medium or large coffee producer, as these tend to be more involved with sustainability (De Marchi et al., 2012). The coffee production size is defined by hectares planted. This criterion has been adopted by the Federation of Cerrado Coffee Farmers, based on legislation regarding the rural territorial property and its classification of rural properties. Hence, all participating producers are at least the minimum size for a rural property to be classified as medium-sized, that is with at least 160 hectares of coffee plantation area. The local institutions, that is the co-operatives and consultancy organisations, were nominated by the coffee producers (See Table 1).

-- Table 1 --

3.2 Data collection

Primary data were gathered over the first year of the COVID-19 outbreak, that is, between April 2020 and March 2021. A total of 46 interviews were conducted with managers and workers of 12 global supplier firms. Six additional interviews were conducted with local institution managers to provide multiple sources of data. To gather data, four rounds (see Table 1) of semi-structured interviews were used with different research protocols including different interview scripts. The interviews allowed the participants to add relevant information to the research according to their judgment.

To determine our sample, the “snowball” technique was adopted to access the participants (Teddlie and Yu, 2007). Initially, we approached some managers to identify their availability for this research. After their acceptance, further producers, employees and local

institutions were added to the sample. Thus, through multiple viewpoints the research sought to ensure a breadth of understanding of the effect of sustainability capability on SCRes during the COVID-19 outbreak. Due to the context and restrictions, the interviews were conducted by phone, according to the availability of each participant. The final sample of 12 cases was possible through the saturation level criterion adopted. To decide when to cease interviews the saturation occurred when no more significantly new information was added (Eisenhardt, 1989).

Data collection was interspersed with data analysis in three phases. First, interviews were carried out with a case representative (April and June 2020). Following our initial data analysis, the second phase allowed us to validate and broaden the findings with all managers invited to another interview in September 2020. In the last phase, we decided to explore the viewpoints of employees and local institution representatives (February and March 2021). This was essential for data triangulation (Yin, 2018). During this last phase no further evidence was detected, which ratifies the saturation level criteria used in our research. All interviews were conducted in Portuguese, recorded and transcribed verbatim, producing a total of 422 pages. Selected quotations were translated to English to present the main results.

Secondary data were also collected during this period (from April 2020 to March 2021) to triangulate the interview information with other sources. Data collected included: website content from participant coffee producers and cooperatives; sector reports; and press articles concerning sustainability actions adopted by coffee producers in the region during the pandemic.

3.3. Data analysis and rigour

An inductive content analysis approach was used to analyse the data (Mayring, 2004; the coding tree is available from the authors on request). The first action was to conduct open coding to understand the empirical findings and their relation to the research questions (Strauss and Corbin, 1990). To develop the analysis, we initially focused on understanding the processes and procedures developed during the outbreak for each case studied. This process led us to develop first order codes. Consequently, we used selected quotations to show the micro-foundations of sustainability mobilised during the outbreak. As this point, we found the second order themes (i.e., the micro-foundations). These micro-foundations are defined in Table 2, which also shows how they are linked to the first order codes identified.

A cross-case analysis was then carried out using axial coding to identify and analyse how sustainability capability connects to the SCRes steps. In doing so, relevant related SCRes capabilities were identified (including visibility, adaptability, anticipation, collaboration, market position and organisation; Pettit et al., 2010). During this process, we compared the results with the extant literature to ensure theory elaboration (Eisenhardt and Graebner, 2007). Therefore, during the axial coding, we explored emerging characteristics related to economic, social, environmental, cultural and institutional issues (Fritz and Silva, 2018) to better classify the sustainability capability. During this phase of the analysis, we used the dance performance metaphor to investigate how micro-foundations of sustainability can lead to transformative SCRes.

To ensure that the research was carried out rigorously, different trustworthiness criteria were applied (Lincoln and Guba, 1985; Yin, 2018). Credibility was achieved by using a research protocol and triangulation of sources (among multiple categories of interviewees and with secondary data; Yin, 2018). The interview scripts (available from the authors on request) offer transparency/transferability of data collection. Transferability was pursued through cross-case analysis and description of characteristics of the research context (Yin, 2018). Additionally, to achieve dependability and confirmability, multiple researchers added interpretation to our data. Therefore, two researchers were involved in the data analysis, thereby eliminating bias when identifying links. Finally, for external validity, following the suggestion of Seuring (2008), the findings were compared with those of the newer research regarding the COVID-19 outbreak and sustainability micro-foundations (e.g., Gruchmann et al., 2021; Negri et al., 2022; Sauer et al., 2022).

4. Findings

To understand the dance performance between sustainability and resilience, we first present the findings regarding sustainability capability through the micro-foundations analysis in section 4.1 below. This section thereby begins the analysis by answering RQ1 as these are the micro-foundations that emerged during the pandemic and are shown in section 4.2 to link to the SCRes steps. Thus, in section 4.2, we present a cross-case analysis of the three dance performance stages: rehearsing, acting and transforming, and also answer RQ2 by linking the transforming dance stage to enhanced SCRes capabilities.

4.1 Identifying the emerging micro-foundations of sustainability capability

Table 2 presents the findings, specifying and defining each micro-foundation of sustainability identified, as well as linking each micro-foundation with the relevant sustainability dimension. Thus, this Table shows how the analysed global suppliers sensed, seized and reconfigured themselves during the first year of the outbreak.

-- Table 2 --

4.1.1 Sensing

As depicted in Table 2, both threats/challenges and opportunities were identified. In terms of threats/challenges, the findings show that firms expected a negative impact on the health of their teams, the imminent harvest processes, and coffee demand. Regarding opportunities, these included changing to mechanised harvesting, sharing of experiences between firms, supply chain learning, and increasing communication with customers through social media. We thereby firstly identified that a *human-centred management* (A) micro-foundation focused on social sustainability was central at this point because firms needed to mobilise their resources to understand how to protect their employees and contract-workers. This was essential because they strongly believed that if some employees caught the virus, their operations would be affected. Also, they expected to experience difficulties in contracting temporary workers due to the risks associated with these workers needing to travel from another region and then be hosted in farm accommodation. Given that the first pandemic peak in Brazil was in May 2020 (Pereira et al., 2021), coffee producers needed to prepare quickly for the next harvest from June to August 2020.

Regarding the identified *flexibility* (B) micro-foundation, we found that firms sensed an opportunity to better use their technological resources to ensure continuity of production and harvest. In this context, targeting economic and institutional sustainability, firms predicted the need to use a mechanised harvesting mode given that a large group of workers would be needed for a manual harvest. Usually these firms hire migrant workers for the harvest, but since the Brazilian states were in lockdown they recognised that it was impossible to move workers from one place to another. However, they also recognised at this sensing step that mechanisation generates negative impacts as the crops for the next couple of years would be adversely affected by this type of harvest. In this context, they also anticipated an

opportunity to improve *horizontal collaboration* (C) as they could share experiences with other coffee producers. This micro-foundation was essential for institutional sustainability because this type of collaboration helped the firms to support one another in planning how to manage the crisis. In turn this led to the emergence of the *knowledge management* (D) micro-foundation through learning together (i.e., institutional sustainability) about the outbreak trajectory. In this sense M8 and M1, respectively, stated: *"Oh, we will be totally different after this situation."*; *"In moments of despair like this, we think outside the box."* Therefore, together they were able to identify opportunities to surpass the crisis.

The *communication* (E) micro-foundation was key for suppliers as this enabled buyers to provide an understanding of the expected significant fluctuations in coffee demand due to the economic crisis caused by the outbreak. In relation to economic and institutional sustainability opportunities regarding communication, firms improved their relationships with customers through social media: *"We will need to use social media more to showcase our product and company. It will be the way to contact business customers and final consumers"* (M10). Given the lack of in-person contact during the pandemic, the use of social media and conversation apps were essential for both communication with buyers/consumers and horizontal collaboration with other firms, for example to define strategies and determine responses to the crisis. In summary, as shown in Table 2, at the sensing step sustainability was therefore managed by firms mainly through institutional sustainability practices in which they worked together to find a solution, with some social and economic sustainability practices also being employed.

4.1.2 Seizing

The seizing perspective of sustainability capability was analysed through three micro-foundations: *communication* (E), *support for health and safety culture* (F), and *adaptation* (G). Following the sensed need to increase communication using social media, as discussed above, evidence that supplier actions were intensified accordingly includes: *"We helped our buyers to promote the coffee for sale to their consumers. We posted on social media that our coffee was being sold online by them"* (M10); *"We have posted many things on social media [...] about our farm and coffee, about our sustainability projects. We also started to have more contact with the final customer"* (E10.2).

The findings also show that workers were stimulated to prevent the disease spreading, with responses that used micro-foundations (E) and (F). As evidenced below, firms both shared information and modified existing operational procedures to avoid infections: *"We explained everything and put up posters around the farm. We pushed them to wear masks and stay away from each other"* (M6); *"We hired a smaller group of workers to reduce the risk of infections here at the company"* (M1). We note that this micro-foundation (F) is directly connected to the micro-foundation (A) identified in the sensing discussion, both targeting social sustainability. This demonstrates that sensing a need for increased awareness of the wellbeing of people – whether they are employees or not – was translated into several actions by firms.

The final micro-foundation identified at this point (i.e., G) is related to institutional sustainability. The evidence suggests that this was the most mobilised micro-foundation as, after sensing the need to be flexible, firms needed to adapt their routines to ensure the continuity of their operations even when in-person meetings were not possible/advisable. For instance: *"The visits were interrupted. The audits were also all remote. Only employees entered the company, we restricted the visits of agronomists, [...] and we managed to get through and we are still doing it today"* (E5.2); *"We are using technology much more. Many more social networks to talk to our customers. They always ask for pictures, videos of the coffee being harvested. Since they can't come here to visit us, it is now all online"* (M11).

In summary, the findings indicate that key responses to the outbreak-related threats and opportunities included the modification of many processes to become online, such as the intensification of online communication on marketing and health and safety. Similarly to the sensing step, Table 2 illustrates that at the seizing step institutional practices continued to be the most commonly employed sustainability dimension, with some aspects of the social and economic dimensions again being relevant.

4.1.3 Reconfiguring

The findings suggest there are two key micro-foundations related to reconfiguring: *co-specialization of assets* (H) and *sense-making* (I). The former (i.e., H) is related to the retention of the intense use of technology in their daily operations, mainly in terms of online meetings and marketing activities. By identifying opportunities and having new routines involving the use of technology, firms are now using this micro-foundation to support their

institutional sustainability management. In this context, M2 and E1.2 stated: *"Many of the meetings will not be face-to-face again. We used to spend a lot of time travelling to attend meetings. Now we only need the time of the meeting and we can continue working straight afterwards"* (M2); *"We have publicized our coffee and our buyers, such as roasters and coffee shops, through social media. We have increasingly done that"* (E1.2). Therefore, we found that many procedures for which an online platform was previously thought to be inappropriate will now remain virtual and even be intensified.

The second reconfiguring micro-foundation (i.e., I) relates to hygiene procedures and health care and hence to social sustainability. We observed that due to certification requirements, firms already have many procedures to ensure health and safety, but seizing opportunities related to the pandemic-related threats meant that new measures emerged and will remain in use. For instance, M3 and C3, respectively, argued that they expect persistent change: *"We are much more aware of the need to take care of hygiene in all processes. I think we will not turn back. We noticed how we also had less flu here since we introduced these measures"* (M3); *"I believe that those hygiene measures will remain. Despite the different phase of the pandemic, I see that many measures have been reinforced. There is a fear of infection rates increasing again"* (C3).

In conclusion, it can be seen that many of the actions undertaken in the seizing step have been evidenced to lead to transformative micro-foundations as these actions were maintained and even intensified. This provides the potential to realise benefits beyond reacting to this specific pandemic as these micro-foundations enhanced two dimensions of sustainability capability (i.e., institutional and social), creating a greater preparedness for future supply chain disruptions.

4.2 Resilience and sustainability as dance partners: cross-case analysis

Using the micro-foundations of sustainability capability analysis, as discussed above, we found that suppliers have 'sensed' the threats and opportunities surrounding the COVID-19 outbreak and 'seized' opportunities by 'reconfiguring' themselves. However, we found that each case used these sustainability micro-foundations differently, that is, they performed their dance using a comparatively different response, thereby building varying SCRes capabilities (see Table 3). In particular, Table 3 both links the micro-foundations of sustainability to the SCRes steps of *preparing*, *responding* and *transforming*, and provides

analysis suggesting that varied SCRes capabilities were linked to the identified sustainability micro-foundations employed by each case to cope with the outbreak. This Table also illustrates that whilst all cases carried out some of the sensing and seizing sustainability steps, not all of them carried out reconfiguring steps, with some only transforming either institutional or social sustainability rather than both. Thus, as further explained below, not all of the cases developed micro-foundations of sustainability that enabled the emergence of transformative SCRes, and hence some did not develop their SCRes capabilities during the pandemic. As a consequence our cross-case analysis discussed below enables us to explain how sustainability and resilience can be effective dance partners by explaining the differences between those cases that did (and did not) embrace change.

-- Table 3 --

Overall, we argue that sustainability capability has played an important role for firms within the coffee supply chain to build SCRes following a social-ecological perspective, as ten (out of 12 firms) were able to reach the transforming stage of the dance performance either using institutional or social sustainability capability or both at the same time. While Cases 1, 2, 5, 7, 8 and 10 demonstrated synergies by building both institutional and social sustainability, and also generated enhanced SCRes capabilities (as discussed in further detail below), Cases 3, 6, 9 and 11 show trade-offs as they have not built SCRes from both dimensions of sustainability capability. Instead, Cases 3 and 6 focused on social sustainability and Cases 9 and 11 focused on institutional sustainability. Finally, Cases 4 and 12 were not able to build SCRes at all, as they did not reach the transforming step. In the following sub-sections, we present more detailed discussion of the connections between the micro-foundations of sustainability and the SCRes steps within the dance performance metaphor, in answer to RQ2. In addition, we consolidate our findings related to RQ1 by further explaining how sustainability capability emerges to build SCRes.

4.2.1 Stage 1: rehearsing (sensing-preparing)

The rehearsing of the dance performance started even before the first lockdowns in Brazil (see Pereira et al., 2021), because most of the firms participate in cooperatives and have acquired sustainability-related group certifications. For example, this led to the prior

establishment of the *horizontal collaboration* micro-foundation (C). Being certified means that they have strict rules to follow, which is also connected to the *human-centred management* micro-foundation (A) and supports them to be prepared. Thus the sustainability sensing step can be linked with the resilience preparing step, and our findings suggest that it was the micro-foundations of sustainability that came first when there were prior certifications of this type, and hence sustainability as a capability was leading the dance at the rehearsing stage. This was evidenced as follows: *"Certifications help a lot as companies are already well organized with well-structured processes. I believe this has already prepared them to adapt quickly to the context of the pandemic"* (C4); *"As the farm has already been certified and already operates with many protocols, it simply adjusted and restricted a little more, mainly to provide better care for people"* (C5). Some managers, such as M6, also stated: *"The farm was already certified. So, so far it has been easy to maintain our activities during the pandemic."*

Although certification was important for all firms during the crisis, differences were identified in terms of the number of micro-foundations evidenced in our data, although all cases provided evidence of having at least two of the micro-foundations of sustainability. Whilst all the cases developed at least one of the four micro-foundations associated with institutional sustainability at this stage of the dance, only cases 1, 5, 7 and 12 mobilised all four, as shown in Table 3. For social sustainability, most firms adopted the associated human-centred management micro-foundation, but not all. Nonetheless, all of the farms successfully continued to produce during the outbreak, as C5 emphasised: *"They have not stopped. The farms have not had any paralysed moments. Being able to keep going like that without stopping, not even for a day, is very difficult and they managed it very well."* These arguments suggest that certifications, along with various combinations of the sustainability micro-foundations, guided them to operate more sustainably in the pre-outbreak period and this experience was then relevant from the onset of the outbreak. Therefore, rehearsing is a key stage in performing the dance as it provides the basis on which firms will seize opportunities and respond in the next dance performance stage.

4.2.2. Stage 2: acting (seizing-responding)

Towards SCRes the acting stage was the most important stage of the dance performance, as it crystallised whether the rehearsing stage was well developed or not. As

shown in Table 3, there are clear differences in how suppliers acted during the crisis. For example, in terms of institutional sustainability, all cases except Case 6 generated *adaptation* (G) – hence only Case 6 did not mobilise any of their rehearsed sustainability micro-foundations for the institutional sustainability dimension. For social sustainability, Cases 2, 4, 7, 9, 11 and 12 did not generate *support for health and safety culture* (F). This finding demonstrates that even when firms have identified the opportunity or threat, they do not always develop effective practices to respond appropriately.

Despite these results, in general the suppliers of coffee production acted positively to cope with the crisis. This was very clear in the research, as stated by M6: *"In comparison to what happened with the rest of the companies in this country, we were very privileged. We were very little affected. We have not had our activities interrupted."* C5 corroborated this: *"They acted quickly, there was no way to wait."* This can arguably also be linked to the pre-existing certifications, and hence to the micro-foundations of sustainability that emerged in this study. For instance, our findings suggest that they did not wait for formal guidance from others to act, as M8 stated: *"The representative of certification said to me: 'What do you feel is the most prudent? We don't have any guidance on this yet. Nothing is certain yet.' So, I followed the existing principles. We followed our own expertise on that. The cares that we always had. We could not stop for even one day."* Thus, our findings suggest that the rehearsing stage is an important pre cursor for the acting stage. However, it is important to also consider how rehearsing impacts the link between acting and transforming, as the acting stage can either lead to transformation or limit firms to recovery actions.

4.2.3 Stage 3: transforming

There were three cases in which the acting dance stage did not lead to the transforming stage. For example, for institutional sustainability, Cases 3, 4 and 12 did not manage to transform, either because they focused on efforts to 'bounce back' to previous stability and hence showed no evidence of transforming (Cases 4 and 12), or because they centred efforts on social sustainability (Case 3). In addition, Case 6 did not transform their institutional sustainability as they entered into none of the associated dance performance stages, but instead focused only on social sustainability. In contrast, in terms of social sustainability, we highlight two Cases (2 and 7) that did not provide evidence of the micro-foundation (F) in the acting stage of the dance, but nonetheless did take part in the transforming part of the dance.

One interpretation for this is the strong rehearsing stage, which led to the transforming stage of the dance without first needing to define practices for acting.

Overall, our findings suggests that the majority of the analysed cases are moving toward a more social-ecological type of resilience (with the exception of cases 4 and 12). Thus, they are no longer interested in simply bouncing back, but want to consolidate the newly learned practices into capabilities that make them better prepared for the future. In particular, they are achieving this through engagement with other stakeholders (i.e., institutional sustainability) and social sustainability strategies, as follows: "*I believe that these companies have become even more careful with hygiene and safety issues at work [...] During the first months of the pandemic, I saw how engaged they were to make everything safe there. [...] We did our best together."* (C1); *"We made a WhatsApp group to exchange information. This group is formed by producers, members of cooperatives, consultancy companies and other local institutions. [...] It has been very important. Each one of us is sharing what we have done positively during this time"* (C5).

In terms of the institutional sustainability capability, for the eight cases that were able to transform, this transformation was demonstrated by the mobilisation of specific SCRes capabilities resulting from the connection between the final SCRes step and the final micro-foundations of sustainability capability. Therefore, four key SCRes capabilities (see Pettit et al., 2010) were enhanced during the crisis: *visibility* (7 out 12 cases), *adaptability* (2 out 12 cases), *collaboration* (1 out of 12 cases) and *market position* (1 out of 12 cases). It is worth noting that Cases 5, 7 and 10 were the only ones to enhance two different SCRes capabilities at the same time and this was due to the use of new technologies. Additionally, we emphasise that *visibility* capability was by far the most common SCRes capability to be enhanced.

In terms of the social sustainability capability, the transforming dance stage was mainly connected with the SCRes capability *organisation* (8 out of 12 cases). In addition, Case 10 also mobilised the SCRes capability *anticipation* due to scenario development to prepare and respond well during the crisis. In general, the transformation related to the importance of health and safety that was not limited to workers but also included their family and surrounding communities. Thus, our evidence suggests that firms are now taking a long term perspective, which demonstrates that the firms consider that social sustainability and resilience have strategic importance that is not limited to coping with COVID-19 alone. Thus

we demonstrate in Table 3 that social sustainability connects with an ongoing culture of caring.

Therefore, our findings show how sustainability capability and SCRes were connected in response to the outbreak, and how they operated together in our cases, even though not all cases engaged with all stages of the dance performance. Therefore, our analytical framework was observed in practice as we clearly found dance movements related to each of the different stages that demonstrate how cases are ready (or not) for the next turbulence.

5. Discussion

Our findings make important theoretical contributions using dance performance as a metaphor. By expanding the dancing the supply chain metaphor (Wieland, 2021), we argue that sustainability and resilience are dance partners and should follow certain dance performance stages to ensure successful management during a crisis. We thereby theorise an underexplored facet of supply chain management, that is, the sustainability and resilience interface, in response to several calls for research further explaining connections between these two concepts (Fahimnia et al., 2019; Negri et al., 2021; Scholten et al., 2020). Based on our research findings, Figure 2 populates the initial framework developed in Figure 1, to illustrate how the use of metaphorical imagination (Stephens et al., 2022) with three dance performance stages (i.e., rehearsing, acting and transforming) provides a deep understanding of how resilience and sustainability transform supply chains in tandem.

-- Figure 2 --

Our final theoretical framework presented in Figure 2 is one of the contributions of this study as it combines the steps for sustainability DCs (sensing, seizing and reconfiguring) with the SCRes steps (preparing, responding and transforming). Thus our first main contribution is to elaborate theory, as whilst this article corroborates Sauer et al. (2022) and Silva and Ruel (2022) who previously identified connections between SCRes capabilities and sustainability, we provide an explanation of how they perform each stage of the dance together. Thus, Figure 2 shows micro-foundations of both institutional and social

sustainability capabilities leading to specific SCRes capabilities. This leads to our first set of propositions:

P1a: The development of micro-foundations towards institutional sustainability culminating with 'co-specialisation of assets' enhances SCRes capabilities (e.g., visibility, adaptability, collaboration and market position).

P1b: The development of micro-foundations towards social sustainability culminating with 'sense-making' enhances SCRes capabilities (e.g., organisation and anticipation).

We therefore found that resilience and sustainability embrace change in tandem when the dance performance generates positive results to overcome disruptions. In addition, building on the prior research of authors such as Fahimnia et al. (2019) and Negri et al. (2022), we identified synergies and trade-offs as not all cases illustrated improved SCRes capabilities through the development of the micro-foundations of both institutional and social sustainability. Specifically, during the dance performance, Table 3 showed synergies in six cases that were able to build both social and institutional sustainability capabilities and enhance SCRes capabilities in tandem. These synergies are possible when all of the stages of the dance are performed. In contrast, we noted that there was a trade-off between resilience and sustainability when the transformative SCRes perspective was not completely applied. This occurred in four cases as our results indicated that these firms focused their resources on just one of the two sustainability capabilities, developing the SCRes capabilities identified with that capability alone (as listed in Figure 2). These trade-offs showed that some firms were not able to fully enhance SCRes, as they did not perform all of the stages of the dance.

The multiple micro-foundations of sustainability mobilised by each supplier firm that explain the above findings are defined in Table 2. Five have been adapted from those already identified in the prior micro-foundations literature (i.e., communication, sense-making, knowledge management; Gruchmann et al., 2021; [organisational] flexibility and co-specialization of assets; Santa-Maria et al., 2022). The remaining four emerged from our findings, and were then defined by building on other extant literature associated with the COVID-19 pandemic (i.e., human-centred management, support for health and safety culture, adaptation, and horizontal collaboration). Thus our findings also further build on the emergent

literature related to SCRes during a pandemic by adding explanation to the micro-foundations of sustainability mobilised in this context. This is our second main contribution as we present the first empirical study that makes these links using a social-ecological perspective, as the prior studies related to COVID-19 (see Chowdhury et al., 2021) focused on identifying responses to disruptions relating to the bounce-back perspective (Holling, 1996).

Our third main contribution is to illustrate how the DC lens is key to creating a transformative social-ecological perspective of SCRes. Using DC steps to study SCRes is not novel. For instance, Hendry et al. (2019) used this theoretical lens to link DC steps with the prepare, respond and recover SCRes steps in studying the constitutional disruption caused by Brexit in the UK. However, in this article, we replace the recover step with the transforming step (Adobor and McMullen, 2018; Tukamuhabwa et al., 2015) to enable a social-ecological perspective to be adopted. Starting with the preparing step, although our findings show differences in terms of how the firms performed the dance, all of them were influenced by sustainability certifications as the dance began. The literature often shows certifications as a risk management concept when studying DC for sustainability in supply chains (Beske et al., 2014; Gruchmann et al., 2021; Siems et al., 2021), whilst Pereira et al. (2021) show that sustainability certification supports the establishment of learning capabilities, using evidence from the COVID-19 outbreak. Thus, building on the findings from this article along with this prior research, for the rehearsing (sensing-preparing) stage we use the DC lens to propose:

P2a: Previously developed social and/or institutional sustainability capabilities (e.g., through certification processes) are effective enablers of SCRes during the preparing step when those capabilities enable the sensing of opportunities and threats.

Moving to the acting (seizing-responding) stage, we show how both micro-foundations of sustainability capability and SCRes capabilities can be developed in tandem, thereby building on the prior research of Negri et al. (2021) and Tukamuhabwa et al. (2015) who also see both constructs as being jointly developed. For example, as shown in Table 3, Cases 1 and 5 both developed the SCRes adaptability capability as they developed the micro-foundation we labelled in Table 2 as ‘adaptation’ by changing their routines, including through the intensified use of technology for their harvest. Thus, we again use the DC lens to propose that during this stage of the dance:

P2b: Social and/or institutional sustainability capabilities work in tandem with SCRes capabilities during the responding step when these capabilities enable the seizing of opportunities to address threats.

The final stage of the dance performance, the transforming stage, represents whether new or enhanced SCRes capabilities emerge. Our results show that when this stage was not performed (e.g., see Cases 4 and 12), as firms were not able to reconfigure their supply chains using the micro-foundations, social and/or institutional sustainability capability were not able to build SCRes capabilities. Thus, the final proposition is:

P2c: New and/or enhanced SCRes capabilities emerge at the transforming stage when social and/or institutional sustainability capabilities are used to reconfigure supply chain practices following a crisis.

6. Conclusions

This article studies the interface between the concepts of sustainability and resilience using a social-ecological perspective for SCRes, which is insufficiently addressed in the literature (Wieland and Durach, 2021; Sauer et al., 2022). Whilst bouncing back might be appropriate in some instances (as found for Cases 4 and 12), when addressing sustainability-related issues there is a need to push firms and supply chains to a higher level of attainment (Wieland, 2021). Therefore, to address this dynamic concept of SCRes, firms pursue adaptation and learning to manage their own resources (Sauer et al., 2022; Silvestre et al., 2020). Specifically, we add to this prior literature by explaining the contribution of social and institutional sustainability capabilities to the building of SCRes during a pandemic.

In particular, in answer to RQ1, this article empirically identified nine micro-foundations of sustainability (in Table 2) that emerged during the COVID-19 pandemic to enhance SCRes. The specific links between these micro-foundations and SCRes capabilities are explained in the first set of propositions – 1a and 1b. In answer to RQ2, we then used a dance performance metaphor to illustrate how sustainability as a capability led to the transformative development of SCRes capabilities, as summarised in the final populated theoretical framework in Figure 2, and explained in the second set of propositions 2a-2c.

Thus, through three interconnected dance performance stages, this article shows that the strategies and actions of the suppliers studied followed in general a social-ecological perspective to overcome disruptions. Although two cases bounced back to their pre-pandemic status, as they did not follow the social-ecological perspective, all the other ten cases achieved social-ecological SCRes as explained in section 4.2 and Table 3. For these ten cases, there were differences in how they performed the dance leading to differences in which SCRes capabilities were developed. Specifically, a set of six SCRes capabilities were found to have been mobilised during the pandemic, most commonly linking *visibility* and *organisation* with the development of institutional and social sustainability respectively.

6.1 Practical implications

Managerial implications were identified by using the dance performance metaphor to connect sustainability and resilience. We thus illustrated how supply chain managers, through the associated steps (i.e., preparing, responding and transforming), can pursue SCRes by using sustainability capability steps (i.e., sensing, seizing and reconfiguring). Therefore the use of our final framework can help managers to identify and strengthen micro-foundations of sustainability to support their development plans for SCRes. For example, we showed that previous sustainability experience (e.g., through certification processes) made an important contribution to enhance SCRes, thus illustrating that managers should increase their sustainability practices in the pursuit of SCRes capabilities.

Policy implications were identified as, for instance, sustainability micro-foundations revealed the importance of collaboration and communication for suppliers when facing a crisis. Therefore policy makers could provide further governmental support projects that link suppliers both with each other and with various additional supply chain stakeholders to develop sustainability practices collaboratively, thereby also leading to enhanced SCRes when these practices enable greater preparedness for future disruptions. In terms of *social implications*, this research reveals the impact of firm actions, both during a crisis and at other times, on workers' health and safety (e.g., using the human-centred management and the support for health and safety culture micro-foundations). This confirms that supply chain activities can have value for all societal actors, when supply chains not only have a transactional purpose, but also address social and institutional sustainability to build social-ecological SCRes.

6.2 Limitation and further research

The main limitation concerns the timing at which the last SCRes step was investigated, as the timing of our study did not provide a final evaluation once the outbreak had run its course. Thus, whilst we were able to identify initial actions as the outbreak unfolded, further innovations may have emerged to cope with the outbreak after we completed our data collection. Further studies could apply our theoretical approach to identify to what extent the third dance performance stage caused learning and can support preparedness for future crises, thereby exploring whether a virtuous cycle could be added to our theoretical framework with the newly enhanced SCRes capabilities then being stronger dance partners in the first stage of a future dance performance.

Additional studies could also explore whether new micro-foundations of sustainability emerge in the aftermath of the outbreak. Further, the dance performance metaphor could be used to explore alternative conditions of the dance floor (e.g., different types and strengths of supply chain disruption) – for example to identify any differences when the disruption being studied is not a pandemic. Therefore, future research may find nuances that we did not uncover in this study as our theoretical framework could also be applied to other types of disruption to further explore whether our propositions hold for other sustainability dimensions, such as environmental and cultural sustainability. Finally, further multi-disciplinary perspectives may provide further insights for the dance performance metaphor, such as the study of organisational sociology, which could further explain the dance performance between sustainability and resilience.

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Table 1. Company, participant and interview information

Organisation	Position Interviewed	Interviewee Code	April 2020	June 2020	September 2020	February/ March 2021	Total
Company 1	Manager	M1	26min	22min	38min	—	86min
	Employee	E1.1	—	—	—	23min	23min
	Employee	E1.2	—	—	—	19min	19min
Company 2	Manager	M2	15min	18min	42min	—	75min
	Employee	E2.1	—	—	—	25min	25min
Company 3	Manager	M3	18min	16min	—	—	34min
Company 4	Manager	M4	18min	29min	27min	—	74min
Company 5	Manager	M5	15min	17min	33min	—	65min
	Employee	E5.1	—	—	—	29min	29min
	Employee	E5.2	—	—	—	15min	15min
Company 6	Manager	M6	16min	19min	35min	—	70min
	Employee	E6.1	—	—	—	15min	15min
	Employee	E6.2	—	—	—	22min	22min
Company 7	Manager	M7	18min	27min	30min	—	75min
	Employee	E7.1	—	—	—	18min	18min
	Employee	E7.2	—	—	—	25min	25min
Company 8	Manager	M8	22min	18min	40min	—	80min
	Employee	E8.1	—	—	—	33min	33min
Company 9	Manager	M9	17min	15min	32min	—	64min
Company 10	Manager	M10	23min	24min	53min	—	100min
	Employee	E10.1	—	—	—	45min	45min
	Employee	E10.2	—	—	—	72min	72min
	Employee	E10.3	—	—	—	33min	33min
Company 11	Manager	M11	21min	19min	38min	—	78min
Company 12	Manager	M12	19min	—	—	—	19min
Other Local Institutions							
Consultancy 1	Suggested by Company 8	C1	—	—	—	42min	42min
Consultancy 2	Suggested by Company 8	C2	—	—	—	25min	25min
Consultancy 3	Suggested by Company 9	C3	—	—	—	44min	44min
Consultancy 4	Suggested by Company 1	C4	—	—	—	29min	29min
Cooperative 1	Suggested by Company 7	C5	—	—	—	37min	37min
Cooperative 2	Suggested by Company 9	C6	—	—	—	50min	50min
Total:	—	—	228min	224min	368min	601min	1421min

Table 2. Micro-foundations of Sustainability Capability

	Micro-foundation of sustainability	Sustainability dimension	Description	Key sources, including sample quotes (categorised according to the first order coding)	Other interviewee sources
		Sensing			
A	Human-centred management	Social	Refers to firms' intensified sensing of opportunities and threats to reduce the risk of contamination. It involves the need to care for employee and local communities' health, with the biggest concern being to secure lives.	**First order code: Increase health management** Generally, we hire many employees from other regions of the country during the harvest. So, it's very risky to bring them in and host them on the farm. (M1) If one employee becomes infected, the whole group can get sick. It's very complicated. (M8) You have to take care of the whole group. The responsibility is collective. This disease is very contagious. (M10) It was a collective fear. If one became infected, it would be a risk to all. (E7.1) Perhaps many will not want to come to work because they receive emergency aid from the government. (M2) This moment in time requires balance. All care for human life is important, but we [coffee producers] will also protect the food that sustains our families and the community at large. In the face of the coronavirus pandemic, we will keep activities safe, using all the tools we have. (Document 2, Press article, 2020)	M3, M4, M7, M11, M12, E1.1, C5, C6
B	Flexibility	Economic and institutional	Refers to firms' ability to change sustainability-related requirements or processes to maintain production during a crisis (adapted from Rajesh, 2018).	**First order code: Intensify the use of technological resources available** If many get infected on the farm, we may have to have a completely mechanized harvest. (M1) Much of it is mechanized, but some of the coffee is better harvested by hand. If we have to harvest everything by machine, this could compromise next year's production. (M5) We knew that there would be the possibility of harvesting everything using machinery. (E1.1) Mechanization is what would save the crop. (E6.1)	M3, M7, M8, M9, M10, M12,

				First order code: Manage the lack of workers The two biggest challenges we had last year, in the harvest, were due to the aid. I had a lot of problems with people who didn't want to work formally. The farms complained a lot about this. It was difficult to find an employee, because many people did not want to sign a contract. (C5)	M1, M3, M7, M8, M11, E1, C6
C	Horizontal collaboration	Institutional	Refers to firms' improvement of their inter-organisational relationships as a key source of information and knowledge from other producers.	**First order code: share experiences with other producers** We always talk through online meetings …. all sharing our worries. (M5) We take time to talk with other producers, and exchange concerns and ideas. We are all in the same situation, but we are not alone. It's all very uncertain. So I think this support is very important. (M7) Many online meetings and conferences have been held as a way to share our ideas and concerns during this crisis. (Document 3, Press article, 2020)	M1, M4, M12
D	Knowledge management	Institutional	Refers to firms' management of sustainability knowledge, as developed during the crisis (adapted from Beske, et al. 2014; Gruchmann et al., 2021).	**First order code: learn new procedures during the outbreak** In these moments of difficulties and uncertainties, we learn a lot. (M2) We have to constantly assess ourselves and rethink the relevance of our working groups. (M5) You will definitely learn a lot from this pandemic. (E7.2)	M1, M8, M10, M12,
E	Communication	Economic	Refers to firms' engagement with information acquisition and sharing for sensing opportunities and threats for sustainability practice (adapted from Gruchmann et al., 2021).	**First order code: Manage (future) risks of coffee demand** Coffee shops are all closed. It will impact consumption. (M2) So we're going to have a very big loss. Unfortunately, we don't know how long this will last and many of these coffee shops may not even reopen. (M5) The price of coffee has fluctuated a lot since the beginning of the pandemic. It's all very uncertain. (M7) There's a lot of concern about how the prices will change. (C4) Due to the economic crisis intensified by the pandemic, I am afraid that people will consume less coffee. (M2) Coffee is not a main item in people's diet, so it may happen that they reduce consumption if the economic situation	M1, M3, M6, M9, M10, M11, M12,

	worsens. (M7). There was a lot of fear about what coffee consumption would look like during the pandemic. (C6) It is already clear that [consumption] varied a lot and very quickly. (M5) The price of coffee is very good because many buyers are afraid of not being able to buy or import it later (M8). This tier of the chain [suppliers] is very important [...]. Covid-19 cannot shake the sustainability of the chain. We have to connect this tier to the customer. [...] Today, more people are interested in having sustainable coffee and they want to understand how it has been produced. (Press article, 2020) The coffee demand is still uncertain. It is important to monitor how consumer countries will recover. (Press article, 2020) There was this concern about whether it would affect consumption. (Document 6, Press article, 2021)	
Institutional	**First order code: Intensify the relationship with buyers and end customers** We will have to use social media more to encourage the consumption of specialty coffees at home as well. There are no open cafeterias, none. We post [*on social media*] that there is delivery, so that people don't stop buying our coffee that they previously drank in small coffee shops, roasters, mainly. Other farms were also doing the same to try to help boost consumption. (M7) We knew that the internet would be the salvation in these times of pandemic. (E5.1) This period was very difficult for small and medium-sized companies. Therefore, we decided to help them - our buyers - in a way that aligns with our values. [...] It was the first time that we did a campaign aimed at the end consumer. Our communication is generally b2b (business to business) but we wanted to show that the power to help small businesses was in the hands of consumers. (Document 8, Press article, 2020)	M2, M4, M5, M10, M11,
Seizing		

E	Communication	Economic and Institutional	Refers to firms' engagement with information acquisition and sharing for seizing opportunities and addressing threats for sustainability practice (adapted from Gruchmann et al., 2021).	**First order code: Provide additional information about the outbreak** Very often I post about our cafe and tag our customers. They asked for help in publicizing their company. (M6) We post everything we do as a social/environmental project. This serves as a means of structuring our knowledge and publicizing our work and product as well as including our organizational buyers and also publicizing these companies. (E10.2) Many campaigns have been held aiming to support our worldwide buyers. The idea is to motivate customers to buy our coffee through [our buyer] companies and support them during this time. [...] For each kilo of coffee, one tree will be planted. (Document 8, Press article, 2020)	M3, M4, M8, M9, M10, M12,
F	Support for health and safety culture	Social	Refers to firms' commitment to modify sustainability processes supporting health and safety by implementing measures to avoid infections and manage risks.	**First order code: Changes to existing internal procedures** To avoid bringing in too many people from other regions in the country, we did all the harvesting using machinery. It was too risky to put everyone together here. (M7) It is harmful to productivity to do all mechanized harvesting, but it was necessary at that time. (M11) We had to do mechanized harvesting only so, as to hire fewer people. Reduce the risk right? (E10.2) There was a reduction in the number of workers due to people's fear of contamination by the virus, but we adopted safety and distancing protocols. (Press article, 2021) The coffee plantation cycle faced difficulties during the harvest last year, the main period of advancing contamination by the coronavirus, but there was no compromise in production. One of the measures adopted by the coffee growers was the use of mechanization to avoid delay and loss. (Document 7, Press article, 2021) Investment in technology was one of the measures adopted. (Document 6, Press article, 2021)	M3, M5, M6, M8, C4, C6

				First order code: Create a safe operational scheme The company psychologist carried out an awareness campaign about preventive care. There was also support for employees. They were very anxious and worried. (M1) We explained the disease. The doctor talked to each group on the farm. We provided cleaning and hygiene materials to all employees. (M10) We were guided, we had lectures. (E3) The health personnel came and explained everything to us about this disease and virus. (E10.1) We help them to capture information and inform the group of employees. We prepare booklets, educational material and act. (C5)	
G	Adaptation	Institutional	Refers to firms' changing their routines to maintain operations and manage risks, including through the intensified use of technology to maintain production .	**First order code: Change the routine, including intensifying the use of technology** We started to control our own contamination curve. So, we started to issue daily bulletins, to carry out educational campaigns. We maintained social distancing and checked worker's temperatures. We believed that, in fact, we were doing what could be done. (M1) We don't receive salespeople and customers personally on the premises anymore. (M2) We alternate lunch times so the cafeteria doesn't get full, to keep the necessary social distance. (M4) We immediately started exporting as much coffee as we could. There was a risk that the ports would paralyze and we wouldn't be able to export. (M10) We had to change a lot here. This question, well, of machinery. We changed the machines, the tractor. (E5.1) Oh yeah, it was a quick change. Change in employee transportation, purchases, sales, meetings, everything. (C5) We've done everything we can on the internet. (M7) Our purchases, sales, audits, meetings. They are all online. (E1.1) Even the audits are being done online. (C1) Technology was essential. We did meetings, audits, all online.	M3, M5, M8, M9, M11, M12, E3, E5, E10.1, C2,

				(C4) During the pandemic, in 2020, there was an initial fear at the time of not being able to fully harvest due to the restriction of municipalities on the transit of people [...]. But we managed to get through it successfully. We had a record harvest, with large volumes exported and consumed. (Document 10, Press article, 2021) In the most recent harvest, amid the challenges imposed by the Covid-19 pandemic and climatic adversities, Brazilian coffee production proved to be resilient and, once again, presented us with spectacular coffees. (Document 7, Press article, 2021)	
		Reconfiguring			
H	Co-specialisation of assets	Institutional	Refers to firms' maintenance and further improvement of their online processes with a focus on changes in routines and sustainability. This target of sustainability leads to mutual specialisation of existing assets (adapted from Beske et al., 2014).	**First order code: Switching to the use of technology as a key resource** This is here to stay. Many things that we used to do in person, now we solve online and we are now doing things online more and more. (M8) We continue to use technology to our advantage. We are doing a lot of online calls and meetings, posting pictures and videos of the farm and coffee on social media. (M11) There's no turning back. We have greatly reduced our travel by keeping many of our meetings online. (E1.2) Even audits remain online. (C3) The producer says that the health crisis has been overcome by the company with an emphasis on three aspects: "worker health and safety, use of high technology and respect for protocols for the prevention of coronavirus". (Document 9, Press article, 2021)	M2, M7, M9, M10, E1.1, E5.1, C1, C4
I	Sense-making	Social	Refers to firms' maintenance and further improvement of hygiene care engagement by multiple actor levels within the supply chain (adapted from	**First order code: Enhancing the importance of increased hygiene during and post outbreak** We try to motivate everyone, daily, so that they don't stop washing their hands, wearing a mask and avoiding working too close to each other. I regularly send emails, messages by cell phone and we leave posters clearly visible. (M8) Coffee is a food and therefore hygiene and other care will be	M1, M2, M3, M5, M6, M7, E3, E5.1, C1, C3

	Gruchmann et al., 2021).	increasingly encouraged here. Not just because of the coronavirus, but because of the flu and other illnesses. (M12) In terms of organization and hygiene, the farm improved even more, so much so that we obtained another quality certificate. (E2.1) We learned to value people more. (E10.3) Hygiene was reinforced and continued. (C4) Coffee growers have adapted to the new normal on plantations and are reaping benefits. (Document 10, Press article, 2021)

Table 3 - Cross-case analysis - Resilience and sustainability as dance partners

Cases	Micro-foundations of Institutional Sustainability								Micro-foundations of Social Sustainability				
	Preparing				Responding	Transforming	SCRes Capabilities		Preparing	Responding	Transforming	SCRes Capabilities	
	B	C	D	E	G	H		Analysis per case	A	F	I		Analysis per case
1	x	x	x	x	x	x	Adaptability	Due to previous technological resources they were able to build flexibility (B) in comparison to the other micro-foundations. This lead to SCRes adaptability generating co-specialisation of assets to cope with the pandemic.	x	x	x	Organisation	Since the beginning of the pandemic, there was a concern with people care (i.e., human-centred management [A]), which led to the building of SCRes organisation capability and sense making of health and safety for social sustainability.
2	-	-	x	x	x	x	Visibility	The use of communication (E) and knowledge sharing (D) during the pandemic built SCRes visibility generating co-specialisation of assets to cope	x	-	x	Organisation	We found a move from preparing (Human-centred management [A]) to transforming (Sense-making [I]). However, they were very unusual as all workers lived on the farm, which

								with the pandemic.					meant that the responding step was not needed.
3	x	-	-	x	x	-	-	Although the case was able to create some micro-foundations of sustainability, there was no building of social-ecological SCRes due to the lack of transforming step.	x	x	x	Organisation	Since the beginning of the pandemic, there was a concern with people care (i.e., human-centred management [A]), which led to the building of SCRes organisation capability and sense making of health and safety for social sustainability.
4	-	x	-	-	x	-	-	Although the case was able to create some micro-foundations of sustainability, there was no building of social-ecological SCRes due to the lack of transforming step.	x	-	-	-	Although we found human-centred management (A), this case did not build SCRes in terms of social sustainability.
5	x	x	x	x	x	x	Adaptability Visibility	We found that this case was able to mobilise different resources to overcome the disruption. While technological resources led to flexibility (B), information resource enhanced communication (E) and knowledge sharing (D). Altogether they built SCRes adaptability and visibility generating co-specialisation of assets.	-	x	x	Organisation	Learning from others and their own experience they reactively created a culture of caring for people (F) building the organisation capability.
6	-	-	-	-	-	-	-	There was a lack of engagement with economic and institutional sustainability, and hence no related emergence of SCRes capabilities.	-	x	x	Organisation	Learning from others and their own experience they reactively created a culture of caring for people (F) building the organisation capability.
7	x	x	x	x	x	x	Collaboration Visibility	The case managed to learn from other producers, particularly through collaboration (C) and exchange of information via	x	-	x	Organisation	We found a move from preparing (Human-centred management [A]) to transforming (Sense-making [I]). However, they were very unusual as

								communication (E). This led to the building of SCRes collaboration and visibility.					all workers lived on the farm, which meant that the responding step was not needed.
8	x	-	x	x	x	x	Visibility	The use of communication (E) resources during the pandemic built SCRes visibility generating co-specialisation of assets to cope with the pandemic. Thus (E) was the most prominent micro-foundation used in this case.	x	x	x	Organisation	Since the beginning of the pandemic, there was a concern with people care (i.e., human-centred management [A]), which lead to the building of SCRes organisation capability and sense making of health and safety for social sustainability.
9	x	-	-	x	x	x	Visibility	The use of communication (E) during the pandemic built SCRes visibility generating co-specialisation of assets to cope with the pandemic. Thus (E) was the most prominent micro-foundation in this case.	-	-	-	-	There was a lack of engagement with social sustainability, and hence no emergence of SCRes capability.
10	x	-	x	x	x	x	Visibility Market position	Due to their position, the case was able to communicate (E) with different supply chain members, including creating new campaigns to engage end consumers with small buyers via knowledge management (D). These actions built SCRes visibility and market position generating co-specialisation of assets to cope with the pandemic.	x	x	x	Organisation Anticipation	Since the beginning of the pandemic, there was a concern with people care (i.e., human-centred management [A]), which led to the building of SCRes organisation capability and sense making of health and safety for social sustainability. In addition, the case built SCRes anticipation as they created scenarios to better manage social sustainability over the first year of pandemic.
11	-	-	-	x	x	x	Visibility	We note that the company only used communication (E) to build SCRes visibility generating co-specialisation of assets. Thus (E) was the most prominent micro-foundation in	x	-	-	-	Although we can found human-centred management (A), there was no evidence that this case built SCRes in terms of social sustainability.

								this case.					
12	x	x	x	x	x	-	-	Although the case was able to create some micro-foundations of sustainability, there was no evidence that social-ecological SCRes was built, due to the lack of transforming step.	x	-	-	-	Although we found human-centred management (A), there was no enhancement of SCRes in terms of social sustainability.
***Note**: A - Human-centred management; B - Flexibility; C - Horizontal collaboration; D - Knowledge management; E - Communication; F - Support for health and safety culture; G - Adaptation; H - Co-specialisation of assets; I - Sense-making.*													

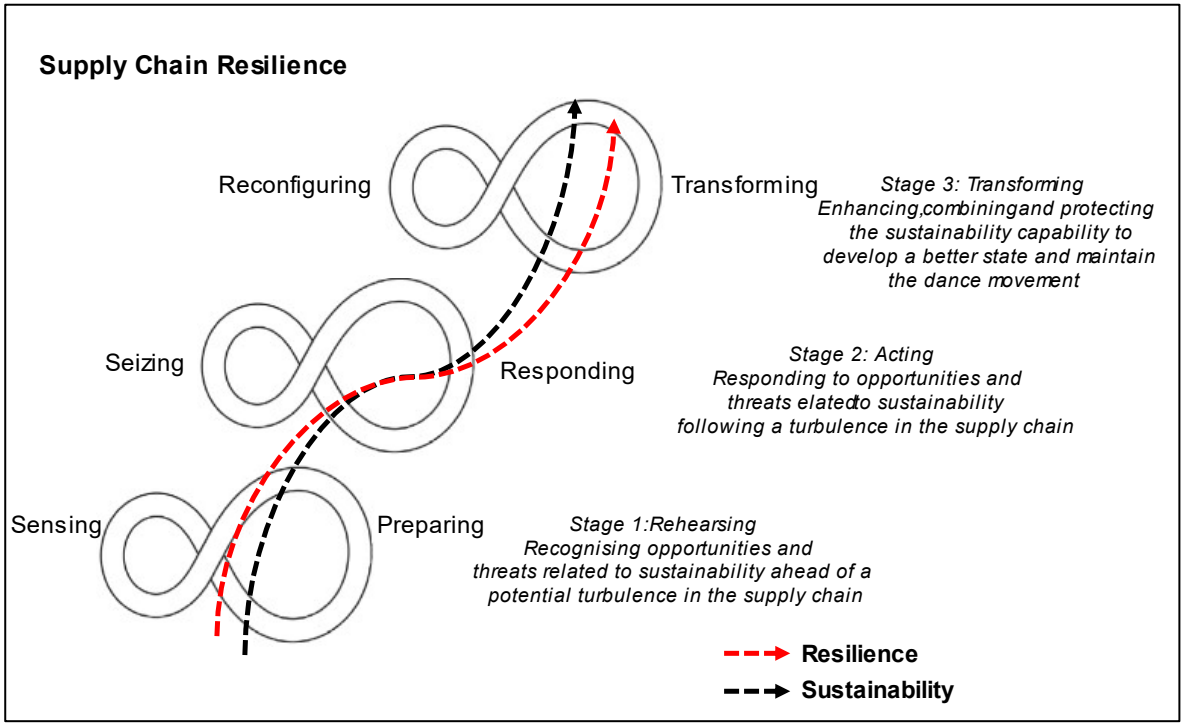

Figure 1: An integrative research model of resilience and sustainability as dance partners
Source: Inspired by Wieland (2021)

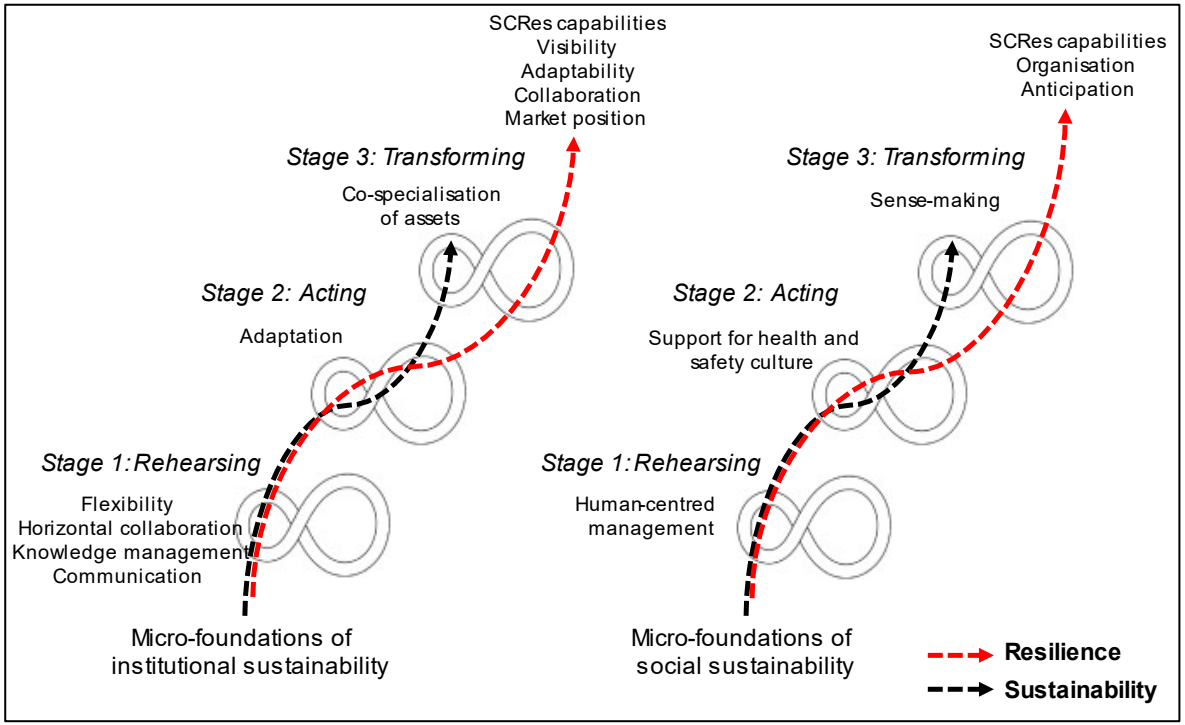

Figure 2. Resilience and sustainability as dance partners transforming supply chains in tandem