

Understanding supply chain orchestration mechanisms to achieve sustainability-oriented innovation in the textile and fashion industry

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ABSTRACT

To establish a Circular Supply Chain, companies must instigate transformative changes at the supply chain level, engaging various stakeholders both within and beyond their organisational boundaries. However, existing literature lacks successful examples of companies implementing circular economy principles and practical guidance on the strategies they should employ to effectively coordinate resources and capabilities for Sustainability-Oriented Innovation within Circular Supply Chains. To address these gaps, this study conducts a longitudinal field study with embedded cases, focusing on a sustainable fashion company as the main unit of analysis and 27 Sustainability-Oriented Innovation initiatives as sub-units of analysis. The investigation delves into the Resource Orchestration mechanisms employed to successfully implement four types of Sustainability-Oriented Innovation initiatives (i.e., B2C collections, B2B partnerships, Circular Service and Social Impact projects). The results provide valuable insights into strategies and practices conducive to achieving triple-bottom-line outcomes and introduce a novel process model for Sustainability-Oriented Innovation in Small-Medium Enterprises. Ultimately, the findings underscore the significance of tailoring Resource Orchestration mechanisms to different Sustainability-Oriented Innovation initiatives. This research contributes to the accumulation of knowledge at the intersection of Circular Economy, Sustainability-Oriented Innovation, and Resource Orchestration Perspective and offers practical implications for companies seeking to orchestrate their networks to achieve a Circular Supply Chain.

1. Introduction

The European textiles and fashion sector, comprising over 160,000 primarily small and medium-sized enterprises (SMEs) and employing around 1.7 million people, generates a turnover exceeding 160 billion euros (European Commission, 2022). However, textile consumption in Europe ranks fourth in environmental impact, affecting water consumption, greenhouse gas emissions, land use, and raw material utilisation (European Environment Agency, 2022). The fashion industry, utilising over 60 % of global textiles, significantly contributes to environmental damage (Ellen MacArthur Foundation, 2017), particularly with the rise of fast fashion, characterised by mass production, low prices, and large sales volumes (Brydges, 2021). This model produces over 90 million tons of textile waste annually (Colucci and Vecchi, 2021).

Circular Economy (CE) emerges as a solution, aiming to replace the current linear economic model and promote sustainable development.

CE strategies involve prolonging material use through recycling, remanufacturing, and reuse, addressing economic, environmental, and social dimensions. CE practices in textiles and fashion offer environmental and economic benefits, reducing environmental impact and production costs while enhancing sustainability and brand image. However, transitioning to CE in the textile and fashion industry faces challenges (Jia et al., 2020; Kazancoglu et al., 2020; Sacconi et al., 2023). Technical issues include limitations in textile waste sorting and recycling technologies, especially for complex materials. Operational challenges involve integrating take-back services, collaborating with supply chain partners, and dealing with high production and marketing costs of circular products. Consumer-related issues include raising awareness, changing consumption behaviour, and shifting from fast to slow fashion. Policy-makers, and especially the European Union, are pushing for a circular and sustainable transition of the sector and pushing for the adoption of technological solutions such as the digital product passport to increase transparency and raise end-consumer awareness of sustainable products

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and supply chains while at the same time, they are trying to regulate the market for textile waste and scrap through the Extended Producer Responsibility directive. Companies, thus, must adopt innovative business models aligned with CE principles, such as longevity and durability, access-based models (renting, leasing, sharing), textile collection and resale, and recycling. Eco-design principles, consumer education, and take-back initiatives are crucial to successful CE adoption. Overcoming these challenges requires a systemic approach involving the entire supply chain in the shift towards sustainability.

Establishing Circular Supply Chains (CSCs) necessitates the collaboration of a focal company acting as an orchestrator and other entities both within and beyond conventional supply chain boundaries to narrow, slow, and close the loops for materials and products (Berlin et al., 2022; Farooque et al., 2019). Recent studies (Saccani et al., 2023), based on evidence from companies at various levels of the supply chain, have highlighted how orchestrators can overcome the challenges associated with the circular transition by taking actions aimed at achieving greater integration, better information sharing, better capacity management, and improved customer engagement. Others (Adams et al., 2016; Neutzling et al., 2018) have stressed how the creation of CSCs requires the development and implementation of Sustainability-Oriented Innovation (SOI) at the supply chain level. Although achieving circularity in the textile and fashion supply chains through SOI has been recognised as a complex task worth empirical investigation (Franco, 2017; Jia et al., 2020), the existing research on SOI is still at an early stage of development, and, to date, it has (i) focused on companies (typically large enterprises) or supply chains as the unit of analysis and (partly because of that) (ii) overlooked implementation aspects (Franco, 2017).

This study conducts a longitudinal field study with embedded cases to address these gaps. The main unit of analysis is “Alpha” an Italian sustainable fashion company based in the textile district of Prato. The sub-units of analysis (embedded cases) are 27 SOI initiatives that Alpha carried out, involving 66 supply-chain partners. The investigation delves into the Resource Orchestration (RO) mechanisms employed to develop and implement SOI initiatives successfully. Building on the RO frameworks by (Parida et al., 2019; Sirmon et al., 2007, 2011), we classify SOI initiatives into four categories (namely, B2C collections, B2B partnerships, circular services, and social impact projects) and present an original framework identifying and describing the RO mechanisms necessary for implementing SOI initiatives and creating a scalable circular business model in the fashion industry. The developed RO process model for SOI provides novel insights on how an SME, with the role of the focal firm, can strategically orchestrate resources and capabilities in the CSCs context to achieve SOI and thus Triple Bottom Line (TBL) outcomes.

Our results show that different SOI initiatives require different RO mechanisms. This research contributes to the accumulation of knowledge at the intersection of CE, SOI, and RO perspectives. It offers practical implications for companies seeking to orchestrate their supply network to achieve a CE.

2. Literature review

This section first reviews the literature on SOI, then the literature on RO, and finally illustrates the research gaps, research question (RQ), and the research framework that guided our empirical investigation.

2.1. Sustainability-Oriented Innovation

The effective transition towards CSCs requires radical changes in values, business models and organisational structure at both company and supply chain levels (Adams et al., 2016). These changes can be introduced by developing and applying new knowledge through innovations (Neutzling et al., 2018). SOI consists of developing a product, service, process, management practice or new or significantly improved business model that contributes to tackling current sustainability issues

(Neutzling et al., 2018). The concept of SOI moves beyond similar ones proposed in literature – among which social, environmental, green, and eco-innovation – by addressing all three pillars of the TBL (Adams et al., 2016; Nilsson and Göransson, 2021).

While the primary goal of traditional innovation is gaining a competitive advantage, SOI is focused on achieving TBL outcomes. Despite this shift of focus, SOI contributes to increasing the competitiveness of firms in the new era of sustainable development (Neutzling et al., 2018). Prioritising the creation and subsequent delivery of social and environmental value – through close integration between the firm, local communities, and other stakeholders – SOI moves beyond pursuing merely profit maximisation (Adams et al., 2016). The inclusion of SOI in the business strategy contributes to the development of new sustainable products and services, with the potential to strengthen the market position of a company by making breakthroughs, improving brand reputation, and attracting new customers (Fontoura and Coelho, 2022; Neutzling et al., 2018). Thus, SOI is a strategic tool for companies to improve their overall performance, especially the TBL sustainability performance of their CSCs, and create long-term market opportunities (Brun and Ciccullo, 2022).

Nowadays, companies – especially those in complex supply chains, such as textiles and clothing – cannot rely only on their resources to develop SOI successfully (Köhler et al., 2022; Yang and Lin, 2020). Having limited resources, they need to enrich and extend their resource portfolio by working with supply chain partners, local authorities, and other organisations to produce sustainable innovation outputs with the most significant potential impact (Carnes et al., 2017; Neutzling et al., 2018). Growth-stage firms especially need to acquire new resources and develop them to create new capabilities by entering into partnerships with external actors (Carnes et al., 2017). Notably, a cross-sectoral collaboration between innovative small companies and powerful large companies has emerged as a significant opportunity for developing innovations to transition towards a CE, given that both types of firms generate superior value by working jointly (Köhler et al., 2022).

In the attempt to achieve SOI, companies tend to focus on operational optimisation at first, exploiting existing internal capabilities for incremental innovations based on technical adjustments of products and processes (e.g., reduced use of natural resources) aimed at decreasing environmental impacts (Adams et al., 2016). Broadening the focus from within the company boundaries to the immediate stakeholders allows companies to develop external linkages and exploit external knowledge to improve their sustainability performance by achieving social outcomes. The most significant potential for developing this kind of innovation concerning business models comes from startups, which seek to address sustainability beyond the traditional focus on environmental aspects by incorporating the social dimension and spreading awareness for sustainable consumption behaviour through their products (De Angelis et al., 2018). Systemic changes – necessary for addressing the current sustainability challenges through SOI – can be achieved only by establishing broad collaborations with multiple stakeholders, which allow a company to expand its research activities, especially concerning the ability to pick up weak signals and to develop new configurations of knowledge (Adams et al., 2016).

Developing SOI capability is quite challenging due to the need to acquire multi-disciplinary knowledge related to economic, social, and environmental aspects (Adams et al., 2016). This renders implementing radical changes quite complex for companies, which indeed, so far, have primarily directed their efforts towards improving existing products and processes or developing incremental innovations (Nilsson and Göransson, 2021). However, focusing just on minor adjustments aimed at attending to environmental challenges is not enough since SOI requires fundamental transformations on different levels, including business models, supply networks, technology, infrastructure, regulations, and consumer behaviour (Adams et al., 2016). In line with this, SOI capacity is the dynamic ability to adapt and reconfigure organisational resources, skills, and competencies to address contemporary

sustainability challenges (Adams et al., 2016). Radical innovations require the focal company to rely on its current suppliers and partners – generally involved in incremental innovation initiatives – and to find new suppliers and partners for knowledge integration (Nilsson and Göransson, 2021). Specifically, focal companies should cross their organisational boundaries to search for the necessary knowledge to develop SOIs. This requires engaging in a dynamic and iterative process whose stages are acquiring, deconstructing, recombining, and reconstructing knowledge. Transformative and pervasive changes in the current ways of conducting business are thus needed, and transitioning from linear to CSCs is recognised as such a change (Nilsson and Göransson, 2021). Due to their potential to entail fundamental changes in the supply chain structure, flows, and value creation strategy, SOIs represent a promising opportunity for sustainable industrial development (Nilsson and Göransson, 2021). Supply chain design and SOI are recognised as strategic drivers for fulfilling the goals of both CE and sustainable development in the CSC management context (Calicchio Berardi and Peregrino de Brito, 2021).

Although most enterprises have relied on their internal resources for innovation activities in the past, nowadays, due to ever-changing business environments, a shift towards networks of actors committed to sustainability is needed for the collaborative development of SOIs (Adams et al., 2016; Idrees et al., 2023; Yang and Lin, 2020; Zhou et al., 2016). The generation of novel ideas, resources, and capabilities within collaborative networks is fostered by the adoption of an open innovation strategy that allows firms to increase further the relational rents, i.e., supernormal profits jointly generated in collaborative relationships and that cannot be produced by a single firm alone (Köhler et al., 2022). The focal firm should manage the search, integration, and absorption of resources from different supply chains in the network to build a unique set of assets and thereby gain a sustainable competitive advantage (Köhler et al., 2022). However, controlling valuable and heterogeneous resources in the network is not enough since the successful development of SOIs also requires the focal firm to strategically orchestrate these resources (Carnes et al., 2017). Table 1 summarises and compares the main characteristics of traditional and Sustainability-Oriented Innovation.

2.2. Resource Orchestration

The RO Perspective – which draws on the overarching Resource Management theory (Sirmon et al., 2007) – has recently emerged as a promising theoretical perspective to understand how focal firms should manage their resources and capabilities in the context of CSCs to achieve TBL outcomes. The RO Perspective had a foundation in the seminal work of Sirmon et al. (2007), who first proposed a resource management process explaining *how* managers/firms transform resources to create value. Building on the Resource Based View (Barney, 1991), Sirmon argues that while it is true that possessing resources that are valuable,

rare, inimitable, and lacking substitutes is important, it does not necessarily lead to a position of competitive advantage nor ensure the creation of value for customers. Instead, they stress the importance of the resource management process and describe it as made of three main subprocesses, i.e., *Structuring* the resource portfolio, *Bundling* the resource into capabilities, and *Leveraging* those capabilities to create value for customers and wealth for owners. The *Structuring* subprocess entails acquiring resources externally (*Acquiring*), developing resources internally (*Accumulating*), and shedding firm-controlled resources that are no longer needed (*Divesting*), thereby creating the resource portfolio. The resources available in the firm portfolio must be combined to form or alter firm capabilities. This dynamic occurs in the *Bundling* subprocess, which includes making minor improvements to the existing capabilities (*Stabilizing*), extending current capabilities beyond just keeping skills up to date (*Enriching*), or even creating entirely new capabilities (*Pioneering*) in response to external or internal stimuli. Finally, in the *Leveraging* process, capabilities are applied in the value-creation process. Leveraging requires identifying the capability needed to exploit a market opportunity (*Mobilizing*), the coordination and integration of these capabilities into effective and efficient capability configurations (*Coordinating*), and, finally, the actual deployment of these capability configurations (*Deploying*). Sirmon et al. (2007), also underline that despite each component of the resource management process holding significance on its own, to maximize value creation, they must be synchronized. It demands top-level managers to engage across all stages of the resource management process while vigilantly monitoring the external environment to grasp meaningful opportunities or changes that may influence one or more components of this process. Carnes et al. (2017) point out that when dealing with innovation, managers of growth-stage firms emphasize resource acquisition, accumulation, and capability enriching and pioneering, while managers of mature-stage firms emphasize resource divestment and capability stabilization.

Concurrently to Sirmon et al. (2007), Helfat et al. (2007), drawing from the literature on dynamic capabilities (Teece et al., 1997), introduced the concept of *asset orchestration* as the dynamic capability of creating, extending, and modifying the company's internal and external resource bases. Hence, they contend that asset orchestration involves two core processes: search/selection, which requires the identification of assets and the design of business models, and configuration/deployment, which is done by coordinating co-specialized assets and encouraging innovation. Similar to the resource management framework, alignment between these processes is deemed crucial for leveraging the firm's resources to foster competitive advantages. Sirmon et al. (2011) stipulate that the two frameworks largely overlap, yet they identify important complementarities. Sirmon et al. (2011), thus, merge the concept of resource management and asset orchestration into a wider concept of RO and discuss how managers can shape a resource-based competitive advantage. They put forward that besides focusing on internal resources, businesses may invest in strategic alliances to acquire additional and complementary resources, such as tacit knowledge, that they lack, thereby bolstering their competitive advantage.

Another strand of literature, rooted in the work of Dhanaraj and Parkhe (2006) on innovation networks, has investigated orchestration mechanisms at a supply network or ecosystem level (Linde et al., 2021; Parida et al., 2019; Shi and Shen, 2022). Unlike RO, which focuses on value creation for an individual company, network orchestration prioritizes managing relationships and creating value for an entire network (Shi and Shen, 2022). The network orchestration usually involves a dominant focal firm (Kay et al., 2018; Parida et al., 2019; Pitelis and Teece, 2018; Schepis et al., 2018) that influences the performance of the network by aligning goals, promoting knowledge sharing, and fostering innovation. Linde et al. (2021) link the concept of dynamic *sensing*, *seizing* and *reconfiguring* capabilities (Teece, 2007) with the one of ecosystem orchestration. In particular, they emphasize how developing innovative value propositions requires orchestrators: (i) constantly searching, scanning, and exploring (potential) customers, competitors,

Table 1
Main characteristics of traditional and Sustainability-Oriented Innovation.

	Traditional innovation	Sustainability-Oriented Innovation
Goal	Gain a competitive advantage	Achieving Triple Bottom Line outcomes
Innovation focus	Technology	People
Capabilities and resources needed	Mainly internal	Internal and external, accessed through collaboration
Pervasiveness	Stand-alone (involves a single unit/department)	Integrated (part of the DNA of the company)
Knowledge needed	Specialistic	Multi-disciplinary
Change needed	Incremental or radical	Systemic
Firm's view in relation to society	Insular (focused on itself)	Systematic (part of the organisational ecosystem)

(Elaborated from Adams et al. (2016).)

and other ecosystem partners to identify new markets and technologies and understand latent demand (*sensing*); (ii) coordinating and combining the capabilities of ecosystem partners to deliver the value proposition (*seizing*); (iii) reconfiguring its resources and structures to changing environments and safeguarding reconfiguring activities of its ecosystem partners (*reconfiguring*). Similarly, Parida et al. (2019), referring to manufacturing transitioning to CE, distinguish between ecosystem readiness assessment and orchestration stages. The former requires orchestrators to analyse the external environment and ecosystem partners to identify capability gaps. The second is ensuring all parties can access necessary resources and capabilities and coordinating ecosystem members to meet common circular objectives.

The RO Perspective has been extensively applied within the context of the sustainable supply chain (Gong et al., 2018; Wong et al., 2015), CSC (Asante et al., 2022) and industrial ecosystems (e.g., Parida et al., 2019). Recent studies have dealt with textile supply chains and districts as well (Bressanelli et al., 2022; Saccani et al., 2023; Sandberg, 2023; Sandberg and Pal, 2024). Bressanelli et al. (2022) show how superior orchestration capabilities characterize successful textile firms producing circular fabrics and yarn in the industrial district of Prato. Saccani et al. (2023), referring to the same district, link supply chain orchestration mechanisms to possible responses to the challenges of CE adoption and define CSC orchestration as “a set of purposeful actions by a focal firm that coordinates and manages diverse interests, ensures alignment among CSC members, and structures, bundles and leverages resources to create circular value”. Sandberg (2023) demonstrates that RO capabilities were at the core of the successful implementation of a project aimed at recycling post-consumer used clothes by a leading fashion retailer. In addition, they point out that orchestration activities in the textile industry likely involve non-profit charity organisations, municipalities, retailers, brokers, and sorting companies. Sandberg and Pal (2024) identify a long list of capabilities needed in each textile-to-textile recycling supply chain stage and emphasize their interdependence and synergies. They argue that better collection practices and efficient pre-sorting activity lead to lower transportation and logistics costs and more efficient recycling. A common feature of the studies focusing on the textile industry is that they discuss the implementation of new circular products, practices, and business models that usually coexist with their core, established, linear counterparts (Stål and Corvellec, 2018) and provide no evidence of *if* and *how* circular initiatives scale (Sandberg and Hultberg, 2021). In this respect, Sandberg and Hultberg (2021), referring to the scaling logics of *scaling out*, *scaling up*, and *scaling deep* introduced by (Moore et al., 2015) in the context of social innovation, assert that merely observing the growth of a circular initiative in terms of numbers and geographic reach of individuals affected and/or revenue generated (*scale-out*) is insufficient. Other aspects, such as whether a circular initiative addresses regulatory or institutional barriers that could hamper the spread of analogous initiatives (*scale-up*) and whether it influences people's value systems and beliefs (*scale-deep*), must also be considered.

2.3. Research gaps, research questions, and research framework

SOI has been recognised as a pathway towards circularity, yet the body of knowledge in this area is still at an early stage of development (Adams et al., 2016; Carnes et al., 2017; Idrees et al., 2023; Zhou et al., 2024). The literature has focused on individual companies as the unit of analysis and lacks studies dealing with the implementation of SOI at the supply chain level (Aarikka-Stenroos et al., 2022; Trevisan et al., 2022). However, especially in highly fragmented supply chains such as the textile-fashion one, sustainable innovation processes require the coordination of numerous actors across the company's boundaries. They require focal firms to orchestrate these actors effectively to create and maintain the resource portfolio and the capabilities needed to enable innovation. The literature provides insights into the RO mechanisms that focal firms can apply to achieve this goal (Sirmon et al., 2007,

2011), yet empirical evidence in this area is limited to cases where orchestrators are resourceful and large (Sandberg, 2023; Parida et al., 2019; Trevisan et al., 2022) or medium-sized companies (Bressanelli et al., 2022; Saccani et al., 2023) with high bargaining power over suppliers. Moreover, the literature does not discriminate between the different orchestration mechanisms that can/should be activated depending on the SOI characteristics. However, SMEs and startups can be actors that can generate and/or orchestrate circular ecosystems and scale as sustainable circular businesses by implementing successful SOIs (Zhou et al., 2024; Idrees et al., 2023). To the best of the authors' knowledge, there are no models in the literature explaining how a company, through a gradual introduction of SOIs and a careful orchestration of internal and external resources, can create, from scratch, a fully circular and successful business, consistently scaling in terms of economic, social, and environmental outcomes. This paper addresses this gap by proposing a process model for SMEs operating in the textile and fashion industry. In this study, thus, we address the following RQ:

RQ. How can SMEs operating in the textile and fashion industry, orchestrate internal and external resources and capabilities to scale through SOI?

This paper aims to address this gap by proposing a process model explaining the process through which SMEs in the textile and fashion industry can orchestrate internal and external resources and capabilities and scale through SOI. The most relevant constructs from the RO literature (Sirmon et al., 2007, 2011) were purposefully adapted (see Table 2) to the context of the circular textile and fashion industry to build an initial conceptual framework (Fig. 1) whose aim was to guide our empirical investigation.

We hypothesise a model in which SMEs/startups can scale through the gradual introduction of new SOIs. Two macro-processes are identified: *Monitoring* and *Supply Network Orchestration*. In the former, SMEs scan the external environment and their current partners to identify opportunities for innovation (*sensing*). Once an opportunity is identified, key partners are involved in the project, and new or existing resources are bundled into capabilities that are subsequently leveraged to achieve TBL outcomes (*seizing, reconfiguring*). The introduction of different SOIs may require different orchestration mechanisms and lead to the consolidation of strategic resources and capabilities (internal and in the network). This accumulation of resources and capabilities, on the one hand, serves as the basis for the introduction of new SOIs and, on the other hand, improves the company's sensing capability and, as such, its capability to identify new opportunities for innovation. Each SOI, by definition, will impact the TBL, and consequently, successful implementation of SOI allows SMEs to scale *out*, *deep* and *up*. The two-stage process model reported in Fig. 1 resembles the one of (Parida et al., 2019) but with three fundamental differences. First, they consider ecosystem monitoring and orchestration as sequential stages i.e., as two stages of a one-way process, where first the orchestrator assesses its ecosystem parties to identify capability gaps, and then coordinates them towards common circular goals. Instead, we consider them as part of an iterative process characterising the introduction of each new SOI. Second, they do not link orchestration mechanisms to specific products/SOIs. Third, they consider ecosystem orchestration mechanisms that are typical of large and powerful companies that, on the one hand, can ensure access to resources and capabilities their partners lack, and on the other hand, can leverage their bargaining power to influence partners' behaviour.

3. Methods

This study employs a longitudinal field study methodology (Karlsson, 2016). Such a methodology involves in-depth examinations of phenomena occurring within an organisation “over time and in real-time” (Karlsson, 2016). It is particularly suitable for exploring and

Table 2
Orchestration process.

Orchestration process		Definition
Structuring	Acquiring	Acquisition of critical resources (human, financial, technical) necessary to implement a Sustainability-Oriented Innovation Inclusion in the supply network of new partners providing access to critical resources necessary to implement Sustainability-Oriented Innovations such as: - new recycled raw materials (yarns/fabrics/felts) - new ^a processes, allowing the use of recycled raw materials in a new way or the collection and recycling of used clothes - new ^a fragile and disadvantaged actors
	Accumulating	Internal development of the resources needed to implement a Sustainability-Oriented Innovation
	Divesting	Divestment of internal resources or interruption of relations with suppliers that are no longer needed as
Bundling	Stabilizing	- alternative new ^a and more sustainable resources allow the implementation of the Sustainability-Oriented Innovation - the Sustainability-Oriented Innovation fails Consolidation of the capabilities required for the production and marketing of a circular product or service
	Enriching	Development of new ^a capabilities needed for new and creative uses of known and already used recycled materials
	Pioneering	Acquisition of new ^a capabilities needed to create new products with materials that were never used before, or services never offered before
Leveraging	Mobilize	Identifying the (internal and external) capabilities needed to support capability configurations needed to exploit market opportunities
	Coordinate	Integrating identified (internal and external) capabilities into effective and efficient capability configurations
	Deploy	Deploying (internal and external) capabilities and their configurations to create value (in terms of TBL dimensions contribution)

^a "New" means that they were not available or had never been used before the introduction of the Sustainability-Oriented Innovation.

(Adapted from Sirmon et al. (2007, 2011).)

documenting change processes and developing theoretical frameworks or theories. Consistent with this aim, the methodology requires researchers to be continuously or intermittently present during the period under study and to gather data. We selected Alpha, a small-sized fashion company, founded in 2018 as the primary unit of analysis and the 27 SOI initiatives carried out by Alpha as sub-units or embedded cases. We selected Alpha as it is a company that managed to grow very quickly (2019–2022 compound annual growth rate of 99 %) by adopting a native and fully circular business model and by constantly implementing SOIs. In addition, one of the authors of this paper was employed at the case company for the entire duration of the study, thereby ensuring constant access to data. We have classified Alpha's SOIs into four main categories (described in detail in Section 3.4):

- (i) B2C collections (11 in total, referred to as C1, ..., C11),
- (ii) B2B partnerships (11 in total, referred to as P1, ..., P11),
- (iii) Circular services (3 in total, referred to as CS1, CS2, CS3), and
- (iv) Social impact projects (2 in total, referred to as SIP1, SIP2).

B2C collections and circular services are respectively *product lines* and *take-back services* permanently offered by Alpha. B2B are temporary initiatives aimed at creating, in collaboration with external partners, products that convey messages of sustainability. Social impact projects are initiatives that pursue well-defined social purposes and involve Non-Profit Organisations (NPOs) and/or disadvantaged people.

3.1. Data collection

The data collection phase employed multiple sources to enable evidence triangulation (Karlsson, 2016; Yin, 2013) and lasted for more than two years, from February 2022 to April 2024. Being one of the authors internal to the company, she gained full access to the organisation, which is generally a major obstacle for carrying out an in-depth case study. Moreover, working often with the CEO also allowed access to the case company's top management and strategic level. Observations and actions were noted in detail as they occurred, following a chronological order. As pointed out by Karlsson (2016), the involvement of someone with the role of an employee increases the quality and depth of the observations made. Data were gathered by actively working and participating in the organisation, where all the teams work collaboratively in a big open-space office, thus facilitating interaction, event observation, and action detection.

Both formal and informal interviews (i.e., not recorded conversations) were conducted with company employees and supply chain partners. The interviews were transcribed, categorised, and later coded in the data analysis phase to detect the presence of the constructs included in the predefined research framework. The company interviews involved multiple respondents with different roles. The total number of formal interviews conducted with internal actors was 22, covering 10 different professional roles, and each interview lasted between 30 and 75 min. Five of the informants were also involved in meetings throughout the data collection and analysis period. Table 3 provides an overview of the interviews with the CEO and employees of the case company. The questions asked in each interview are provided in Tables S3–S12 in the Supplementary materials.

Most of the interviews with supply chain partners were conducted during on-site visits, thus allowing observing the activities carried out by the directly involved and the relationship between Alpha and its partners. The interviewees include the most important suppliers and partners in the CSCs orchestrated by the case company; the full list includes as many as 66 partners (as reported in Tables S1 and S2). The questions included in the interview guideline (see Table S3) aimed at gaining an in-depth understanding of the partner core activities, their relationship with Alpha, and their involvement in the Alpha SOI initiatives. Most of the questions were answered by informants in high-level positions (e.g., company owner or project manager). At the same time, employees gave information and practical demonstrations of the company's processes and activities, mainly related to recycling processes. All the interviews and on-field observations were recorded for subsequent transcription, analysis, and interpretation. A total of 15 informants and eight supply chain partners were involved in 10 interviews. Each partner interviewed is engaged in more than one SOI initiative, specifically from a minimum of two to a maximum of eight. Table 4 summarises the interviews with the supply chain partners.

3.2. Data analysis

All the material gathered was carefully read and studied for data reduction and subsequent analysis. The definition of an initial research framework ensured the selection of relevant data and information only, as well as their coding according to the constructs (i.e., orchestration stages and mechanisms) identified in the literature and included in the framework.

Data analysis involved both a within-case analysis and a search for cross-case patterns of constructs among the SOI initiatives. By examining and interpreting the data and information selected and coded, it was possible to identify and categorise recurring events, i.e., RO mechanisms implemented by the case company across different stages for developing SOI initiatives. The initial conceptual framework's constructs and structure were adapted and reshaped to develop a new RO framework for SOI. The final framework was then corroborated by conducting a feedback session with the company's CEO and the apparel

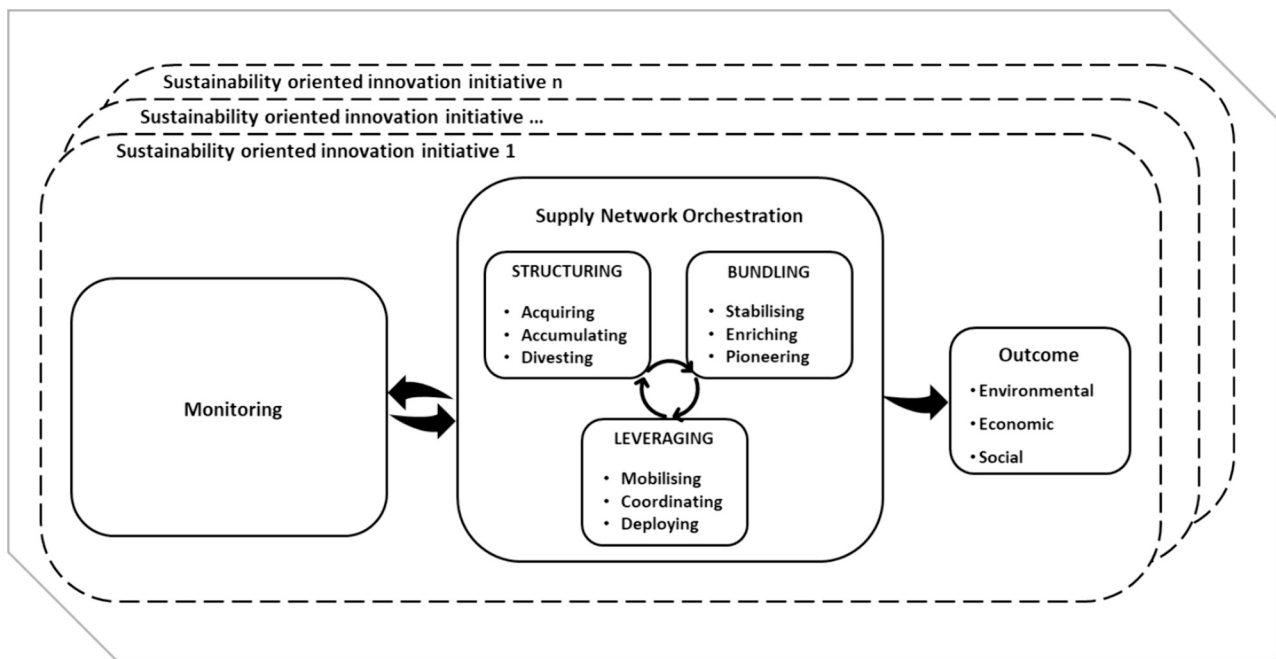


Fig. 1. Research framework.

Table 3
Informants from the case company.

Informant role	Number of interviews	Involvement in Sustainability-Oriented Innovation initiatives	Additional meetings
CEO	5	All	Yes
Product Developer	2	B2C collections and B2B partnership	
Fashion Designer	1	B2C collections and B2B partnership	
R&D Design Specialist	2	C7, C11, P10	Yes
B2B Sales Assistant	1	B2C collections	
Sales & Operations Manager	1	B2C collections	
Apparel & Fashion Professional	3	Circular services and B2C collections	
Customer Service & Logistics	2	All	Yes
Communication Designer	2	All	Yes
Communication Specialist	3	All	Yes

and fashion professional. The coding tree resulting from the analysis of the collected data is shown in Fig. 2.

3.3. Case description

Alpha is a sustainable fashion brand of clothing and accessories made from recycled and recyclable materials based in the textile district of Prato, Italy. It was established in July 2018 after two crowdfunding campaigns in 2017 and 2018 and an acceleration programme for innovative start-ups. Since 2022, it has been adopting the legal status of B-Corp. In 2023, Alpha achieved a turnover of 3 M€ (67 % in Italy) and produced 72.169 pieces of clothes and accessories using 14.1 tons of recycled fibres, 14 % of which were collected with its own take-back circular services. 85 % of the fibres used by Alpha are recycled and 15 % are virgin (8 % of which are organic).

3.3.1. Internal structure

Alpha is organised into five teams: *Product Development & Design*, *Communication & Marketing*, *Sales & Operations*, *Sustainability & Innovation*, and *Accounting*. Alpha organizes its activities by adopting a project-based approach. Each SOI initiative is considered a project. The allocation of the existing resources as well as the acquisition of new resources, depends on the activities to be carried out and the goals to be

Table 4
Informants from the supply chain partners.

Partner ID	Partner role	Turnover	# of employees	Initiative IDs	Informant(s) role	Date(s)	Duration (h)
4	Yarn production	5.7 M€	29	C2, C7, P8	Commercial Director, Project Manager	06-Apr-23	2
20	Yarn production	45.4 M€	94	CS2, C1, P1, P2, P4, P11, SIP1	Vice President, Employees	24-Mar-22, 12-Nov-22	1
23	Sorting and shredding	3.6 M€	5	CS1, SIP1	General Manager, Employees	24-Mar-22, 12-Nov-22	1
24	Sorting and shredding	5 M€	23	CS1, P6, SIP1	Company Owner, Employee	24-Oct-22	1
49	Yarn production	11.2 M€	48	CS2, C6, C8, C7, P9	Company Owner	10-Mar-22	1
51	First sorting and sanitisation	13.3 M€	365	CS1, CS2	Project Manager	24-Oct-22	3
52	Material and Packaging production	19.1 M€	86	C11, P10	Research & Development Manager	24-Oct-22	1
64	Sorting and shredding	0.8 M€	12	CS2	Company Owner	24-Oct-22	1

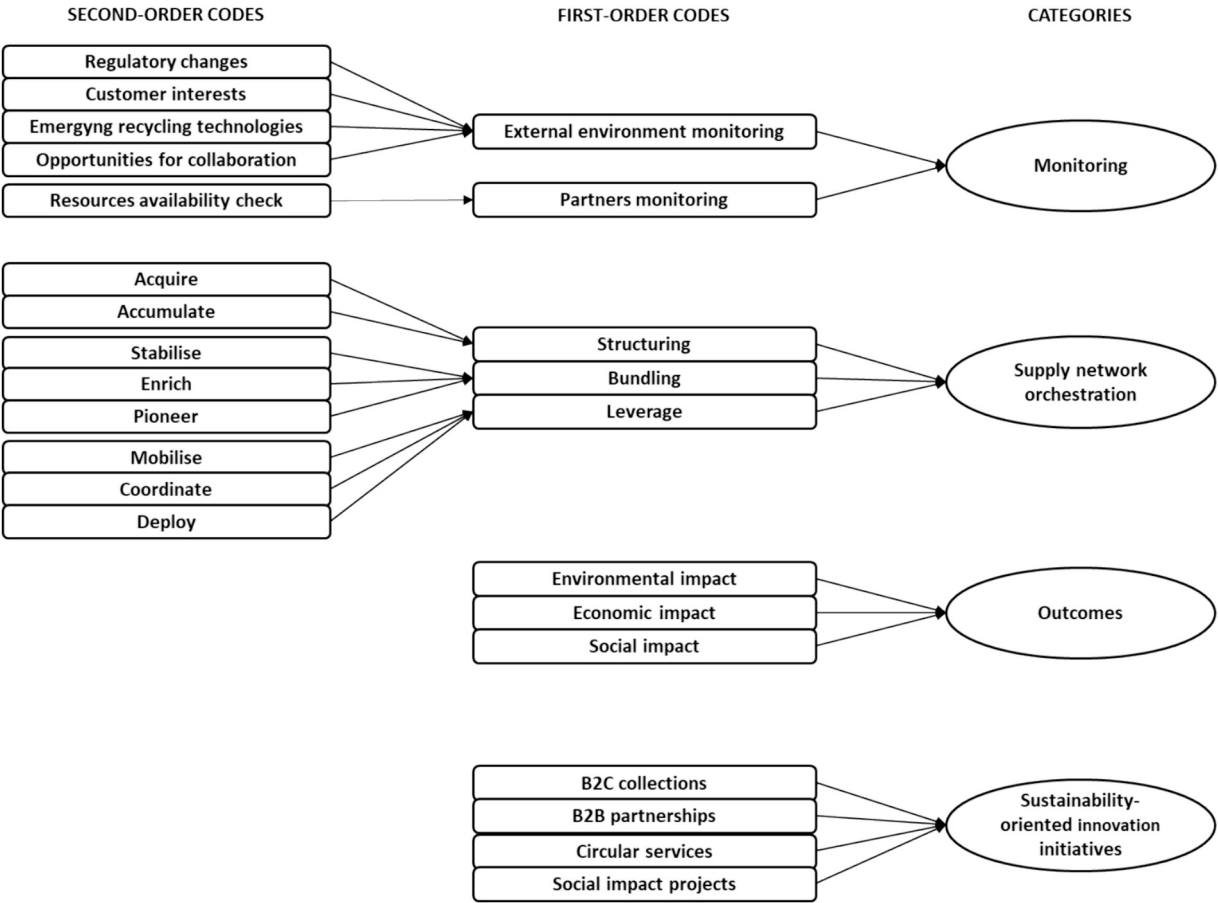


Fig. 2. Coding tree.

achieved for each specific initiative. The CEO executes the strategic planning of each SOI initiative, specifically defining the key activities to be carried out, and the outcomes and objectives to be achieved. Based on this, a dedicated cross-functional team with an assigned budget is created and a team leader is designed. Team leaders then assign specific tasks to their team members and set a deadline for the completion of each task. Team members regularly meet with the CEO to report on achievements and issues. For clothing collections and circular services, which are continuous, the created cross-functional team is permanent, while for collaborations and social impact projects, which generally have a predetermined duration, it is temporary. Thus, once temporary initiatives are complete, the involved resources are moved to form cross-functional teams for the new projects. This type of organisational structure allows the creation of a strong team culture, cross-functional learning, and knowledge transfer within and across the company boundaries.

The Product Development & Design Team is devoted to the development of sustainable garments and accessories characterising B2C collections and B2B collaborations. All Alpha products are designed in compliance with eco-design principles: all of them are made from recycled and recyclable materials and have a timeless and trans-seasonal style. This means that they are designed to be reused, repaired as much as possible and recycled at the end of their life. New collections always stem from the desire to exploit new recycled materials. Starting from recycled material entails fundamental changes in the traditional design process of new collections.

“Usually, a new collection starts from the designers’ inspiration and is driven by their desire to express a certain concept or theme as a means of clothing pieces. Material, fabrics, colours, and accessories are then chosen accordingly. For us, instead, a new collection always originates from the

idea of using recycled fibres innovatively. When we decide to launch a new collection, we must first understand what technical limits the adoption of such a recycled fibre will pose. Then we strive to design a piece of cloth that can be reused over time and recycled at the end of its life.”

Fashion Designer at Alpha

Designing a new collection always requires interaction with current partners (including consultants) and identification of new suppliers (among them, indeed, the suppliers of the latest materials) with the needed resources and capabilities. Supplier selection occurs following environmental and social sustainability principles.

“Partners and suppliers are selected based on three main driving criteria: quality/cost trade-off, workplace ethics, and geographical distance. If possible, we tend to source from local suppliers, both for environmental concerns and because it makes it easier to control our suppliers and implement a small batch production model. In any case, each of our suppliers must adhere to our Code of Conduct and hold third-party certifications for recycled materials, ensuring compliance with environmental and social criteria.”

CEO & Founder at Alpha

The interaction with suppliers and consultants occurring when new collections are released allows the development of new capabilities in the Product Development & Design Team that are subsequently leveraged to improve and enrich the collection and establish new collaborations with companies interested in products made from the same materials.

The Communication & Marketing Team is responsible for creating and sharing relevant, consistent, and valuable content (e.g., text, images, videos, blog posts) – related to each SOI project and sustainable fashion in general - intended to reach and engage customers. These

contents are conveyed through the company's website and multiple social media platforms. As part of its marketing endeavours, Alpha organizes textile tours, i.e., guided tours of its supply chain partners, dedicated to potential customers and partners, as well as schools and universities, to give visibility to Alpha's CSCs.

“Circular fashion has a foundation on the work of individuals such as sorters, recyclers, and producers of recycled yarns and fabrics, whose fundamental work does not receive the appreciation and visibility it deserves. Valuing our closed-loop supply chain is a powerful tool to promote our territory and products.”

Communication Specialist at Alpha

The Sustainability & Innovation Team engages in *boundary-spanning* activities to capture signals of incoming changes in the competitive landscape, filtering them and turning them into valuable insights and ideas. These activities include systematic monitoring of regulatory and political changes, competitive benchmarking, technology scouting, and frequent interactions with customers and suppliers. As Alpha's take-back programs are a distinctive feature of its regenerative/circular business model, this team is also responsible for managing circular services, setting targets in terms of collection volumes and structuring the collection network, qualifying and adding new partners and/or taking care of the set-up and management of new collection points at the facilities of established partners.

The Sales & Operations Team is responsible for the effective and sustainable implementation of the pre-order model adopted by Alpha and for managing the stock to avoid overproduction. Sales occur through non-proprietary physical stores in Italy and abroad (332 to date, 148 in Italy) and the company website. Alpha organizes production in small batches (<100 SKU per batch) to prevent overproduction risks and favour better quality control. To facilitate production planning throughout the supply chain and avoid stock and overproduction, it uses a presale model to launch collections in advance so that customers can pre-order at discounted prices. In addition, it provides warranty and repair services to prolong the life of its garments. Finally, it employs a no-discount strategy, maintaining fair prices to cover the production costs of its local suppliers, discouraging impulse buying, and better communicating the value of its products.

“In the past, we utilized the specialized e-commerce platform, yielding favourable results in terms of sales volumes. Regrettably, our products were frequently listed online at significantly discounted prices, diminishing their perceived value, and adversely affecting the sales of our business partners. The discounts we offer on pre-sales are not intended to stimulate over-consumption, but to anticipate the purchasing decisions of our customers, facilitate the work of our supply chain partners and avoid stockpiling”

Sales and Operations Manager at Alpha

3.3.2. Supply network structure

Alpha operates in the textile district of Prato, where there is a strong specialisation in the production of woolen yarns/fabrics and an ancient tradition in wool mechanical recycling and production of natural-colour no-dye yarns (Bressanelli et al., 2022; Saccani et al., 2023). Alpha buys recycled yarns and fabrics, internally designs garments, and outsources the final stages of the garment/accessory manufacturing process to artisans. Woolen and cashmere yarns (but also the Denim ones) are entirely sourced from suppliers located in Prato. Other recycled fibres (e. g., silk and cotton) are sourced outside the district.

Approximately 90 % of Alpha's supply chain partners, from material sourcing to garment manufacturing, are located in the Prato District. To produce clothing made from recycled materials, the company has set up multiple CSCs, and created linkages among yarn suppliers, fabric suppliers, garment manufacturers, social cooperatives of sorters, local authorities, logistics providers and NPOs. Alpha manages and coordinates

the flow of materials and products between these actors, establishing a collaborative relationship based on mutual trust, information sharing, and joint decision-making.

“We have started collaborating with Alpha since the very beginning, with the first crowdfunding campaign. Initially, we did not really understand the project. In Prato we have always produced fabrics from recycled wool and our skill has always been to do it in a way that no one would notice. Using recycled fibre was something that helped our customers keep costs down without compromising too much on quality. Alpha wanted to take pride in using a recycled material in the first place, without yet fully understanding the issues that can arise from using a recycled yarn or fabric. We saw the project evolve and closely worked together with Alpha to address the challenges they faced in developing their products.”

CEO at Partner 24

The company purposefully selects the partners to be involved and activated in each SOI initiative, depending on the specific needs and goals set for each initiative, orchestrating the resources and capabilities available in its supply network.

3.4. Embedded cases description: sustainability-oriented innovation initiatives

As pointed out in Section 3, we have classified Alpha's SOIs into B2C collections, B2B partnerships, circular services, and social impact projects. Each type of SOI is described hereafter.

3.4.1. B2C collections

B2C collections are product lines that have become a permanent part of Alpha's offerings. Specific recycled fibres characterize each product line. B2C collections are renewed and launched on the market for the Autumn/Winter and Spring/Summer seasons every six or twelve months. To prevent overproduction, >40 % of the styles offered each season are carryover products from the previous season. Alpha's clothes and accessories are covered by a warranty service that guarantees free repair in case of imperfections (203 items were repaired in 2023). Furthermore, a take-back service permits customers to return a clothing item after five years. If the product is in good condition, it undergoes free repairs; otherwise, it is recycled, and the customer receives a coupon in exchange.

C1 - Recycled Cashmere and Wool knitwear is a collection featuring clothing (knitwear and tracksuits) and accessories (hats, scarfs, gloves, and blankets) designed by Alpha and crafted from recycled cashmere/wool yarns obtained through a sustainable no-dye mechanical recycling process. C1 was the first collection developed by Alpha:

“We started our venture with the production of cashmere scarves and hats. First, they were very simple to design and produce, and we could easily source locally valuable recycled raw materials at a reasonable price. The opportunity to locally source a secondary raw material of comparable quality to virgin one but at a significantly lower cost, coupled with the fact that no one in Italy was selling recycled cashmere and wool sweaters motivated us to create our first collection [C1]. For these products, we could set a price way lower than that of a premium fashion brand's cashmere sweater, which ensured robust sales volumes. Such a price though was way higher than that of a typical fast-fashion sweater, which allowed us to ‘signal’ the value of our product.”

CEO & Founder at Alpha

Starting this collection, however, required adequate resources to design the product and communicate our value proposition. To this end, Alpha hired a content creator, a fashion designer, and a communication specialist and established relationships with

strategic partners (20), providing access to strategic resources - recycled wool and cashmere yarns - and capabilities related to the production of *knitting* products.

C2 - Recycled Cotton includes t-shirts, polo, and tracksuits, made of a sustainable coloured cotton yarn named ECOLIFE composed of 50 % recycled cotton from pre-consumer industrial cotton waste and 50 % virgin organic cotton, sourced from a well-known Spanish supplier (4) and manufactured and embroidered by local artisans most of which already in the Alpha supplier network. Such a collection allowed Alpha to develop the skills required to produce recycled cotton items and to access a resource (recycled cotton) for which no Italian suppliers were available.

C3 - Recycled Cotton Accessories include beach towels, blankets, and shawls. Due to the lack of local alternatives, these products are produced by resorting to a raw material supplier (26) and a garment maker (39) located outside the Prato district in Northern Italy.

“Contrary to cashmere and wool, recycled cotton has a cost comparable to virgin cotton. This, coupled with higher market competition, significantly constrains the profitability of the collections. Nonetheless, we believe it’s crucial to diversify our product range and by working with our supply chain partners, develop the skills to design and produce garments with increasingly more recycled fibres. We aim to raise awareness of environmental concerns inherent in each fibre, such as water consumption, particularly relevant in the case of cotton.”

CEO & Founder at Alpha

C4 – Zero Waste Collection features striped socks, gloves, travel laundry bags, scrunchies, and pochettes. All these products are obtained from recycled cotton and cashmere yarns leftover from the production of the corresponding collections. These accessories originated from the joint effort of Alpha and one of its established suppliers (9).

C5 - Recycled Carded Wool includes coats and hats made from recycled woolen fabrics locally sourced from (40) and obtained from pre-consumer industrial fabric surplus with the addition of recycled polyamide. The introduction of such a collection required the acquisition of capabilities related to the design and production of products out of recycled woven fabric.

C6 - Recycled Denim includes knitwear made from recycled denim yarn obtained by recycling 100 % cotton old jeans, an innovative recycling process developed by a local supplier (49) producing knitting and weaving yarns, and directly involved in the denim recycling process. Garments are produced by local knitting companies that are also involved in the production of C1. The experience gained with recycled denim yarn also led Alpha to develop an innovative fabric called denim twill and canvas, which has subsequently used in the development of new collections (C7, C8).

“I wanted to use our recycled denim yarn to create something different from sweaters. I came up with the idea of creating a denim twill fabric with this yarn and studied how to develop it together with technicians of a woollen mill in Prato (7)”

Apparel and Fashion Professional at Alpha

C7 – Home collection includes tableware, blankets and pillow covers, born out of a desire to go beyond garment production and find new uses for denim twill, canvas fabrics and cashmere yarns. In addition to consolidated local garment makers, the production of this collection involves a local social cooperative (11) employing disadvantaged people.

C8 - Recycled Denim Twill and Canvas includes clothing and accessories based on innovative denim fabric, i.e., the denim twill and canvas, co-developed with a local supplier (7). The collection uses yarns from an established supplier (49). Alpha extended the recycled denim collection, mainly consisting of sweaters, by creating a new collection, including trousers, dresses, shirts, and jackets, whose production required new skills and suppliers. In addition, accessories such as hats and shoppers were added to the collection, involving a social cooperative (11) in their production, thus increasing the social impact of this SOI.

C9 - Recycled Jeans Sweatshirt includes sweatshirts and sweatpants made from recycled fabric from old jeans, which are particularly suited for producing tracksuits whose demand at the time the collection was launched was rising due to the COVID pandemic. To catch this opportunity, initially, Alpha sourced this fabric from a Spanish company (18), which was then replaced by a local fabric supplier (33) that uses the yarns supplied by an established Alpha supplier (49).

C10 - Recycled Silk Collection is a capsule collection that includes a cardigan, a polo, and a stole made from an innovative recycled silk yarn obtained by processing virgin mulberry silk industrial waste. As for C2, and C3, this collection too was created resorting to the competency of a specialized provider (55) located in Northern Italy in the silk district of Como. The production phase is outsourced to an established, trusted local garment manufacturer (45).

“As with cashmere, recycled silk has a lower cost than virgin silk. However, there are limitations on its use. While with recycled cashmere it is possible to create products similar to those obtainable with virgin fibre, with recycled silk the range of use is limited to lower-margin products. With recycled silk, for example, it is not possible to make shirts. Recycled silk, yet can be used to create knitting yarn, the use of which is not very different from the one of yarns we are accustomed to using to produce our garments.”

Sustainability & Innovation Management at Alpha

C11 – Fluffypack is a reusable bag made of recycled felt used for shipping online orders, thereby replacing disposable cardboard packaging. Alpha collaboratively designed this package with a company (44) producing felts from textile waste. This material, due to its composition, is unsuitable to be used in the apparel industry and it is typically downcycled and used to create insulation for the automotive and construction industries.

3.4.2. B2B partnerships

B2B partnerships are initiatives carried out jointly with partner companies wishing to convey sustainability-related messages through products purposefully created by or together with Alpha from recycled materials. B2B partnerships have a variable duration, generally lower than one year.

With **P1**, Alpha created a recycled cashmere ‘capsule’ collection of embroidered sweaters, collaborating with the designers of an Italian clothing brand to launch a campaign against Black Friday. With **P3**, Alpha produced sweatshirts made from recycled materials obtained from a soccer team’s uniforms. With **P4**, a knitting kit was created by a knitting company with Alpha-branded recycled cashmere. This kit aimed to stimulate people to create handmade knit garments and encourage emotional attachment to clothing. **P8** led to the creation of a capsule collection made of recycled cotton t-shirts reporting sketch sentences created with a media company to convey inclusivity messages. With **P5**, Alpha coordinated the recycling of old jeans of a famous brand and their upcycling into a patchwork bucket hat. The sewing process was carried out by a social cooperative involving vulnerable people. Profits from the sale of these products were used to finance work

traineeships for people in conditions of social disadvantage. P10 led to the creation of a felt bag by recycling the flannel bags leftovers of a luxury fashion brand, which subsequently distributed the new bags as corporate gifts to its employees. Finally, P2, P6, P7, P9, and P11 focused on crafting personalized corporate gifts from various recycled materials. These gifts were then distributed by Alpha's corporate customers to their employees, showcasing the company's commitment to sustainability.

3.4.3. Circular services

Circular services are take-back services, permanently offered by Alpha, to (i) raise consumer awareness of the value of their used clothing and (ii) feed its CSCs. Customers who donate their clothing receive a discount code to be used in the Alpha online shop. Circular services are specialized by material and involve a dedicated CSC coordinated by Alpha.

CS1 aims to collect and recycle 100 % of wool and cashmere sweaters. Collection occurs at 60 retailers, where customers can drop off their 100 % wool or 100 % cashmere sweaters in special boxes and obtain an online discount code in return. Customers can also ship their sweaters. Collected sweaters are sorted and selected by a social cooperative (51). Clothes in good condition are reused and sold in the cooperative's second-hand shops, while others are recycled by a local supply chain, including a sorter (23) and a yarn producer (20) who supplies recycled yarns to Alpha.

CS2 aims to collect and recycle old jeans. Collection occurs using Alpha-branded collection boxes placed in the physical stores of Alpha partners. CS2 involves a social cooperative that sanitises and sorts the collected jeans, a recycler that shreds and reduces them to a fibre state, and a yarn producer that converts fibres into new yarn. Alpha uses recycled yarns to produce its clothes. Alpha coordinates the physical and information flows in the CSC.

“The pain point of recycling denim is that a minimum quantity of 5 tons of jeans is required by the supplier to start the production process. To reach this quantity, we have planned an expansion strategy for the collection network, involving the inclusion of new partners [typically B-Corps operating in Italy] and the expansion of collection points at existing partners facilities.”

Sustainability & Innovation Manager at Alpha

For both circular services, consumers who donate their used clothes receive a discount code for the Alpha online shop.

CS3 aims to collect and recycle old 100 % cotton workwear to produce new work uniforms made from 50 % recycled and 50 % organic cotton. Due to a lack of local suppliers able to recycle open-end cotton fabric, Alpha decided to involve its Spanish recycled cotton supplier (4). The project however was discontinued due to excessive logistic costs.

“Various companies operating in different sectors such as hospitality, food, and manufacturing provide their employees with cotton workwear that needs to be frequently replaced due to wear. This creates enormous quantities of cotton textile waste that could be recycled. CS3 was conceived to address this problem. However, the service never started because organizing the collection of workwear in many different sites and - most of all - shipping this material to Spain, generates costs far higher than the revenues that can be obtained from the sale of the collected material. We will probably re-launch the project if we can find a local recycler and cut logistic costs”

CEO and Founder at Alpha

It's worth highlighting that, currently, circular services do not fully address Alpha's secondary raw material requirements (CS1 covers 65 % of Denim fibre needs, CS2 covers 13 % and 2 % of wool and cashmere fibre needs, respectively). However, they have played a vital role in (i) developing crucial skills related to managing reverse logistics processes, (ii) strengthening ties within supply chain partners (in total 120 partners were involved and 227 collection points were set up), (iii) promoting

sustainable consumption habits (over 1500 individuals donated at least one garment in 2023, of the 3089 items collected, 50 % were reused, 40 % recycled, and 10 % disposed of), and finally (iv) promoting the Alpha's brand and providing visibility to its CSCs partners.

3.4.4. Social impact projects

Social impact projects are initiatives with a well-defined social purpose that goes beyond the involvement of social cooperatives and enterprises usually operating in Alpha's supply chain. We identified two initiatives. The first (SIP1) consists of a donation to a local NPO of 2€ for every purchase made online to fund social services to support the local community. The second (SIP2) is an initiative promoted by Alpha in collaboration with various institutional stakeholders such as municipalities, trade associations, NPOs, and corporate sponsors, aiming at organizing and financing internships for migrants selected from the local migrant reception centre. The ultimate goal of the project is to help migrants find legal and fairly paid employment while preserving local textile crafts that are at risk of disappearing, such as rag sorting.

4. Results and discussion

This section first presents a cross-case analysis of the embedded cases (Alpha's SOI initiatives), then it presents the process model emerging from our study along with a discussion of the study's results.

4.1. Cross-case analysis

In Table 5, all the SOI initiatives carried out by Alpha are mapped in terms of the year when the initiative was launched (Year), partners involved (Partners) and TBL outcomes achieved (Economic, Social, Environmental). Concerning the column “Partners”, local suppliers are identified in bold, suppliers of direct materials (yarns, fabrics, or felts) in italics, social cooperatives/NPOs are underlined, and an asterisk identifies that the supplier was used for the first time in the corresponding SOI initiative. The initiatives are chronologically ordered. The contribution to the TBL was assessed by considering:

- Whether the initiative was profitable (*economic dimension*) (in line with Jo and Kwon (2021) and Sudusinghe and Seuring (2022))
- Whether the initiative involved social cooperatives and/or NPOs, either directly or indirectly through donations (*social dimension*).
- Whether the initiative contributed to reducing the negative environmental impacts generated by the industry (Sudusinghe and Seuring (2022)) (*environmental dimension*).

Since they are very sensitive data, the profits generated by each SOI, despite being available, is not provided here. Instead, in Table 5 we consider a SOI as having a positive outcome (X on the column “Economic”) if it has proven profitable. As far as the environmental dimension is concerned, Sudusinghe and Seuring (2022) suggest that the use of recycled materials in production processes can be considered an environmental outcome per se. Consequently, B2C collection, B2B collaborations, and circular services all contribute to the environmental dimension. The environmental impact of Alpha's SOI can also be inferred from the Life Cycle Assessment (LCA) reported on its Sustainability Report 2023 which quantifies the benefits of using these materials over virgin materials in terms of water, energy, CO₂, and chemicals consumption. For materials used in small quantities, the LCA analysis is not available, but they are recyclable and certified (in the case of silk being 100 % recycled implies that no silkworms are killed in the production process). Table 6 reports for each main type of fibre the main supplier involved, the collections in which it is used, the related certifications, and the use of resources evaluated through the LCA (when available).

From the cross-case analysis emerges that is possible to identify different types of SOI initiatives characterised by different orchestration mechanisms and TBL outcomes (Table 7).

Table 5
Sustainability-Oriented Innovations initiatives characteristics.

ID	Sustainable-Oriented Innovations	Year	Partners	Economic	Social	Environmental
C1	Recycled Cashmere and Wool Knitwear	2017	2^a , 14^a , 17^a , 20^a , 27^a , 28^a , 37^a , 41^a , 45^a , 48^a , 56^a	X		X
C2	Recycled Cotton	2018	4^a , 9^a , 46^a , 47^a	X		X
C3	Recycled Cotton Accessories	2019	26^a , 39^a	X		X
C4	Zero Waste	2019	9	X		X
CS1	Take-back service for used cashmere/wool sweaters	2019	20 , 23^a , 24^a , 42^a , 51^a , 56	X	X	X
C5	Carded Wool Fabric	2020	10^a , 25^a , 40^a	X		X
C6	Recycled Denim	2020	14 , 48 , 49^a , 56	X		X
C7	Home Collection	2020	4 , 7^a , 32^a , 11^a , 49		X	X
CS2	Take-back service for used jeans	2020	3 , 42 , 43^a , 49 , 51 , 56 , 64^a , B-Corps		X	X
P1	Recycled cashmere embroidered sweaters for a local fashion company	2020	14 , 16^a , 20	X		X
P2	Recycled cashmere knitwear for a social enterprise	2020	20 , 50 , 56	X	X	X
P3	Recycled cotton sweatshirts for an Italian football club	2020	29 , 33^a , 46^a	X		X
P4	Recycled cashmere skeins for a local knitting company	2020	1^a , 6 , 20	X		X
C8	Recycled Denim Twill and Canvas	2021	7 , 12^a , 21^a , 22^a , 25^a , 32^a , 47^a , 49 , 53^a			X
C9	Recycled & organic denim sweatshirt	2021	33^a (18^a), 46	X		X
P5	Recycled denim accessories for a large apparel company	2021	21 , 35^a	X	X	X
SIP1	2LoveMyCity-Donations to local non-profit organisations	2021	60^a , 61^a , 62^a , 63^a		X	
C10	Recycled Silk	2022	45 , 55^a	X		X
C11	Fluffy pack	2022	44^a , 52^a			X
P6	Recycled cashmere scarf for two large companies	2022	2 , 15^a , 19^a , 24	X		X
P7	Recycled cotton blanket for a local outdoor clothing brand	2022	26 , 13^a , 39	X	X	X
P8	Recycled cotton shirts for a media brand	2022	4 , 54^a , 57^a , 58^a	X		X
SIP2	In Our Clothes - Internships for migrants to learn rag sorting	2022	5 , 20 , 23 , 34^a , 38^a , 59^a , 62 , 64^a , 65^a , 66^a , institutional stakeholders		X	
CS3	Recycled workwear	2022	4			
P9	Recycled denim twill aprons and hats for a local biscuit factory	2023	7 , 8^a , 32 , 36^a , 49	X		X
P10	Felt bag for a global luxury group	2023	30^a , 44 , 52	X		X
P11	Recycled wool beanies and scarfs for a local sports cooperative	2023	20 , 2 , 31	X	X	X

Legend: Bold - Local suppliers; Italics – Suppliers of direct materials; Underlined – Social cooperatives/NPOs.

^a Supplier used the first time.

Table 6
Environmental impacts of the different fibres.

Fibre	% of the total fibre used	Supplier	Collections	Certification	Life Cycle Assessment			
					Water	Energy	CO ₂	Chemicals
Recycled cashmere	41	20	C1, C4	GRS	−0,66	−0,67	−0,85	–
Recycled wool	15	20	C1, C4	GRS	−0,99	−0,76	−0,92	–
Light cashmere	1	20	C1	GRS RWS	−0,4	−0,39	−0,55	–
Recycled denim	12	49	C6	RECYCLED 100	–	–	–	–
Recycled & organic cotton	16	4	C2, C7	ORGANIC 100, GRS, OEKOTEX	−0,43	−0,42	−0,44	−0,99
Recycled & virgin cotton	7	26	C3, C4	GRS, OEKOTEX	−0,67	−0,38	−0,34	−0,6
Recycled silk	2	55	C10	GRS	–	–	–	–
Recycled wool fabric	4	40	C5	GRS	–	–	–	–
Recycled & organic denim sweatshirt	2	33	C9	GRS	–	–	–	–

(Source: Alpha's Sustainability Report 2023.)

In Table 7, we classify B2C collections into *core* and *ancillary*. Core B2C collections are product lines that when launched, required the utilisation of a recycled material that had never been used before and/or new manufacturing processes. Ancillary B2C collections are developed to leverage the capabilities accumulated by developing the core ones. These two types of collaborations fundamentally differ regarding the orchestration mechanism activated.

The launch of C1, for example, required hiring new resources (designers, content creators, communication specialists) and establishing supply chain relationships with a strategic supplier of recycled wool and cashmere yarns and accessing its knowledge about these yarns (acquiring). In addition, it required an internal learning process mainly related to the design and pricing processes (accumulation), the consolidation of existing skills gained through the production of simple scarves and gloves (stabilizing) and the development of new skills (enriching and pioneering) needed to design and market significantly more complex products. Finally, this B2C collection required identifying the suppliers' capabilities to effectively mobilize them (mobilize),

coordinating the acquired resources and capabilities to effectively bundle them for value-creation (coordinate) and leveraging them to create value (in terms of TBL dimensions contribution) for customers in the market arena. Similarly, C5 has led Alpha to deal for the first time with designing and producing garments from orthogonal fabrics rather than knitwear and establishing relationships with a new strategic partner that supplies recycled wool fabrics (not yarns). C6 required developing skills regarding using recycled denim and establishing a partnership with a recycled denim manufacturer (which has a pivotal role in CS2). C10 represented the first attempt to make garments from recycled silk. Through this capsule collection, a relationship with a strategic supplier of a second raw material was established, and an innovative use for knitting yarns from recycled silk was found (at the time the collection was launched was almost unused by any fashion brand). Finally, C11 represented the first time the company used recycled felt, finding a way to reuse garments and scraps not reusable in other ways. Looking at the ancillary B2C collections, they completely lack the structuring orchestration mechanism. In fact, they usually build

Table 7
Categorisation of Sustainability-Oriented Innovation initiatives according to the orchestration mechanisms and outcomes produced.

Sustainability-Oriented innovation initiative type	Sustainability-Oriented Innovations	Supply network orchestration mechanisms						Triple Bottom Line outcomes			
		Structuring			Bundling			Leveraging			
		Acquiring	Accumulating	Divesting	Stabilizing	Enriching	Pioneering	Mobilize	Coordinate	Deploy	Social
B2C collections	Core	X	X		X	X	X	X	X	X	X
	Ancillary				X	X	X				X
B2B partnerships	Circular synergies					X		X	X	X	X
	Corporate										
Circular services	P1, P3, P4, P5, P8, P10										
	P2, P6, P7, P9, P11										
Social impact projects	CS1, CS2	X	X		X			X	X	X	X
	CS3	X	X	X							
Fund Co-create	SIP1	X						X	X	X	X
	SIP2	X			X			X	X	X	X

on the core B2C collections. For instance, C3 and C4 bundle and leverage resources and capabilities already available and used for C2. Instead, C7, C8, and C9 are built on resources and capabilities used for C6. Among the leveraging mechanisms, ancillary B2C collections only entail coordinating and/or deploying resources and capabilities, as the mobilization was already activated for the core B2C collections. Finally, while core B2C collections allow to achieve economic and environmental outcomes, the ancillary B2C collections contribute to environmental and social outcomes but not necessarily to the economic one.

B2B partnerships, too can be subdivided into two categories, *circular synergies* and *corporate gift*. With both Alpha leverages the capability acquired with the development of B2C collections to create clothes and accessories. However, while the former requires interaction with a partner to co-create products conveying sustainability- and circularity-related messages (enriching), the latter only requires Alpha to design and produce sustainable and circular corporate gifts. For example, P1 required to create a new capsule collection in collaboration with a partner, representing a new creative use (enriching), rather than just replicating a B2C collection, as it happens with corporate gifts (P2, P6, P7, P9, P11). Similarly to ancillary B2C collections, circular synergies only produce environmental and social outcomes, while corporate gifts allow achieving all the TBL outcomes, even if with a limited scope.

Circular services are all showing the same pattern in terms of orchestration mechanisms, what differentiates these initiatives is the fact that while CS1 and CS2 were successful and are still ongoing, CS3 was terminated. Therefore, CS3 also entailed a divesting mechanism, since the relationship with the supplier was interrupted for this SOI, while the company is looking for alternative local suppliers. In general, circular services require structure, bundle, and leverage capabilities to obtain environmental and social outcomes.

Finally, social impact projects are divided between *fund* and *co-create*. The former simply entails funding charities or purpose-driven associations, thus only requiring a leveraging mechanism. The latter entails a co-creation of social projects, with the aim to contribute back to the community, thus requiring both structuring, bundling, and leveraging mechanisms. Both types of initiatives only contribute to the generation of social outcomes.

Alpha, through the systematic introduction of SOI, in addition to obtaining steady growth, has been able to scale also in terms of social innovation, along the three dimensions identified by Moore et al., 2015 (i.e. scale up, out, and deep). For example, it was able to impact local policies, by facilitating (through SIP2) the integration of migrants from reception centres into the companies of the Prato's District (scale up). It succeeded in involving a growing number of individuals (scale out) in implementing circular and sustainable practices and using circular products, by setting up services (e.g. CS2, but also free repair and warranty services) but also B2C collections even when they had uncertain financial returns, just to engage current and future customers in circular practices. Finally, to influence consumers' value system (scale deep), Alpha regularly creates multimedia content on its platforms to raise awareness about fast-fashion issues and promote responsible consumption. Additionally, it frequently engages in B2C partnerships aimed at spreading sustainability messages.

4.2. Final process model and discussion

Building on our initial research framework, we enriched it with valuable insights about RO mechanisms for SOI derived from the case study. As a result, a new process model was developed (Fig. 3). The model is composed of two interacting stages: (i) Monitoring, and (ii) Supply network orchestration. The third box in the figure outlines that the SOI initiatives are aimed at achieving a TBL outcome. In the initial stage – *Monitoring* – the orchestrator proactively gathers information on opportunities and threats in the external environment and in its network of partners. *External environment monitoring* implies committing resources to intercept anticipatory signals of changes in regulations, of the

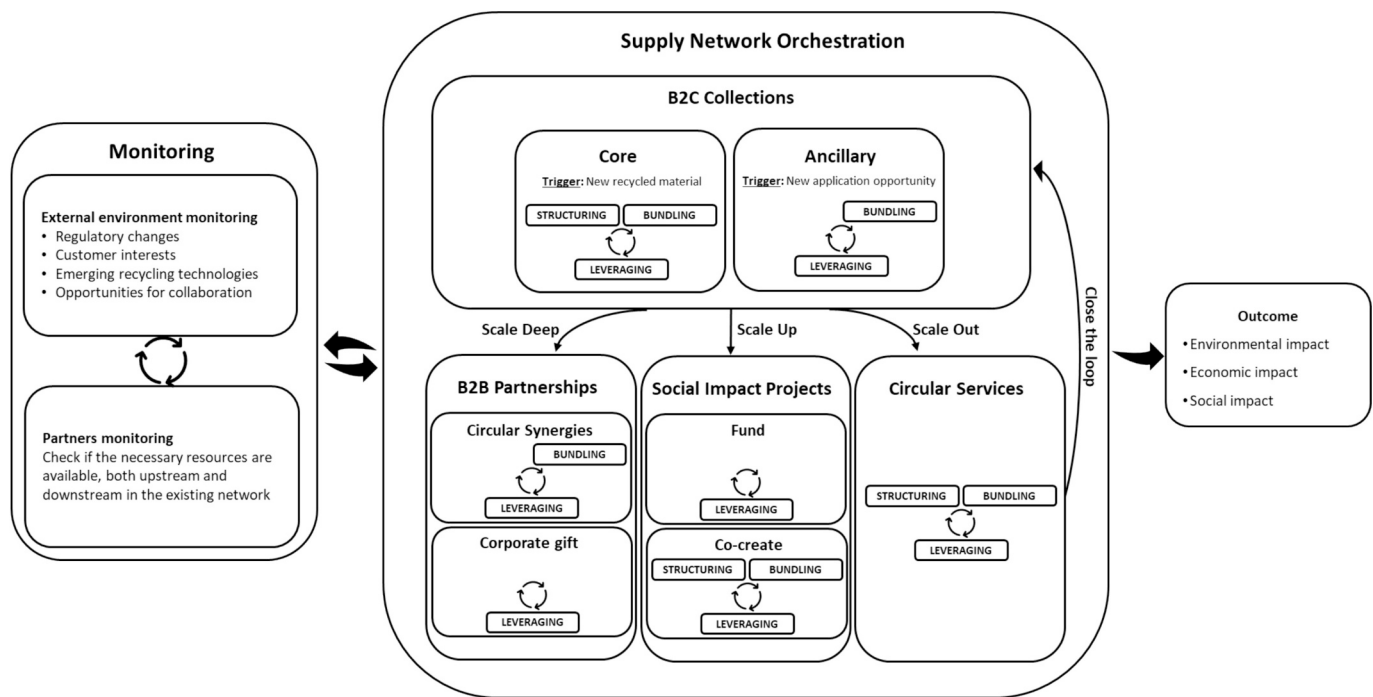


Fig. 3. Resource orchestration process for Sustainable-Oriented Innovation by small-medium enterprises.

emergence of new recycling technologies and fibres, of mutated customer interest and needs, or the potential interest of new partners (e. g. companies, NPO, institutional actors) in establishing a collaboration. In addition, the orchestrator should also be able to filter those signals by selecting only the relevant ones and then turning them into valuable insights and ideas triggering one of the SOI initiatives. The monitoring process is also extended to existing partners (*partners monitoring*). In fact, on the one hand, new SOI can emerge from the interaction with established partners, and on the other hand, the success of a new SOI can be hindered by a lack of competence in the supply network that needs to be promptly identified. In the *supply network orchestration stage*, different types of orchestration mechanisms (structuring, bundling, leveraging) should be activated, depending on the type of SOI initiatives to carry out as discussed in Section 4.1 and reported in Fig. 3.

The orchestrator can eventually achieve the TBL outcomes by structuring, bundling and leveraging resources and capabilities throughout the network to develop and implement different types of SOI initiatives, namely B2C collections, B2B partnerships, circular services and social impact projects. Besides economic outcomes, the main focus of the foundational SOI initiatives, i.e. B2C collections, is on achieving environmental outcomes. This finding is consistent with the extant literature on CSCs, which points out that CE practices are more biased towards sustainability's environmental and economic dimensions, with social outcomes becoming their next priority (Sudusinghe and Seuring, 2022). Social outcomes are introduced only once a clothing collection becomes profitable, i.e. economically sustainable, and the corresponding resources and capabilities are leveraged through B2C collaborations, circular services, or social impact projects. The supply network orchestration process, in turn, will allow the company to develop skills and relationships that will make it progressively more capable of monitoring the environment and will create new opportunities for exchanging ideas with partners that could be the basis for new SOIs.

4.3. Implications and limitations

4.3.1. Implications for theory

Our study highlighted the importance of analysing SOI not at the firm-level but at a lower level, namely the single initiative, to deeply

understand the multi-faceted nature of SOI. Moving to the initiative-level allowed us to understand that the TBL outcomes of SOI cannot be achieved all at once, but need to be created and developed through an incremental path of initiatives by which the supply network needed for achieving SOI can be established, strengthened, and leveraged. This is a novel contribution with respect to the existing literature on SOI, that assumed SOI had to be achieved by an individual company at once with a simultaneous contribution to all the dimensions of the TBL, being forgetful about the contributions that suppliers and other actors in the supply chain could bring (Aarikka-Stenroos et al., 2022; Trevisan et al., 2022). In addition, the study demonstrated that a small company, in its start-up phase, could act as an agent of change, driving and orchestrating multiple stakeholders in addressing sustainability challenges by developing new configurations of knowledge towards SOI (Adams et al., 2016).

This research creates a relevant contribution to theory primarily by bridging the theoretical developments regarding SOI and RO. While the literature on SOI acknowledges the importance of developing new configurations of knowledge by collaborating with various stakeholders in order to address contemporary sustainability challenges (Adams et al., 2016), it did not specify which mechanisms need to be developed in order to achieve SOI. In this paper, we claim and show that resource orchestration can be the mechanism through which SOI is incrementally developed by summing up multiple initiatives, which, in the end, enable the scalability of SOI. Also, this research showed how the supply network orchestration can be adapted in terms of orchestration sub-processes, according to the characteristics of the SOI initiative under development, which represents a novel contribution. Finally, the study showed how to isolate the resource orchestration processes at play by zooming into the specific SOI initiatives, instead of looking at the firm as a unit of analysis. This choice represents an important methodological contribution for researchers willing to analyse how to achieve SOI through resource orchestration.

4.3.2. Implications for practice

The study highlights how the identification of new opportunities for sustainable innovation requires the structuring of mechanisms to monitor the external environment and own partners. It also highlights

how there is a hierarchy between different types of SOIs, that implementing each type of SOI requires different orchestration mechanisms, and that it is crucial to focus, at first, on economically viable SOIs. These SOIs will allow the accumulation of resources and competencies that will also enable TBL outcomes to be pursued through other, not necessarily profitable, SOIs. From the case, it can also be inferred that the sustainable fashion market has the potential for significant growth in the future if the cost of recycled fibres becomes substantially lower than that of its virgin counterpart. This will happen if the efficiency of sorting and recycling processes is improved, thus reducing the cost of the recycled alternative. As the case demonstrates, Alpha's overall economic viability is maintained through “core” collections (C1, C2) for which the cost of recycled fibres (e.g., wool and cashmere) is significantly lower than that of virgin fibres (despite a costly and inefficient manual sorting process), and the selling price of the garments is not much lower than those made from virgin fibres. In the future, sustainable brands will have to support their upstream supply chains with the necessary investments to streamline sorting and recycling processes. Furthermore, to preserve the economic sustainability of their “core” collections, brands will need to invest significant marketing efforts in the non-economic value of sustainable products, e.g., using value-based pricing strategies rather than cost-based ones. In this regard, the case suggests how using specialized online platforms, where garments are often offered at heavily discounted prices, may prove deleterious. The use of this channel, in fact, on the one hand, diminishes the perceived value of the garments. On the other hand, it harms partners in the distribution stage (e.g. physical shops) that, instead, can be important allies in conveying the value of sustainable products to end consumers. The case also suggests that helping customers establish an emotional attachment to the garments being sold is very important and that providing complementary services such as warranty and repair services can help create such an attachment. On the other hand, the emotional content of fashion products thus conceived, together with their frequent and extended use, may make them less suitable to be sold “as a service” and thus rental-based business models are probably less attractive.

4.3.3. Implications for policy

The case of Alpha also allows for some policy considerations. The case demonstrates that the success of a sustainable brand is largely due to the orchestration of the resources and capabilities of upstream suppliers involved in the design and production of recycled textiles and yarns (e.g. Partners 4, 7, 18, 20, 26, 33). Most of the skills and technologies critical for sustainability are found in companies that do not directly interact with the final consumer. The European Commission, through the Extended Producer Responsibility (EPR) schemes for textiles, is proposing rules to make producers responsible for the full life-cycle of textile products and pay a fee (eco-contributions) for each item sold, to fund investments in the separate collection, sorting, reuse, and recycling of textiles and in supporting social enterprises involved in textile collection and treatment. This is undoubtedly a good and most needed thing. The eco-contribution will be transferred to Producer Responsibility Organisations (PROs) that will organize the collection and recycling process. In certain countries (such as Italy) PROs, fashion brands are already taking part in the creation of their own PROs. It will therefore be important for member states to ensure that this legislation will not contribute to transferring further power deriving from the control and management of eco-contributions to the strongest players in the supply chain (e.g., established fashion brands) and that this does not end up penalising virtuous first-tier suppliers such as producers of recycled yarns and fabrics. Alpha's case also highlights how relying on a local supplier network facilitates the effective implementation of sustainable practices such as small batch production, pre-order sales model, ethical sourcing, and low-volume take-back services. These models are not feasible with offshore production, which requires large volumes (stimulated by low prices and overconsumption) to pay off logistical costs. Local supply chains and industrial districts (around 50 in Italy's

textile and apparel sector, which produces over 40 % of EU apparel (European Commission, 2021)) suffer from well-documented chronic weaknesses, such as excessive fragmentation of production processes, limited digitisation, and lack of supply-chain integration (Bressanelli et al., 2022). Incentives to sustain the growth and digital transition of local suppliers thus could help EU countries develop competitive advantages based on circularity and sustainability.

4.3.4. Limitations

It is worth observing that the described process model was developed considering a single small enterprise, born circular, that just emerged from its start-up phase and operating in a very favourable context such as a textile industrial district. This represents the main limitation of our study. In fact, considering a young company that was a first-mover in the circular fashion market has probably led us to overlook broader challenges faced by established companies wishing to develop circular collections alongside traditional ones. In addition, focussing on a company operating in a highly munificent environment such as the textile district of Prato, prevented us from investigating whether our model can be applied by small and medium enterprises operating in less munificent contexts. The “environmental munificence” of the context where a company operates (i.e. the ease with which critical resources can be found), however, is an important contingency influencing how resources should be managed to create value (Sirmon et al., 2007). Internal development of resources becomes more critical in less munificent environments, as resources cannot be easily acquired from external factor markets (Sirmon et al., 2007). In these environments structuring the resource portfolio required to carry out SOI is more complicated and risky, especially for new collections based on recycled fibres that lack well-established supply chains. To overcome these limitations, future research should be aimed at testing the model with fashion companies with different characteristics (age, product portfolio, etc.) operating in and with more geographically dispersed supply chains.

5. Conclusions

The results of the study demonstrated that the supply network orchestration process should be articulated in two main stages: (i) monitoring, consisting of a continuous attempt to capture weak signals of ongoing changes in regulations, market trends, and recycling technologies, to find potential local partners to develop a new SOI initiative collaboratively; and (ii) supply network orchestration, which entails the implementation of different RO mechanism to implement different categories of SOI initiatives. In particular, resources and capabilities should be first structured and bundled to develop SOI initiatives related to the company's core business. Then, once the economic impact of a core SOI initiative is achieved, the resources and capabilities created should be leveraged through collaborations with partner firms (B2B partnerships) in similar or different sectors, take-back programs (circular services), or social impact projects to achieve non-economic outcomes. B2B partnerships, circular services and social impact projects allow for achieving social outcomes for instance, by involving social cooperatives and disadvantaged people in activities that do not require complex skills or capabilities. Notably, the focus on SOI initiatives as (sub-)units of analysis represents one of this research's innovative elements. The process model proposed in the present study draws on the intuition that introducing various SOIs might necessitate distinct orchestration mechanisms and result in the consolidation of strategic resources and capabilities, both internally and within the network. This accumulation of resources and capabilities not only forms the foundation for introducing new SOIs but also enhances the company's ability to sense and identify new opportunities for innovation. By its nature, each SOI will affect the TBL; consequently, the successful implementation of SOIs enables SMEs to grow without significantly impacting the environment while scaling out, deep, and up in terms of social innovation.

Regarding the practical implications, the RO framework for SOI

developed in this study can be used by orchestrators and members of circular ecosystems as a reference model for managing resources and capabilities towards CE. Moreover, the description of the SOI initiatives carried out by the case company provides valuable insights into how to achieve TBL outcomes in the textile and fashion industry. Managers aspiring to succeed in the challenging realm of sustainability are provided with a real-life example of how, through SOI initiatives, it is possible to successfully establish a short-range supply network, reinforce traditions, and forge robust connections with local communities.

CRedit authorship contribution statement

Claudia Ermini: Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Filippo Visintin:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Albachiara Boffelli:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used Grammarly to proofread the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The first author of this paper (Claudia Ermini), at the time the data was collected, was a student at the University of Florence who was doing a curricular internship at the company that is the subject of this study. Now the same person has been hired and is working as an employee for the company.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.spc.2024.07.008>.

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