

Circular supply chain valorisation through sustainable value mapping in the post-consumer used clothing sector

Circular supply chain in used clothing sector

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Abstract

Purpose – The purpose of this study is to explore the antecedents of uncaptured sustainable value and strategies to generate opportunities to capture it in the circular supply chain of post-consumer used clothing.

Design/methodology/approach – This study is based on an inductive analysis of 21 semi-structured interviews conducted with various stakeholders in the circular clothing supply chain (for-profit and not-for-profit) using the value mapping approach, as previously applied in the literature on sustainable business models.

Findings – Fifteen antecedents of uncaptured sustainable value, and thirteen value opportunity strategies were revealed that hinder or generate multi-dimensional value types. Economic value is impacted the most, while there is lack of explicit understanding of the impact of these antecedents and strategies on environmental and social value capture. From a multi-stakeholder perspective, the ecosystem is emerging as new for-profit actors are developing novel process technologies, while not-for-profit actors are consolidating their positions by offering new service options. There is also an emerging “coopetition” between the different stakeholders.

Research limitations/implications – More granularity in the different types of uncaptured value could be considered, and external supply chain stakeholders, such as the government, could be included, leading to more detailed value mapping.

Practical implications – This research provides practitioners with a value-mapping tool in circular clothing supply chains, thus providing a structured approach to explore, analyse and understand uncaptured value and value opportunities.

Originality/value – This extended value perspective draws upon the value-mapping approach from the sustainable business model literature and applies it in the context of the circular clothing supply chain. In doing so, this research illustrates circular clothing supply chains in a new way that facilitates an improved understanding of multi-dimensional and multi-stakeholder value for embedded actors.

Keywords Circular supply chain, Clothing, Value uncaptured, Value opportunity, Europe

Paper type Research paper

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1. Introduction

Amid growing climate concerns, operationalising circular supply chains (CSCs) is essential for the circular economy, where material flows are reversed through reuse, remanufacturing or recycling (Geissdoerfer *et al.*, 2018). Together, these respective resource loops are operationalised by different CSCs recharging end-of-use/end-of-life products by recovering the residual value (Jayaraman and Luo, 2007; Batista *et al.*, 2018; Mishra *et al.*, 2018).

At the heart of efforts in CSCs to maximise valorisation potential (González-Sánchez *et al.*, 2020; Hazen *et al.*, 2021) is *rendering sustainable value that is not only economic, but also includes natural resource preservation and societal wellbeing* (Geissdoerfer *et al.*, 2018). In the growing CSC literature and adjacent scholarly work on closed-loop supply chains, reverse supply chains and reverse logistics, although sustainability and the circular economy have been approached from a sustainable value perspective, that is, by considering how economic, environmental and social value types are created and captured (De Angelis *et al.*, 2018; Mishra *et al.*, 2018), two specific gaps still persist. First, value is often interpreted solely from an economic perspective; that is, whether and how waste materials/products are recirculated is often determined in monetary terms, for example, minimising costs or enhancing profitability (Mishra *et al.*, 2018), while a more comprehensive and simultaneous view of value in CSCs, in terms of capturing environmental and social benefits, remains implicit (Schenkel *et al.*, 2015; Jain *et al.*, 2018), with few exceptions (e.g. Ripanti and Tjahjono, 2019). Thus, there is a need to approach sustainable value from a multi-dimensional perspective in CSCs. Interpreting sustainable value from an integrative perspective, for example, through triple-bottom line dimensions (economic, environmental and social), which is currently limited, is crucial for empirically studying, scheming and assessing CSCs (Jain *et al.*, 2018). Second, beyond this lack of multi-dimensional treatment of sustainable value in CSCs, a multi-stakeholder perspective is crucial, as CSCs involve a number of organisations that, alone or together, create value through effective management and integration of stakeholders within product life cycles (Atlason *et al.*, 2017). Schenkel *et al.* (2015) highlighted the adoption of stakeholder perspectives that include diverse businesses, non-profit organisations (NPOs) and governments. Despite the adoption of such multi-stakeholder perspectives in CSC and adjacent literature (e.g. Beske and Seuring, 2014; Kazancoglu *et al.*, 2022; Majumdar *et al.*, 2022), the CSC literature is limited in explicitly linking which multi-dimensional values are generated “by whom” (sources) and “for whom” (targets). For instance, the extant literature (e.g. Saha *et al.*, 2021; Kazancoglu *et al.*, 2022) highlights CSC enablers and barriers but seldom adopts an integrated sustainable value-and-stakeholder perspective.

Overall, as noted above, such a limited integrated sustainable value-and-stakeholder perspective in the CSC literature has prevented the extension of the value concept (beyond value creation and capture). More specifically, it has prevented us from understanding “where additional value might be created and captured” in a CSC, that is proactively identifying value uncaptured (VU) and new opportunities for value capture in addition to current value. Thus, to infuse this extended value perspective, we draw upon the sustainable business model innovation literature (e.g. Bocken *et al.*, 2013; Yang *et al.*, 2017a, b) to explore the sources or antecedents of VU and understand the negative aspects of the current approaches that might trigger the discovery of new sustainable value opportunities (VOs). In the context of emerging CSCs undergoing transition, such an extended understanding of value by recognising VU and VO is crucial to consider.

As one of the most polluting industries in the world, the transition from a linear to a circular economy is crucial for the clothing industry (Kazancoglu *et al.*, 2020; UNEP, 2020); hence, the operationalisation of an effective post-consumer used clothing CSC has gained significant prominence (Kazancoglu *et al.*, 2020; Saha *et al.*, 2021). In Europe, for instance, the European Union (EU) has been pushing for a separate collection of post-consumer textiles by 2025, aiming for higher value recovery in clothing CSCs (EC, 2022). This has led to the

emergence of several new commercial actors, including multi-stakeholder collaborations, to create novel industrial value chains (UNEP, 2020). Such CSCs for used clothing handling are typically complex chains that include NPOs such as charities and for-profit actors such as fashion retailers, commercial integrated sorter-recyclers and global reverse logistics firms working to effectively recover material value (Sandberg *et al.*, 2018). These multi-stakeholders in CSC strive to create multi-dimensional value types (economic, environmental and social), including information, customer and image value (Sandberg *et al.*, 2018; Pal *et al.*, 2019), thus providing a rich empirical basis for exploring the integrated sustainable value-and-stakeholder perspective. Moreover, the ongoing rapid circular transitions (as discussed above) further underscore the need to not only understand the *status quo* of post-consumer used clothing flows and the embedded value therein for the different actors involved, but also to explore how to improve their valorisation potential, that is, the VU antecedents and VO strategies. The purpose of this study is to *explore the antecedents of uncaptured sustainable value and strategies to generate opportunities to capture it in the circular supply chain of post-consumer used clothing*.

2. Literature frame of reference

Given this purpose, a number of aspects of the concept of value and its treatment in the context of CSC require attention to provide a conceptual reference for this study.

2.1 The concept of value in CSC literature: an overview

With its theoretical grounding in the strategic management literature, the concept of value has gained prominence through discussions of value creation and capture (Bowman and Ambrosini, 2000; Lepak *et al.*, 2007), among other competing discourses. Critical to this discourse are the conceptualisations of (1) value creation, which is determined by the novelty and appropriateness of the utility of any product/service; (2) value capture, which depends on several market aspects, including competition, isolation/safeguarding mechanisms and bargaining power and (3) their different sources, targets and levels, such as individuals, organisations, the environment and society. Emanating from this value concept is the multi-dimensional and multi-stakeholder perspective on value, which is also used to define sustainable value in the supply chain literature. Although value is predominantly calibrated in economic terms, it has increasingly been extended to a multi-dimensional construct (Lepak *et al.*, 2007). For instance, in the sustainability context, the triple bottom line (TBL) is widely acknowledged by considering environmental and social value types in addition to economic value (Stubbs and Cocklin, 2008; Joyce and Paquin, 2016). Beske and Seuring (2014) highlight that a commitment to the TBL is the exclusive foundation of sustainable supply chains. In the context of the circular economy, Ripanti and Tjahjono (2019) frame value as enabled by the supply chain and logistics for sustainable value creation, where economic value is underpinned by optimisation; environmental value is enabled by increasing awareness, cascading mechanisms and maximising waste elimination and social value is generated by collaborative networks to achieve common goals. Additionally, Lepak *et al.* (2007) recognised value creation beyond the organisational level, where society is a key appropriator of value. Thus, a multi-stakeholder perspective on value is evident, which can be impacted by both the cooperative potential and competing interests of stakeholders (Freeman and Liedtka, 1997). This notion of multi-stakeholder value is adopted in the context of sustainable supply chains, for example, in Sarkis *et al.* (2010), Beske and Seuring (2014) and Boruchowitch and Fritz (2022), acknowledging the broader consideration of stakeholders beyond the supplier-firm-customer level to include employees and communities. Together, these value perspectives argue that multi-dimensional value types are often incommensurable (Norris *et al.*, 2021) and

can often be appropriated by different stakeholders or have (negative) externalities that affect each other (Sarkis *et al.*, 2010).

As mentioned in the Introduction, multi-dimensional and multi-stakeholder perspectives largely uphold the primacy of the value concept and its need for further adoption in the CSC literature. From an implementation perspective, a clear stance can be observed in the existing CSC literature in exploring and explaining the key enablers and barriers to creating and capturing such sustainable value (Batista *et al.*, 2018; González-Sánchez *et al.*, 2020). While many studies have highlighted the barriers and strategic enablers to creating and capturing value in CSC, with a few notable exceptions (e.g. Saha *et al.*, 2021; Kazancoglu *et al.*, 2022), they have not explicitly provided a nuanced view of the types of value generated and for whom. In essence, despite the growing body of CSC literature, there is little evidence linking CSC practices to TBL sustainability or for whom such sustainable value is created. Through an extensive survey of 114 textile and clothing companies in Southeast Asia, Saha *et al.* (2021) identified the current state of the circular economy, challenges and opportunities to implement the necessary interventions at different stages of CSCs to enhance sustainability from a multi-dimensional perspective (economic, environmental and social). Based on this, they also proposed a set of strategies, resource requirements and action plans for the adoption and implementation of a circular economy. Kazancoglu *et al.* (2022) investigated barriers in CSCs from a multi-stakeholder perspective to understand what hinders the transition of the circular economy in textile CSCs, which consist of multiple stakeholders such as brands, suppliers, manufacturers and recyclers. The lack of CSC infrastructure for collection, sorting and recycling, as well as a lack of standards and reluctance to adopt circular economy practices, were found to be the main barriers. However, a drawback of these studies, due to their quantitative nature, is the lack of explanation of how these barriers or strategies hinder or enable sustainable value. Some other scholarly works (e.g. De Angelis *et al.*, 2018; González-Sánchez *et al.*, 2020) highlight how multi-dimensional value types (predominantly economic and environmental value) are created in CSCs, for example, through network collaboration, supply chain adaptation and structural flexibility and the use of disruptive and smart technologies. However, these studies are conceptual in nature and thus lack a real-world context. Specifically, in the used clothing sector, such a value perspective of CSCs has recently been reported (Sandberg *et al.*, 2018; Pal *et al.*, 2019), mapping the value created and captured for multiple CSC members from a multi-dimensional perspective. For instance, Pal *et al.* (2019) adopted a relational view to understand how multi-dimensional value types (economic, environmental, information, customer and brand) are created and captured by different CSC stakeholders, such as retailers and brands, sorters and recyclers and non-profit organisations. Through the study of three CSC cases, the research identified how value is created downstream through interpersonal ways of knowledge sharing and informal safeguards, while seamless (and routinised) knowledge-sharing practices and financial incentives play a crucial role in enabling value upstream. In essence, research on sustainable value creation from an integrated, multi-dimensional and multi-stakeholder perspective is scarce in the CSC literature.

2.2 Broadening the value concept in the CSC literature

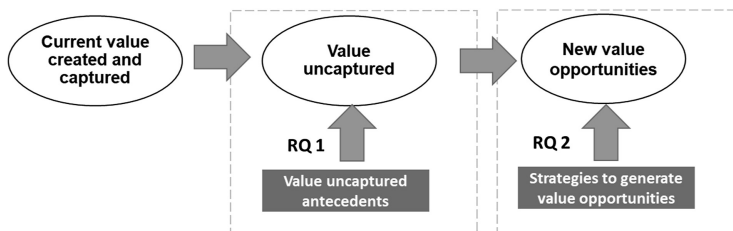
Recent literature on sustainable business models (e.g. Bocken *et al.*, 2013; Yang *et al.*, 2017a) captures multi-dimensional and multi-stakeholder perspectives on sustainable value by integrating them into an innovation process of sustainable value mapping, a perspective currently missing in the supply chain literature. Crucial to this assumption is that the innovation process should also *help companies identify new opportunities to create and capture (sustainable) value by analysing the value captured and uncaptured for key stakeholders across the product lifecycle* (Yang *et al.*, 2017a). In this innovation process, understanding the notions of VU and VO as conceptualised by Yang *et al.* (2017a, b) is crucial. Yang *et al.* (2017a, b) refer

to VU as the potential value that is not currently captured due to various (negative) externalities, while VO focuses on identifying and determining how to integrate sustainability concerns to create innovation opportunities in business models by uncovering approaches to create, capture and deliver new value (Bocken *et al.*, 2013; Yang *et al.*, 2017b). Yang *et al.* (2017b) further categorise VU into four sub-categories: value surplus, value absence, value missed and value destroyed, based on the rationale for why certain values remain uncaptured. In a nutshell, value surplus is an outcome of the unnecessary presence of something, for example, overproduction; value absence is the result of something that is needed but does not exist, for example, lack of labour; value missed occurs when something that exists is not exploited, for example, underutilised by-products and value destroyed refers to something that undermines value, for example, pollution. While reconceptualising and further revising these VU categories can improve the value proposition, a potential problem is that while some VUs are visible, such as waste streams, inefficient production processes and quality defects, others are invisible, such as underutilised expertise and knowledge or completely new value forms (Yang *et al.*, 2017a, b). Yang *et al.* (2017b) further referred to VOs as *potential solutions to reduce the negative forms of value or to transform them into positive forms of value*. Although not all VUs can be turned into VOs by implementing certain strategies, new VOs can be triggered and inspired by identifying the VUs and their antecedents or reasons for their emergence. For example, in the circular economy context, Zacho *et al.* (2021) used this notion to demonstrate how municipal preparation for waste reuse and recycling can enable the identification of VUs to enhance the value creation potential associated with increased material and resource efficiency. Kvadsheim *et al.* (2021) acknowledged such an extended value perspective by considering uncaptured value and how VOs can be realised, highlighting that such an understanding is ingrained in a circular economy where waste valorisation is the starting point. However, such an extended view of sustainable value mapping is sparse in the supply chain literature but contributes to the understanding of how to achieve sustainability, as already conceptualised in the sustainable business model literature.

Acknowledging the current shortcomings in the CSC literature, we adopt this extended value perspective to formulate two specific research questions (RQs), which are linked via the conceptual framework (Figure 1). Based on the value innovation process proposed by Yang *et al.* (2017a, b), RQ1 aims to identify *the main antecedents (or reasons) for uncaptured sustainable value in used clothing CSCs*, and RQ2 addresses *what strategies are devised by used clothing CSC actors to generate opportunities to capture these uncaptured value types*.

3. Methodology

Given the relative paucity of an explicit value perspective in the CSC literature, this exploratory research is based on an inductive, qualitative approach to data collection from multiple CSC actors operating in the clothing sector. Motivated by the introduction, clothing



Source(s): Authors' own work

Figure 1.
Conceptual frame of
reference

CSCs serve as an interesting empirical ground involving multiple stakeholders, both for-profit and NPO, with inherent diversity in terms of their primary value objectives. These differences also lead to contrasts in terms of value creation and capture processes and the value types that are uncaptured at each stage of the used clothing CSC. This makes the context analytically interesting and thus beneficial for extending the value concept within the CSC literature, which is essential for theory emergence (Sætre and Van de Ven, 2021).

3.1 Post-consumer used clothing CSC: description and data collection

In total, 21 semi-structured interviews were conducted with 20 organisations (referred to as cases) involved in used-clothing CSC, including two fashion retailers, eight NPO-owned second-hand businesses, nine sorters and recyclers and one municipality. The CSC operations of these cases span four CSC stages: collection, sorting, reselling and trading and recycling/remufacturing/circular procurement, as mapped in [Table 1](#). This constitutes an overall study of the post-consumer used clothing sector with non-paired cases, with each CSC stage representing a distinct level of analysis.

The overall motivation for including NPOs and fashion retailers from Sweden and integrated sorter-recyclers from north-west Europe is as follows: Sweden serves as an interesting landscape for understanding the collection and subsequent CSC stages in the midst of the ongoing development of a national circular textile strategy and extended producer responsibility (EPR) for textiles and the emergence of various new players, such as automated sorters and chemical recyclers. Traditionally, NPOs have been the major players as resellers and traders, but in recent years, there has been a strong emergence of for-profit actors such as retail brands in the resale market (Sweet *et al.*, 2019). The majority of used textiles collected in Nordic countries, such as Sweden, are exported unsorted, mainly to north-western Europe (Germany, Benelux and Poland), where the largest industrial textile sorters and recyclers are located (van Duijn *et al.*, 2022). A summary of each CSC stage and how these cases operate is given below, and a detailed overview is provided in the [Supplementary File](#).

Of the 20 cases, 16 were involved in collection activities. One of the large multinational retailers organises its collection through a take-back partner, while the other offers in-store collection in collaboration with an NPO. The NPOs included in our study are the largest in Sweden in terms of collection volume (Carlsson *et al.*, 2016), whereas the Norwegian NPO in this study operates joint export activities with a Swedish NPO. Furthermore, the three integrated sorter-recyclers are among the top six in the EU in terms of the volume of used clothing handled, and their collection is organised in different ways, predominantly through collaboration with retail brands, NPOs and municipalities (van Duijn *et al.*, 2022). Finally, a Swedish municipality was included as a representative of urban municipal collection in connection with the impending EU and national regulations to establish separate collection systems for textiles by 2030. Sorting, as the next CSC stage, is conventionally organised by NPOs and large-scale integrated sorter-recyclers, represented by 14 organisations in our study. The Swedish NPOs included are among the top ten in terms of the volume of used clothing handled (Carlsson *et al.*, 2016), although social work, such as humanitarian aid and creating employment outside the labour market, are the main objectives (Persson and Hinton, 2023). Integrated sorter-recyclers are mainly located in north-western Europe (e.g. Germany, Switzerland and the Netherlands) and operate through one or more sorting facilities. The two Swedish cases are new entrants to the CSC market with automated sorting facilities based on near-infrared technology. Subsequently, resale is organised by 14 organisations, predominantly NPOs and integrated sorter-recyclers, either through their own business-to-consumer (B2C) channels or business-to-business (B2B) wholesalers. Most of the NPOs and integrated sorter-recyclers are involved in both reselling and export trade, so quality used clothes are sold via their own second-hand stores, but much of the lower-quality material is

Case labels	Description	Respondents' designation	Collection	Sorting	Resell or trading	Recycling/ Remanufacturing and circular procurement
1	Integrated sorter-recycler headquartered in Netherlands and operating in Benelux and Germany, with large-scale sorting and recycling, and established collection partnerships and own vintage shops and exports	Head of business development	x	x	x	x
2	Swedish NPO with 50 years of experience in second-hand business, with various collection partnerships, sorting facility, own second-hand shops and exports	Head of acquisition and recycling	x	x	x	
3	Swedish NPO with second-hand operations that include collection, sorting and resale of second-hand items via 60+ stores	Environmental strategist	x	x	x	
4	Largest collector with over 3,000 containers in Norway, and a part of an international charity. Main operations include sorting, reselling and exports by sister trading concern jointly with its Swedish counterpart	Head of sustainability and innovation; Export Manager	x	x	x	
5	Swedish clothing brand operating 155 stores in five Nordic countries. Its current circular initiatives and collaborations focus on product and production, and also circular design	Sustainability manager	x		x	x
6	Swedish internationally operating clothing retailer with over 4,000 stores in 54 markets. Its main circular activities include collaboration with an international sorter-recycler to engage with in-store take back, and also running various second-hand resale concepts	Circular strategy lead	x		x	x

Table 1.
Details of the
interviewed cases
(continued)

Case labels	Description	Respondents' designation	Collection	Sorting	Resell or trading	Recycling/ Remanufacturing and circular procurement
7	International aid organization with Swedish second-hand business with large scale collection and exporting to Africa, Eastern Europe and the Middle East. A small amount is also sorted in Sweden for own stores	Deputy director	x	x	x	
8	German collection company operating mainly in Germany, Austria and Switzerland. It is a subsidiary of an international sorter-recycler with about 90,000 tonnes of annual used clothes collection. Also runs in-store garment collection program by partnering with fashion brands	Managing directors	x			
9	Upper class municipality in west Sweden, which has adopted several initiatives when it comes to handling textile waste streams	Strategy developer	x			
10	Sweden's oldest chain of second-hand stores and is owned by an international charity organization. Organizes collection, sorting and reselling of used clothes in both own stores and via exports	Managing director	x	x	x	
11	Swedish NPO and part of an international humanitarian organization, with around 250 shops, each decentrally organizing collection, sorting and reselling activities	Business developer	x	x	x	
12	Swedish chemical recycler, which converts cellulosic-rich textiles into fibre pulp as raw material for viscose and lyocell	Strategy director				x
13	Swedish automatic sorter (a public-private venture) using near-infrared technology for sorting large volume of used clothes into colour and material composition	Senior project manager		x		

Table 1.

(continued)

Case labels	Description	Respondents' designation	Collection	Sorting	Resell or trading	Recycling/ Remanufacturing and circular procurement
14	Integrated sorter-recycler headquartered in Germany with operations in Germany, Austria and Switzerland. Operations include organization various collection channels, extensive sorting, reselling and exports and also mechanical recycling	CEO; Key accounts manager		x	x	x
15	Swedish social enterprise – an NPO with second-hand business that includes various ways of collection, sorting, reselling and exports along with an upcycling concept	Head of acquisition; Area Manager Recycling and Production	x	x	x	x
16	Integrated sorter-recycler headquartered in Switzerland with operations in Germany, Austria and Switzerland, and engaged with collection, large-scale sorting, reselling and mechanical recycling of used clothes	CEO	x	x	x	x
17	Swedish social enterprise – an NPO managing the small-scale collection in collaboration with municipalities and real-estate companies. Partners with large European sorter	Regional head	x			
18	Integrated sorter-recycler operating in Poland and Germany with current operations consisting of collection, sorting, gradation and then reselling used clothes. Also conducts mechanical recycling on pilot-scale	Director; R&D director	x	x	x	x
19	Dutch integrated sorter-recycler operating with the entire recycling supply chain, from collection, sorting, recycling (own mechanical recycling) and creation of new textiles by spinning and weaving the recycled fibres	Innovation Manager	x	x	x	x

*(continued)***Table 1.**

Table 1.

Case labels	Description	Respondents' designation	Collection	Sorting	Resell or trading	Recycling/ Remanufacturing and circular procurement
20	Swedish sorter with R&D based semi-automated pilot line operated for both sorting for reuse and recycling	Innovation manager		x		
			16	14	14	9

Source(s): Authors' own work

exported to countries in the Global South. In our study, with one exception—a Dutch integrated sorter-recycler—all others operate their own second-hand resale, either through vintage or “pay-per-weight” stores. A key difference between NPOs and integrated sorter-recyclers is the percentage of reusable fraction in the sorted volume; on average, 5–10% of the sorted items are resold as B2C by the integrated sorter-recycler, and this fraction could be as high as 20% for the NPOs (Carlsson *et al.*, 2016). However, owing to a lack of large-scale infrastructure, the NPOs only sort a small fraction of the collected items, and the rest is exported unsorted. Of the two Swedish retailers, one operates a variety of resale business models, while the other conducts only peer-to-peer resale by collaborating with other re-commerce platforms and second-hand services. The last CSC stage is recycling or remanufacturing, which requires additional preparatory processes such as shredding or trimming. In our study, all five integrated sorter-recyclers engaged in the mechanical recycling of poor-quality used clothes into industrial wipers, rags, insulation materials and recycled fibres. The two fashion retailers procured recycled yarns as inputs for their recycling collections. As an alternative to mechanical recycling, chemical treatment generates higher-quality fibres, as demonstrated by one Swedish recycler included in the study. Both fashion retailers engage in remanufacturing. Data were collected from nine patients representing this stage.

The cases were selected purposively, first by developing a list of organisations and contacts based on our previous interactions during research projects, and then by exploring and assessing their relevance to our study, particularly ensuring diversity across countries, stakeholder types and CSC stages. To make this judgement, we consulted organisations' webpages and published documents, such as sustainability reports, to understand their current activities. *Convenience* played an essential role in conducting the interviews taking advantage of previous connections with the stakeholders. Additionally, theoretical sampling guided the process of data collection and “pre-analysis” concurrently (Charmaz, 2014) and subsequently to determine whether a new case needed to be interviewed, to achieve data saturation (Hennink *et al.*, 2017). In short, after each interview, we jointly discussed our interpretation of the interview in terms of novelty in the empirics in terms of value aspects, and aimed to use it to extend and refine our findings (Corbin and Strauss, 2008), and to further illuminate whether a new case was needed. Often, the interviewed organisation also provided leads in a snowballing fashion; for instance, case 20 directed us to contact case 2, while case 8 referred us to case 14.

As well as seeking basic information about current CSC activities in each case, the main part of the interview included specific questions related to understanding the antecedents of VU and strategies developed/planned to capture VOs. As we were looking for the “stories” that the interviewees had, our questions were open-ended and structured around three main areas.

- (1) Understanding existing challenges leading to VU,
- (2) Reflecting on the future/emerging context leading to foreseeing VU, and

(3) Strategies to capture VU.

Specifically, we asked respondents *how they currently create and capture multi-dimensional value types, what are the major challenges or barriers to capturing these value types, what value types are uncaptured due to their current ways of operation, what new VOs do they foresee achievable through new activities, relationships and network configurations, and what are the main strategies/solutions that can improve these VOs*. Additional elaboration was provided, both during the distribution of the questionnaire and orally during the interviews, to guide and clarify our interpretations of the concepts of VU and VO. For instance, a specific elaboration section was presented in the distributed questionnaire, where we elaborated, for example, on the environmental value captured in terms of *higher reuse, recycling, etc. higher process performance, green processes and logistics, waste reduction and landfill prevention*; the economic value was explained in terms of *cost reduction, productivity, efficiency, new business opportunities* and so on. In line with Yang et al. (2017a, b), VU was defined when a certain value type was inadequately or not created/captured, was currently lost, or yielded negative outcomes due to current operations. VOs occur when a certain value type is aspired to, and can be additionally created and captured by changing operational methods.

Given the need to critically and clinically reflect not only the VU antecedents and VO strategies, but also to think and reflect on how the emerging context affects them, it was a prerequisite that our respondents had a strategic decision-making position in their organisation. In this way, the respondents had not only an understanding of the key CSC processes/activities but also a strategic outlook on their organisation's positioning, competencies and challenges in an emerging textile circular economy landscape in Europe; in short, they were all considered to be the most informed and relevant person for this study (see Table 1). In some cases, we had more than one respondent to ensure the best possible representation; for instance, in cases 4, 8, 14 and 15, two respondents participated in the same interview session, while in case 18 two respondents participated separately. We ensured this by emailing the questionnaire several weeks in advance and asking the respondent to invite additional colleagues, if necessary. All interviews were conducted between August 2021 and April 2022, were conducted in English, digitally recorded (after obtaining oral consent) and transcribed verbatim using automated transcription software, resulting in nearly 22 h of recordings. Interviews ranged in length from 45 to 96 min, with the average interview lasting approximately one hour. The recording of the interviews was not an issue for the respondents as their anonymity was maintained.

3.2 Data analysis

Overall, the analysis followed a qualitative coding process similar to inductive research, specifically utilising the grounded theory method proposed by Corbin and Strauss (2008). The first step involved open coding, in which each transcribed interview was scrutinised to extract relevant data fragments that highlighted the key aspects of our inquiry: existing and emerging VU antecedents and VO strategies, as illustrated in Section 3.1. The interviews were divided equally between the two authors for transcription, with both authors ensuring that one of the interviews supported harmonious interpretations of the key aspects. Next, we followed a procedure of "directed content analysis" (Hsieh and Shannon, 2005), in which we jointly classified and labelled these data fragments from all interviews into two categories: (1) VU antecedents and (2) VO strategies, according to our RQs. To initiate the axial coding process, we first tabulated these two categories of labels across the four CSC stages (or levels of analysis), followed by explicitly extracting which TBL value was hindered or generated. For the axial coding process, all labels were retabularised CSC stagewise to explore emerging patterns in terms of VU antecedents and VO strategies. This was performed not only by extracting the essence of each label, but also by comparing and contrasting them to ensure

that similarities and differences were accounted for. The process continued for two iterations until we jointly concluded that no new pattern (i.e. code) could be found, nor was there any ambiguity in classifying the extant labels into codes; thus, saturation in data coding was achieved (Ligita *et al.*, 2020). All steps of the axial coding process were carried out jointly by both authors. Finally, [Appendixes 1 and 2](#) were generated inductively, where the distinct codes, that is, categories of VU antecedents and VO strategies, for different CSC stages were summarised and specific convergent descriptions written based on cross-case comparisons.

3.3 Research quality

To ensure the robustness and legitimacy of the qualitative findings following an interpretivist approach, we adopted credibility, transferability, dependability and confirmability frameworks (Halldorsson and Aastrup, 2003). Credibility or internal validity is ensured in the data analysis by separating the key constructs (VU antecedents and VO strategies) in terms of their “positioning” in the value mapping approach (as shown in [Figure 1](#)), and by directly asking the respondents to reflect on the resulting impact on multidimensional value types during the interview (Ellram, 1996). Each case analysis summary, which included explanations of VU antecedents and VO strategies along with the results and types of VU and VO captured, was emailed to each respondent for validation by approval or written feedback. Transferability, or external validity, is ensured by following a structured procedure for conducting inductive coding, as mentioned in [Section 3.3](#), to ensure the validity of data categories and support established patterns (Ellram, 1996). We followed joint coding, code-matching, saturation principles and cross-case comparisons to derive the VU antecedents and VO strategies to ensure that they were exhaustive and exclusive. Dependability, which is closely related to reliability, was ensured by a relatively narrow focus on VU and VO and by clearly explaining the purpose of the study to respondents at the beginning of each interview. Although there were slight changes in the interview questions, as is obvious in a semi-structured format, we tried to ensure that the “key words” such as value captured, VU antecedents and VO strategies, TBL sustainable value, guided the interview process. Finally, confirmability, related to objectivity, was obtained via “a chain of evidence” between the interview transcripts, the value-mapping approach (i.e. the theoretical foundation of this research) and the findings. An inherent limitation of such a study is that respondents’ reflections are “as true” as their own biases and factual premises. However, we did our best to elicit logical reasoning from the respondents during the interviews.

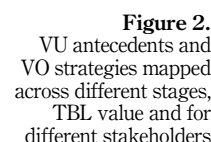
4. Findings and analysis

Our inductive analysis revealed 15 VU antecedents and 13 strategies to enhance VOs spanning the used clothing CSC stages as well as within the case organisations. [Table 2](#) lists them, while a detailed mapping into different levels (CSC stages and organisational), TBL values and different stakeholder groups (for- and non-profit) is provided in [Figure 2](#). Given our level of analysis, the following section is structured into the four CSC stages investigated in this study and the organisational level. For each level, the VU antecedents and VO strategies are discussed briefly, and [Appendixes 1 and 2](#) are supplemented with detailed elaboration and representative quotes. The section ends by drawing inferences about recurring VU antecedents and VO strategies across the CSC stages and their influence on the TBL value.

4.1 Collection stage

Regarding the collection stage of used clothing CSC, although traditionally organised by NPOs, in recent years, fashion brands and retailers have rapidly entered the scene, running

Table 2.
List of VU antecedents
and VO strategies



Italic – Observed in single case

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potential. Furthermore, the collection landscape is changing rapidly owing to increasing competition, which is one of the main VU antecedents (VU1). Growing competition between non- and for-profit actors and municipalities in an increasingly competitive landscape results from each actor trying to obtain a larger share of the collected used clothing in order to capture more economic value, as illustrated in *quotes 2–4* in [Appendix 1](#) and in recent studies (e.g. [Sandberg et al., 2018](#); [Sandberg, 2023](#)). While some cases highlighted that the looming uncertainties in the form of upcoming regulations and laws (VU6) related to extended producer responsibility, GDPR, etc., are crucial antecedents to economic VU, others pointed to limited know-how and competence (VU4) in terms of market and customer orientation as a key reason for underperforming collection programs (*quotes 5 and 6*, respectively, in [Appendix 1](#)).

To capture these VUs, the main VO strategies devised aim to increase partnerships for improved collection efficacy by adapting collection initiatives (VO2) to enhance the degree of coordination and thus customer convenience (*quotes 1–2*, [Appendix 2](#)), or to find or offer new collaborations (VO5), as seen with fashion and food retailers, real estate, etc., to improve customer convenience (*quotes 4–5*, [Appendix 2](#)). Some cases also highlight the importance of embarking on innovation projects (VO3), as illustrated by Case 4 via *quote 3* ([Appendix 2](#)), to continually generate awareness and learning about what can be improved in new collection systems. In addition, the collection process and market optimisation (VO4 and VO7) also featured strategies, followed by some cases to improve cost and eco-efficiency.

4.2 Sorting stage

Sorting used clothing is a crucial value-adding activity, as it determines the disposition route of the items ([Sandberg et al., 2018](#)), that is, whether the used clothing is reused or recycled, and the geographical location. As it is generally a very cost-sensitive activity, it becomes especially challenging in high-cost countries, such as the northern EU ([van Duijn et al., 2022](#)). Striving towards cost-efficient handling in terms of economies of scale (which may be lacking) and aspects such as lack of knowledge and capacity are some of the main reasons for increasing the VU, mainly in terms of economic potential. More specifically, the cost of manual grading makes sorting highly cost-inefficient (VU5), thus require more transport of used clothing from the country of origin (increasing environmental footprints as well), as pointed out by several cases and illustrated by *quotes 8–9* ([Appendix 1](#)). This is further a consequence of the lack of adequate sorting competence (VU4), as illustrated in *quote 10* ([Appendix 1](#)), in high-cost EU countries, such as the Nordic countries, where used clothing is transported to comparatively cheaper locations, such as the Baltics, for the main sorting operations. Thus, charity-owned sorting activities, for example, in Sweden, mainly extract the *crème*—the highest quality items—for reselling in their own stores, while the rest are sold or donated unsorted. The integrated sorter-recyclers located in north-west Europe have higher economies of scale as they find markets for all fractions of sorted items, B2B and B2C sales and recycling. However, some of these integrated sorter-recyclers highlighted that the lack of adequate capacity (VU9) for the increasing volume and share of low-quality items will further aggravate this VU in the future (e.g. *quote 11* in [Appendix 1](#)). The limited availability of automated sorting technologies (VU8) and lack of legislative support (VU6) further act as the main antecedents hindering the scaling of operations (illustrated through *quotes 12–14* in [Appendix 1](#)). There are also several other VU antecedents that hinder sorting activities, such as VUs 2, 3, 7 and 14, as these exacerbate the cost and process inefficiencies, along with the possibility of attaining scale; however, these were pointed out within only a single highlighted case.

The analysis identified nine different strategies for improving VO. In summary, the cases highlighted different ways to enhance process efficiency, such as relying on automatic and

AI-based technologies (VO6), developing market-oriented sorting competencies and skillsets (VO8), conducting specialised sorting (VO4), and even through correct location decisions to design locally/regionally distributed sorting activities (VO7), as illustrated by several quotes (*quotes 9–10, quotes 13–14, quotes 15–16 and quote 17* in [Appendix 2](#)). While these strategies mainly aim to enhance economic value by gaining economies of scale and scope, they also avoid waste trading, and thus reduce the environmental footprint. In conjunction with the supply chain process and design issues, increased interaction and collaboration (VO5) are crucial for enhancing VO, for example, by locating the right suppliers and buyers or by contracting sorting services. Offering new sorting service models (VO12), such as sorting-as-a-service, has also been explored in some cases to offer innovative solutions to brands and other commercial actors, as illustrated in *quote 18* ([Appendix 2](#)). A number of other strategies to enhance VO are also evident, such as jointly running innovative sorting projects (VO3) and implementing end-of-life product information management (VO10), mainly to increase sorting efficacy through knowledge building, although in several cases such strategies are not implemented.

4.3 Resell and trading stage

B2C reselling of used clothes is growing in volume for NPOs' second-hand businesses and for integrated sorter-recyclers, as highlighted by [Zanjirani Farahani et al. \(2021\)](#), although the type (quality) of the items and how they are resold differ. Additionally, fashion retailers are increasingly entering the market to capture economic VOs ([Sandberg et al., 2018](#)). This makes the resell marketplace highly contested due to emerging competition from many new actors, such as fashion brands, peer-to-peer sales and recommerce (VU1), as pointed out by some NPOs and integrated sorter-recyclers (illustrated by *quotes 26–27* in [Appendix 2](#)). A number of cases, predominantly NPOs and integrated sorter-recyclers, also pointed out that with the rapid influx of fast fashion over the years, the demand for used clothes has not grown in proportion to the collected volume, as the quality of used clothes has become poor (VUs 3 and 7), thus leading to uncaptured economic value potential, as evident from *quotes 23–25* in [Appendix 2](#). In addition, competition between different disposal options means that reusable clothes are often mutilated and recycled, which is not good for the climate, according to the EU waste hierarchy model ([EC, 2023](#)). Within the B2B trading of used clothes, the integrated sorter-recyclers mainly reflected on how stricter and less harmonised legal regulations and a probable ban exercised on exports could be foreseen as the main reasons for VU, thus adding to operational complexities. This may hinder future exports of low-value textiles, leading to both economic and environmental VU, as pointed out in Case 8 (see *quote 21* in [Appendix 2](#)). Another reason for VU along all three TBL pillars is inadequate information on the flow and quantities of exports (VU11), which also hinders the understanding of the actual sustainability performance of CSC operations; for example, waste dumping is often a problem (see *quote 28* in [Appendix 2](#)). A few other process-level antecedents also hindered economic value capture, such as a lack of process standards, cost efficiency and competence (VUs 2, 4 and 5).

The two main strategies for enhancing VO in reselling are (1) design and development of the customer market, including sales channels, and (2) sustainability branding. For instance, by offering different business models for selling second-hand items (VO12), such as pays/kilos, outlets and re-commerce, and through the right mix of these sales channels (VO7), actors can enhance their opportunity to capture more economic value, including brand image and customer satisfaction, as evident respectively through *quotes 22–24 and 25–26* ([Appendix 2](#)). Dedicated branding activities (VO11), for example through novel second-hand retail concepts, enable communicating a “sustainable luxury” image to customers directly, as could be deduced from *quotes 28–29* posited by a couple of NPOs. Of

crucial importance in supporting such branding strategies and business model additions is market and customer orientation, for which process optimisation (VO4) and developing market knowledge (VO8) are essential for capturing economic value. A few NPOs (cases 2 and 3) and an integrated sorter-recycler (case 1) have worked out such strategies over the past few years (illustrated via quotes 30–32 in [Appendix 2](#)). In addition, digital advancements such as establishing AI-enabled re-commerce platforms (VOs 6 and 10) are also emerging strategies observed in a few cases. Within a B2B context, one integrated sorter-recycler highlighted the need to be cost-efficient, which has guided their development of an optimal design of their supply chain and transportation network (VO7), while another NPO acknowledged how they have strived to create social value in developing countries where they are exporting used clothes by deploying a code of conduct, among other social responsibility measures that can be ensured by establishing higher degrees of supply chain coordination (VO2).

4.4 Recycling, remanufacturing and circular procurement stage

Recycling and remanufacturing operations are relatively niche in the clothing CSC, although the practices and associated actors and customers are rapidly growing ([Janmark et al., 2022](#)). There is an immense focus on economic valorisation in these operations, which currently lack financial viability, scale and process efficiency because of a number of VU antecedents, as our analysis suggests. The most crucial factor, that is, recurring among organisations, is the lack of data and information at the product, process and supply chain levels (VU11), such as material composition, supply chain actors and flows, as evidenced by *quotes 35–37* ([Appendix 2](#)), which can hinder TBL sustainability value. Such a lack of knowledge often contributes to suboptimal CSC design because of the geographical dispersion of the actors along the CSC (VU13), creating issues such as a lack of optimal procurement of feedstock or higher carbon footprints, leading to economic and environmental VUs, as illustrated in *quotes 38–40* ([Appendix 2](#)). As an alternative to such distributed CSCs, developing regional value chains at the EU level to valorise recycling is being discussed and planned in a few cases; however, this currently suffers from undercapacity (VU9), thus hindering scalability. In contrast to such regional configurations, globally operated recycling CSCs have higher environmental and social footprints owing to waste transportation, as pointed out by the chemical recycler (Case 12) in *quotes 41–42* ([Appendix 2](#)). The intrinsic factors in designing such global-local CSCs are market demand and process competence, which are currently lacking in both recycling and remanufacturing businesses. The low variety of recycled materials available in the market (VU3) and lack of process-level competence (VU4) limit the economies of scale and scope of these operations (see *quotes 43 and 44–45*, respectively, in [Appendix 2](#)). Other VU antecedents, although not recurring across organisations, include cost- and quality-related issues related to incoming feedstock (VUs 5 and 7) and inadequate recycling technology readiness (VU 8) were highlighted as additional concerns.

As the volume of low-quality clothes in the market increases, there is an increasing demand for scaling post-consumer textile recycling to increase the flow of circular materials ([Janmark et al., 2022](#)). Remanufacturing, which is much smaller in scale, is gaining prominence among fashion brands. It is important to strengthen economic VO by developing new collaborative circular ecosystems (VO5), as highlighted by a few cases (see *quotes 35–37*, [Appendix 2](#)) and [Sandberg \(2023\)](#), to secure both process capabilities and the recycled product market. This goes together with finding new suppliers and other partners to build new CSCs (VO7) and simultaneously increasing market orientation by developing know-how (VO8) (see *quotes 37 and 38–39*, respectively, in [Appendix 2](#)). To increase the market uptake of such circular material supplies, aligning industry standards and circular KPIs is crucial;

fashion brands highlight the need for reporting and compliance with CSC practices (VO9). The recycling of used clothes is clearly visioned by these CSC actors as a future economic VO by enabling better market positioning, as a recent report by [Janmark et al. \(2022\)](#) also confirms. Several other VO-enhancing strategies aimed at process improvements (e.g. VOs 1, 4 and 6) and sustainability marketing (e.g. VO11) are also highlighted by individual cases.

4.5 Organisational level

Some of the VU antecedents are operating within organisations involved in used clothing CSC, instead of being relevant at different CSC stages. For instance, in general, a lack of coordination is observed in a few NPO cases because of the lack of collaborative cost-sharing routines among partners (VU10) and the lack of power within the circular clothing ecosystem (VU12). These issues are often perceived as destroying their strong and longstanding foothold in the used clothing sector (as illustrated through *quotes 49–50* in [Appendix 2](#)), and, in turn, NPOs' economic and social value capture potential. NPOs are increasingly concerned about the lack of incentives for them in the ongoing legislative measures and the unethical expectations posed by other for-profit CSC actors. Such a loss of strategic positioning of NPOs is further aggravated by the current decentralised structure of operations (resulting in VUs 2 and 9) and the internal organisational misalignments (VU15) of some NPOs, as this limits their operational effectiveness compared to for-profit actors. Integrated sorter-recyclers are concerned about the foreseeable restriction on waste trading (VU6) and how they could instead valorise optimally within the EU (due to VU13). However, most of these VU antecedents were experienced by a single organisation.

At the organisational level, the VO strategies most recurring among the cases point towards finding new partners and business models adapted to the market requirements (VOs 5 and 12) and establishing higher degrees of process control and coordination (VO2), for example, through more centralised operations, following standards and audits. Finding new collaborations (VO5) is particularly important for establishing circular ecosystems to understand market potential and create learning and scalability, as evidenced in a number of cases (see *quotes 51–52*, [Appendix 2](#)). Business model change is pointed out by a few large NPOs as a key VO strategy to become more profit-driven and competitive in the used clothing sector and simultaneously establish circular jobs outside the labour market (see *quote 53*, [Appendix 2](#)). Coupled with these VO strategies, a few cases also highlight how a value-driven organisational approach is necessary, for example, through a decentralised way of working to enable economies of scope and create learning through engagement with diverse circular initiatives (VOs 4 and 8). Such a value-driven perspective is also noticed in the case of a brand and an NPO, where compliance with ESG reporting tools (VO9) and work integration (VO13) allowed them to commit more towards enhancing environmental and social VOs, respectively (see *quotes 58 and 59*, respectively, in [Appendix 2](#)). In contrast, chemical recyclers highlighted the need for volume when sourcing recycled feedstock, thus highlighting the strategy to source globally (VO7), which can create TBL value through their operations.

4.6 Cross CSC-stage analysis

A number of VU antecedents are evident across all CSC stages, which are related to hindering traditional enablers of logistics competitiveness, such as cost (VU5), quality (VU7) and demand (VU3), as well as skillset and know-how (VU4). Owing to the growing proportion of low-quality used clothes in the reverse stream, the valorisation potential is lower, either via reselling or recycling. This increases operational costs, and at the same time, products are often not up to customers' quality expectations ([Persson and Hinton, 2023](#)), thus making the demand for second-hand clothes persistently low. This is further aggravated by the lack of

knowledge and competencies in devising efficient and effective clothing CSC in many northwestern EU countries. Overall, while these VU antecedents most recurrently hinder economic value potential (mapped in [Figure 2](#)), environmental footprints also increase because of the lack of cost-efficiency (VU5) in some CSC stages, such as collection and sorting, which often means transporting used clothes (and textile waste) to low-cost countries, either for processing or for finding a market. In addition, regulatory uncertainties and traceability challenges (VU11) also impede value capture, and beyond hindering economic value impact, environmental and social value capture potential is also hindered due to a lack of information on the measurable impacts of CSCs. While nine VUs (as mapped in [Figure 2](#)) impeded environmental value capture at different CSC stages, only VU 5 and VU 11 were found at multiple CSC stages. In total, five VUs (1, 4, 10, 11 and 12) impeded social value creation at different CSC stages in several cases; however, none of them were evident recurrently across CSC stages. VUs 12 and 15 are evident at the organisational level, hindering the capture of economic and social value. Overall, the least highlighted VU antecedents (evident in the CSC stages) are related to optimal supply chain design and lack of investment, although these are typically specific stage-level requirements to ensure cost and CSC optimisation.

Among the prevalent strategies to enhance VOs, optimising processes (VO4) and designing an optimal supply chain (VO7) are the most common across all CSC stages, along with the need to build critical competencies and knowledge of CSCs internally (VO8). Designing optimal CSCs can solve the most critical challenges related to cost inefficiencies and quality concerns in reverse supply chains and logistics ([Pal et al., 2019](#)). Additionally, collaboration and partnering (VO5) were highlighted as critical to building effective circular ecosystems, as recently evidenced by [Sandberg \(2023\)](#), through resource and capability complementarities. Overall, the least evident VO strategies are VO9 and 13; this could be attributed to the fact that the clothing industry has only recently started to prioritise used clothing CSCs as a strategy to generate TBL sustainability ([Pal et al., 2019](#)). Consequently, aspects such as compliance, standards and other sustainability performance indicators have rarely been applied. The complexity of CSC also hinders its implementation. Despite some VU antecedents hindering environmental and social value capture potential, as explored above, the VO strategies found in the case organisations were predominantly aimed at enhancing economic value. A few cases highlight how optimising collection channels (VO4) and sorting locations (related to VO7) can reduce the transport of used clothes or how recycling product innovation can valorise textile waste by finding new market collaborations (VO5), thus enhancing the environmental value potential. In general, there was a lack of explicit justification by the case organisations of how other VO strategies could enhance their environmental and social value dimensions. However, none of these VO strategies were found to improve environmental value across multiple CSC stages. A few VO strategies explicitly created social value for the case organisations, such as VOs 2, 7, 9, 11, 12 and 13, whereas none were found to create social value across multiple CSC stages.

5. Conclusions

Drawing on the value mapping approach from the sustainable business models literature ([Yang et al., 2017a, b](#)), our research investigates the main antecedents of uncaptured sustainable value and the prevalent strategies for generating opportunities to capture it in post-consumer used clothing CSCs.

In summary, from a TBL value perspective (shown in [Figure 2](#)), economic value is hindered and generated, respectively, by a plethora of VU antecedents and VO strategies. In contrast, there are fewer examples of explicit reasoning by practitioners from different cases about the impact of these antecedents and strategies on the potential environmental (nine VUs and six VOs) and social (five VUs and three VOs) value capture. Specifically, it can be inferred that the

intention to increase economic value dominates, thus revealing more economic VU antecedents and the strategies devised to capture them. This is perhaps not surprising; previous literature on sustainable supply chains has also highlighted this dominant focus on economic sustainability as the ultimate outcome (e.g. [Pagell and Shevchenko, 2014](#)). In our context, this further demonstrates how the increasing emphasis on circular transition in the clothing industry has created a green economic space for the CSC actors involved to consider VU and how to capture it. Today, there is an urgent need for economic value creation, as post-consumer clothing and waste volumes are growing and competition is increasing, making the achievement of cost efficiency a prerequisite for competitiveness. In contrast, social value seems to have the least number of VU antecedents and strategies devised to capture them, and is therefore the least uncaptured (after economic, followed by environmental). The nine antecedents of environmental VU mostly pointed to the high environmental footprints of the cross-border transport of used clothes, either due to a lack of scale and infrastructure, cost-efficient handling therein or adequate knowledge about processing activities. While increasing competition for NPOs largely hampers their ability to generate higher social value, such as creating competitive jobs outside the labour market, the lack of adequate traceability along the CSC has negative social spillovers in the Global South, where extremely low-quality used clothes often end up in landfills ([Dissanayake and Pal, 2023](#)). Despite fewer antecedents, it cannot be concluded that social value is already adequately captured in used clothing CSCs; however, social sustainability has yet to receive comprehensive attention and understanding in the CSC context, as also indicated by [Walker et al. \(2021\)](#), which may mean that the know-how of social VUs and how to turn them into VOs is less understood, both in theory and in practice.

From a multi-stakeholder perspective, our study focuses directly on CSC actors, including both for-profit firms (fashion brands and integrated sorter-recyclers) and NPOs, which constitute the main CSC stakeholder groups ([Figure 2](#)). In general, while new for-profit actors are emerging to conduct collection and recycling activities, NPOs are increasingly trying to consolidate their position by offering new business models, such as operating innovative second-hand clothing sales channels or offering sorting services to for-profit firms. Although a clear differentiation between these two stakeholder groups in terms of their main VU antecedents and VO strategies could not be deciphered, we observed that NPOs are increasingly concerned with growing competition in the collection of used clothes, as highlighted by [Zanjirani Farahani et al. \(2021\)](#). The decline in pre-emptive positioning due to gradual loss of market volume of good-quality resalable items increasingly renders these NPOs less cost-efficient in their sorting activities, making it more difficult to retain skills and know-how. This has implications for how CSCs can enhance the social value dimension. For for-profit actors, the main VUs relate to capturing economic value from an increasing proportion of low-value items collected and developing scalable market potential. While sorters are concerned with the threat of stricter regulations on cross-border exports, retailers and recyclers are more concerned with finding an optimal balance between supply and demand and processes to scale up recycling or remanufacturing CSCs. In addition to the CSC stakeholders directly involved as both “source” and “target” of the value generated, the environment and society could be ranked as the second and third most important “targets” of value appropriation, but to a much lesser extent compared to the economic value.

From an ecosystem perspective, we observe an emerging “coopetition” between the different stakeholder groups across the CSC stages, as also postulated by [De Angelis et al. \(2018\)](#). For- and non-profit organisations tend to compete in securing the supply of high-quality items via collection channels; due to the complementarity of resources and availability of skills, they tend to collaborate more in other activities, such as sorting. For example, NPOs offering sorting-as-a-service to brands or integrated sorter-recyclers who receive unsorted material from NPOs sort it for recyclers. However, conflicting objectives and value propositions also lead to clashes between for-profit and non-profit actors, for example,

when brands place unjust expectations on NPOs for the disposal of used clothes or when they jointly engage in providing input to ongoing developments in legislative regulations, such as EPR at the ecosystem level.

5.1 Implications for CSC research and practice

Our research offers a new and extended perspective on value mapping in CSCs by incorporating the VU and VO aspects proposed in the literature on sustainable business models. CSC transitions embed innovation dimensions that are hindered by several antecedents that are currently present or may arise in the future due to changing market dynamics. In this context, our study's extended value mapping provides a foundation for the current understanding of CSCs and how to configure these CSCs in the future by revealing VU antecedents and strategies to capture these VOs. In doing so, our study inductively produces a checklist of 15 antecedents of sustainable VU and 13 strategies to enhance VO, which can serve as a conceptual foundation for future CSC work. Another key contribution of this research is to present an integrated sustainable value-and-stakeholder perspective of CSCs by drawing an explicit link between what TBL values are generated "by whom" (sources) and "for whom" (targets), thus extending previous works that have treated the multi-dimensional and multi-stakeholder perspectives disjointly (e.g. [Kazancoglu et al., 2020](#); [Saha et al., 2021](#)).

In terms of practical implications, we offer a more dedicated value-mapping tool for multi-stakeholder CSCs and multi-dimensional value types. [Figure 2](#), redesigned to incorporate the information presented in [Table 2](#), can be useful for practitioners to adopt a structured approach to explore, analyse and understand their own VU antecedents and VO strategies across different stages and TBL values. Simultaneously, this can help to develop plans for how to enhance the valorisation potential, while identifying potential strategies and underlying challenges in the operation of used clothing CSCs.

5.2 Limitations and further research

Given that research explicitly considering the value perspective in CSCs is still in its infancy, several research avenues can be pursued to further extend the value-mapping perspective adopted here. Similar to the literature on sustainable business models ([Yang et al., 2017a, b](#)), more granularity can be included to understand multidimensional VUs using the framework of value missed, destroyed, surplus and absent among multiple stakeholders. Such revelations are complicated as these categories often overlap; therefore, they are not considered in this interview-based study due to the need for more intervention-based methodological approaches. However, such a degree of granularity can identify the exact implications of VU antecedents and more precisely define the corresponding VO strategies. This will also reveal the shared value perspective, that is, what value conflicts exist, between whom and how they can be consolidated.

Another direction to extend this explorative research is to understand "how" CSC actors identify their VU antecedents and devise VO strategies and underlying capabilities, thus going beyond our current scope of "what" VU antecedents and VO strategies are. This requires exploring theoretical perspectives such as dynamic capabilities to investigate how CSC actors can sense VUs, seize VOs and reconfigure themselves accordingly.

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Further reading

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(The Appendix follows overleaf)

Table A1.
VU antecedents and
their influence on
sustainable value from
the TBL perspective

COLLECTION					
VU No.	Thematic categories of VU antecedents	Specific explanation of VU antecedents	Result of VU	Type of VU	Evidence from
7	Large share of low value items	Increasing fraction and volume of low quality collected textiles leading to less cost-effective processes	Lack of financial viability due to low value potential due to high transportation cost/volume	Economic	Cases 8; 10; 16; 20
		Higher transportation of low quality collected textiles to achieve economies of scale from whole operation	High transportation footprints	Environmental	Case 8
1	Competition	More competition in collection of used clothes among several actors, e.g. municipalities, retailers, NPOs etc.	Lack of financial viability due to low collection volume; Uncertain future of NPOs to valorize in emerging circular ecosystems compromising their economic and social value propositions	Economic; Social	Cases 2; 7; 17; 18
6	Legalities and regulations	Stricter regulations, e.g. EPR, GDPR, increasing operating costs related to waste and information handling without enough financial incitements	Lack of financial viability due to low value and volume potentials; High operating and information handling costs	Economic (incl. Information)	Cases 7; 10; 18
					Descriptive and representative quotes QUOTE 1: "we had some warehouses in some countries but the value of the garments, it's only a few cent. It's all about how well packed is the container and how far did we have to ship. ... so it doesn't make sense to store too long. It's too expensive. So we need to transport immediately from distribution center to a processing facility. This is actually one of the difficult tasks in evaluating which place to ship the garment and how it processed the most economical and ecological way." (Case 8) QUOTE 2: "when the producer responsibility arrives, the retailers or the big brands suddenly feel and see an interest in many ways to take care of the material that we are handling today. ... so what I see in the first place is that we are losing market for second-hand." (Case 2) QUOTE 3: "... increased competition when it comes to collection of textiles. Some municipalities have already started. The bigger problem for charities like us is if the companies realize that we can earn money, then the charities don't have a chance." (Case 7) QUOTE 4: "Take-back initiatives of huge retailers affects us because our business is based reselling something that has value." (Case 18) QUOTE 5: "Two years ago a law was made that each place where you collect waste should have TV camera sharing all the information to the municipality. But when it comes to sharing information from 1000 cameras to the municipality no stop. It is difficult and requires large investment. ... Also in EU a lot of work about artificial intelligence and how it will affect people, e.g. laws of GDPR and collecting consumer data related to the textiles, about the country, etc. How the data privacy law will emerge in future is uncertain and risky to invest million euros on such algorithms." (Case 18)

4	Lack of knowledge and competence	Limited knowhow and skillset to valorize collection landscape, e.g. of different market requirements and demands, quantity and quality, role of different business stakeholders and organizing finance	Underperforming collection programs in terms of market potential, customer orientation and optimal valorization; Less scalable circular impacts and climate gain	Economic (incl. image & customer); Environmental	Cases 8; 9	QUOTE 6: "the collection system should be adjusted to either collect separate or to find a good cooperation with the next stage... one of the challenges is that we don't know much about the potential of how much of the textile could be collected, how much of that can be recycled or reused" (Case 9)
5	Cost inefficiency	High operating costs related to waste and information handling, due to low market volume, low value items, surveillance requirements etc.	Low economic value potential due to high operating and information handling costs; High transportation footprints	Economic (incl. Information); Environmental	Cases 8; 18	QUOTE 7: "biggest struggles are in those countries where we are collecting close to zero but as a service provider we need to offer a solution ... when we look at our 70 markets we have a whole lot of markets where we are creating a huge loss." (Case 8)
3	Lack of market demand volume	A number of low volume markets with high handling costs	Low collection volume; High handling costs	Economic	Case 8	
SORTING						
VU No.	Thematic categories of VU antecedents	Specific explanation of VU antecedents	Result of VU	Type of VU	Evidence from	Descriptive and representative quotes
5	Cost inefficiency	High presorting/sorting costs in high-cost countries, e.g. Sweden, demanding transportation of collected textiles	Low economic value potential due to high processing costs; Manual sorting outside country of collection leading to cost inefficiencies and higher waste transportation	Economic; Environmental	Cases 2; 4; 7; 10; 11; 17; 20	QUOTE 8: "the cost level in Sweden for sorting is very high. We don't have enough people (in Sweden) that knows how to sort and most of all, they don't know how much to sort to be economically viable. If you compare Sweden to the Baltic countries, we have to pay 3 times more, and the people over there have the culture, productivity, and knowhow. As a result of the higher sorting cost, we do not sort into so many categories" (Case 7) QUOTE 9: "To sort ourselves requires people and it requires another structure that we don't have at this moment. But it does not make sense to send it back to Sweden after it is sorted (at our partner) in Poland." (Case 17) QUOTE 10: "we employ older people ... so might be difficult in the selling and sorting to young people." (Case 3)
4	Lack of knowledge and competence	Lack of market-oriented sorting competencies and knowhow due to inexperience and initiatives to retain skillset	Lack of market and customer orientations and loss of human capital leading to process inefficiencies	Economic; Social	Cases 3; 7; 11; 20	QUOTE 11: "If you just see in Europe, we're collecting now 2.4 million tonnes, and they're estimating 5.5 within three years. And for this 2.4, we do not have sorting facilities enough. If within three years we are going to collect 5.5, where are these going to be sorted?" (Case 20)
9	Lack of process capacity/volume	Lack of enough sorting capacity for handling increasing volume of textile waste and collected textiles	Lack of scaled infrastructure restricting volume potential	Economic; Environmental	Cases 11; 14; 20	

Table A1.

Table A1.

8	Low Technology readiness level	Limited AI technology readiness	Process and cost inefficiencies in manual sorting resulting in low quality of feedstock output	Economic (Ind. customer)	Cases 16; 18	QUOTE 12: "AI and machine learning may be a promising path ahead, but this is still the future. The main problem is how do I need to prepare the item in order for the AI to see it." (Case 16) QUOTE 13: "AI and machine learning are still in its infancy (to segregate) textile into two categories: for reuse or recycling ... you have to have human eye. A machine could never say that this shirt is good enough for anyone to buy in a second-hand store." (Case 7)
6	Legalities and regulations	Regulatory uncertainties and lack of legislative incentivization resulting in less investment willingness and circular solutions	Less scalable circular solutions, restricting volume potential and attaining climate gain	Economic; Environmental	Cases 16; 19	QUOTE 14: "The sorting capacity in EU must be extended to cope with increased volumes. And that's of course something that we really have an issue, we have a very high uncertainty on how things are going to emerge from a regulatory perspective." (Case 16) QUOTE 15: "Take two T-shirts 100% cotton, both of them from the same container from some collector. You will see that those two T-shirts contain different type of cotton fiber. That means producing fiber-to-fiber technology from two completely different T-shirts will give you fiber but of quality unacceptable from the point of view of the customer. So the problem is how to make sorting automated, meaning to ensure quality of textiles and robotise the process." (Case 18)
2	Lack of process standardization	Automated sorting technology is not fullproof due to diversity in fiber-to-fiber recycling feedstock	Process inefficiency and low quality of feedstock output	Economic (Ind. customer)	Case 18	QUOTE 16: "The technical capacity is there but the market is still immature, and the business case is still evolving. I think that it will benefit if there would be a few more facilities because that would stabilize the market and make it easy to see the supply side." (Case 18)
3	Lack of market demand volume	Lack of market for automated sorted textiles	Lack of market demand in scale	Economic	Case 13	QUOTE 17: "We have quite small margin on our products ... rent of the location and the wages that are the two high costs."
7	Large share of low value items	High operating costs due to low profit margin from low value products	Low economic value potential due to high processing costs	Economic	Case 4	QUOTE 18: "So far, we have experienced limited willingness from brands to collaborate on circular solutions. Among others, making brands more interested to invest time and money in collaborations is important."
10	Lack of collaboration	Limited business stakeholder collaboration on developing circular solutions	Less scalable circular solutions, impacts and climate gain	Economic; Environmental	Case 19	QUOTE 19: "Tracing our stuff is difficult. We don't have QR codes. Challenge is when handling high quality things that will it come from point A to point B." (Case 19)
11	Inadequate information transparency/tracing & tracking	Lack of tracking of flow of used clothes for process optimization	Lack of optimal processing due to information inefficiency	Economic	Case 10	QUOTE 20: "The sorting capacity in EU must be extended to cope with increased volumes. And that's of course something that we really have an issue, we have a very high uncertainty on how things are going to emerge from a regulatory perspective. So building up investment cases (is required)"
14	Lack of public-private investments	High degree of regulatory uncertainty reducing investment willingness	Lack of scaled infrastructure restricting volume potential	Economic	Case 16	

RESELL AND TRADING					
VU No.	Thematic categories of VU antecedents	Specific explanation of VU antecedents	Result of VU	Type of VU	Evidence from
6	Legalities and regulations	Stricter and less harmonized legal regulations related to waste exportation; Upcoming export restrictions in terms of regulations proposed by the EU to ban export of waste	Difficulty in efficiently organizing used clothes exports from Europe to developing markets losing opportunities to trade large proportion of used clothes that cannot be sold or valorized in Europe	Economic; Environmental	Cases 1; 4; 8; 12; 16; 18
		Operational complexities and high costs due to increased demands of data regulations, e.g. regarding waste handling and export	High operating and information handling costs	Economic (incl. information)	Case 18
		Inadequate resale value of large share of poor quality of collected used clothes	Lack of financial viability due to low value potential from reselling	Economic	Cases 10; 15; 18; 19
3	Lack of market demand volume	Limited second-hand clothes demand compared to collection volume; Future untapped resale market	Relatively low demand for buying second-hand clothes	Economic (incl. customer)	Cases 4; 6; 11; 20
1	Competition	Increased competition from newly emerging actors, e.g., peer-to-peer platforms, re-commerce, recyclers etc. to have a larger share of collected volume	Diminishing donation volume leading to lack of viability to finance operations; Incorrect end-of-use/end-of-life disposition alternative for resalable fraction of used clothes reducing climate gains	Economic; Environmental	Cases 10; 11; 18

QUOTE 21: "In most countries, the goods we collect even if we subjectively consider them as product or resources, they are by definition waste, and that's why we are not allowed to export them" (Case 8)

QUOTE 22: "... changing legal directives of the EU government on how to treat the wastes, adds paperwork and controls ... Also requires reorganisation of things, e.g. related to international transportation of exported used clothes. Also EU started a lot of work about artificial intelligence and how it will affect people, e.g. laws of GDPR and collecting consumer data related to the textiles, about the country, etc. Because we have to pay for the transportation, and have to put the AI running to make price offer. How the data privacy law etc. will emerge in future is uncertain and risky for us to invest million euros."

QUOTE 23: "... quality will reduce but not quantity, because people, as they understand the value will use internet and other ways to get money for themselves, more than just donating." (Case 15)

QUOTE 24: "... the reuse stream today funds the other streams, but as the volumes increase, there is a need to find alternative ways to make money." (Case 19)

QUOTE 25: "According to Naturvårdsverket, Swedes donates like 3 kilos per capita annually to secondhand but they only buy 0.8 kilos. So we have to make people see the advantages with buying second hand." (Case 11)

QUOTE 26: "I think the traditional model will bring us worst quality because this is not only the competition from the biggest players on the market, but look how many virtual competitors we have since last two years, e.g. peer-to-peer ... this kind of platforms are the new competitors." (Case 18)

QUOTE 27: "... we really can't forget the benefits of secondhand trying to prolong the life of items. You can collect and you can fiber separate them and you can

Table A1.

Table A1.

VU No.	Thematic categories of VU antecedents	Specific explanation of VU antecedents	Result of VU	Type of VU	Evidence from	Descriptive and representative quotes
RECYCLING/REMANUFACTURING & CIRCULAR PROCUREMENT						
11	Inadequate information transparency/tracing & tracking	Limited transparency and control on flows and quantities of exported used clothes leading to lack of understanding of the benefits and impacts	Lack of optimal/lean processing due to information inefficiency. Lack of understanding and information of measurable impacts of undertaken circular operations on environment and society	Economic (incl. Information); Environmental; Social	Cases 1, 2, 6	produce new clothes and can still have fast fashion. But then you have forgotten the benefits of secondhand.” (Case 11) QUOTE 28: “It’s a problem for us that we are not in control of what is happening with the clothes down the supply chain, because we don’t have proof of the end of line when it comes to waste dumping and environmentally secured handling.” (Case 2) QUOTE 29: “(we are) starting a holistic approach to set a circular impact on circular jobs ... the reason for lack of clear communication in this area is because the impact is still unclear, e.g. how it will create jobs or not” (Case 6) QUOTE 30: “We have a decentralised organisation which may hinder value extraction. For example, if I say to one shop we will take all your textiles and you don’t know what you will receive back from us they won’t be very happy since they really want to keep the good items. But we are concerned that the good items can receive a much better price in another shop or internet.” QUOTE 31: “one issue is related to current HS code which is not currently appropriate to label/feedback for a process where-in there is a value.” QUOTE 32: “(we are) starting a holistic approach to set a circular impact on circular jobs ... the reason for lack of clear communication in this area is because the impact is still unclear, e.g. how it will create jobs or not” QUOTE 33: “We are today exporting a big volume for 10 eurocent and already today this costs more than it prices to be able to finance this whole handling” QUOTE 34: “This is seen as a social responsibility to donate to charity organizations given the uncertainties of fashion industry leading to overproduction. With this charity organizations can secure next life to products and also financial value. But trying to tap into the resell business seems to be a sensitive issue as this is the key part of charity organizations’ ecosystem.”
2	Lack of process standardization	Decentralized operations hindering optimizing resale operations	High handling costs due to lack of process and cost optimization	Economic	Case 11	
4	Lack of knowledge and competence	Lack of harmonized trading and tariffing system for exporting used clothes for different purposes	Difficulty in efficiently organizing used clothes exports due to lack of appropriate shipping codes for textile waste trading	Economic	Case 12	
5	Cost inefficiency	Lack of clear communication due to lack of understanding of the impact of different circular operations/services on society	Lack of understanding and information of measurable impacts of undertaken circular operations on society and its welfare	Social	Case 6	
10	Lack of collaboration	Whole waste stream operations is funded by resell stream	Small proportion of resalable quality funding the operational handling of the remaining low value fractions	Economic	Case 2	
		Engaging in circular ecosystem without destroying values of the traditional members like charities	Competing and cannibalizing stakeholder profit margins and their value creation possibilities; Bad reputation due to lack of corporate citizenship	Economic (incl. Image); Social	Case 6	

	transparency/tracing & tracking	information limiting e.g. developing circular solutions and measuring potential benefits, in remanufacturing or recycling	information of measurable environmental gains	Information)		sorting tables, that's when we realize what this piece of garment is made of. This is way too late. We need to be involved in the early stage design for recycling. And that's a matter of information management... that's something still hasn't been thought through. (Case 14) QUOTE 36: "Today, these collections are quite small compared to our (conventional) garments, so it's really hard to tell its impact as we don't have full control over." (Case 5) QUOTE 37: "The problem is that they are second tier supplier... For their own activities, we have kind of good control, e.g. printing. But for the sortment we haven't made a visit yet." (Case 5) QUOTE 38: "we are collaborating with (Case 13) ...but we cannot send anything directly to them... because (Case 13) does not have any manpower to sort out." (Case 5) QUOTE 39: "With lack of infrastructure for our end-of-life kind of wastes in Europe it makes more expensive for precision sorting in Europe. But for customer value to the end of the value chain brands) reduction in climate and environmental impacts is the first question we get." (Case 12) QUOTE 40: "...when we are collecting used clothes from Sweden, they are going to Poland, we sort them and rest that cannot be used we are producing our planks that then are sent back to Sweden there is a lot of energy that will be wasted, a lot of carbon footprint from producing, transportation..." QUOTE 41: "On the supply side challenge is in securing stable supply of high-volume of homogeneous feedstock, i.e. finding the waste that we need." (Case 12) QUOTE 42: "With lack of infrastructure for our end-of-life kind of wastes in Europe it makes more expensive for precision sorting in Europe. But for customer value to the end of the value chain brands) reduction in climate and environmental impacts is the first question we get." (Case 12) QUOTE 43: "...they have very high minimum order quantities. They said you can order 30 tonnes... but that's way too much for us. We want maybe 12/3 tonnes and with different colour options. 2500 pieces in some colour is a lot." (Case 5)
		Limited control and visibility/transparency of circular supply chain actors and trade flows, in remanufacturing and recycling	Limited auditing of ethical and social practices; Difficulty in efficiently organizing used clothing operations due to limited bargaining power or data availability which increases transportation footprints	Social (CSR) value; Economic (Information); Environmental	Cases 5, 12	
		Structural hole or lack of balanced global sourcing in recycling	Limited economies of scale; Lack of optimal procurement of feedstock	Economic	Cases 5, 12	
13	Lack of optimal supply chain design	Geographically dispersed reverse logistics between collection and processing resulting in high carbon footprint in recycling	Higher transportation footprints	Environmental	Case 18	
		Lack of processing volume or scale in existing recycling or remanufacturing value chains due to fragmented supply, feedstock heterogeneity etc.	Lack of process scalability and infrastructure restricting financial viability and attaining economies of scale	Economic	Cases 6, 12	
9	Lack of process capacity/volume	Low volume of textile waste collection from Europe limiting enhancing sustainability image in recycling	Increased footprints of global circular operations leading to bad reputation	Environmental (incl. image)	Case 12	
3	Lack of market demand volume	Low variety-high volume circular material limiting market uptake of recycled materials and products	Limited variation in circular supply not fitted to fashion market demand requirements	Economic	Cases 5, 18	

Table A1.

Table A1.

VU No.	Thematic categories of VU antecedents	Specific explanation of VU antecedents	Result of VU	ORGANIZATIONAL LEVEL			Evidence from	Descriptive and representative quotes
10	Lack of collaboration	Lack of cost-sharing routines/standards between collaboration partners leading to unequal responsibility sharing and unethical expectations from NPOs by commercial actors in the circular ecosystem	Lower cost benefit for and unethical expectations from NPOs by for-profit actors	Economic; Social		Cases 3; 10	QUOTE 49: "... there is an attitude towards NPOs that can we have some material from you. ... some of the retail chains ask us, we have a collection that has been damaged. Can you take that and burn? And then a company that has made too much clothes not selling them want us to take it and burn it." (Case 10)	
12	Lack of Power/Voice	Lack of strong positioning of NPOs yet in ongoing EPR discussions limiting financial incentivization and depleting social work	Uncertain future of NPOs to valorize in emerging circular ecosystems compromising their economic and social value propositions	Economic; Social		Cases 2; 3	QUOTE 50: "Acknowledging the importance of charities in future EPR-led systems in terms of logistics expertise, knowledge, experience, and social work. The risk of being forced to change business models of selling second-hand clothes due to the fashion retailer's expectation that charities' work/activities are free of cost, and that retailers in future aim at buying their own material back. ... Missing social value in terms of volunteers lacking training in store-like environments if charity shops closes." (Case 3)	
2	Lack of process standardization	Local and decentralized ways of operation leading to inefficiency processes and lack of workplace routines	Lack of routines increasing employees workload and process inefficiencies	Economic (incl. Information); Social		Case 3	QUOTE 51: "Local/decentralized decision making in terms of sorting criteria, when and what to donate, and in what volume, when to contact logistics operator for picking up, etc. poses a challenge to standardize	
4	Lack of knowledge and competence	Limited knowhow of circular processes limiting competitiveness in terms of lowering efficiency and quality, and increasing lead time of circular suppliers in remanufacturing and recycling	Lack of competence leading to lack of economies of scale and scope	Economic		Cases 5; 12	QUOTE 44: "we want to train them. I want them to be as fast as our regular suppliers." (Case 5) QUOTE 45: "...lack of local sorting knowhow for separating reuse and recycling streams." (Case 12)	
5	Cost inefficiency	Lack of economic feasibility for recycling in contrast to linear model	Cost intensive processes	Economic		Case 16	QUOTE 46: "Even if we are only collecting and sorting for recycling, highly automatized, we don't foresee any scenario where we would have a positive business case for recycled materials compared to raw material prices."	
7	Large share of low value items	Growing proportion of low quality feedstock suited for recycling purpose	Lack of financial viability due to low value potential	Economic		Case 14	QUOTE 47: "the material quality received in 2025 is not everything like cr�me quality. The majority of the material right now is blend. So it's probably a challenge to process that kind of material. This is a challenge to recycling."	
8	Low Technology readiness level	Low quality recycled material	Low value potential of process output feedstock	Economic		Case 19	QUOTE 48: "The yarn produced is not thin enough to be used for new garment. It is today instead used in bags and shoes."	

							operations and launch sustainability program ... sometimes less effective and efficient. QUOTE 52: "Different ownership models of the stores (50% owned, 50% in cooperation with local church) creates complexity in capturing value, ideological challenges and problems in harmonizing the message across all stores. ... Also hinders developing new partnership with waste management company (Avfallsbolag) for handling waste better, getting better data on sorting and recycling" QUOTE 53: "... [we] see them as a potential raw material provider. But the challenge is where they have their plants. They are located in the wrong place based on where the production is. They are really successful in being in Sweden, and with EPA etc. coming, it makes sense that we need more global presence, to really utilize that." QUOTE 54: "Difficult for global players to act locally with one body as different countries also in the EU will have different directives. But the ship has sailed because there are already discussions about how it's going to be implemented in different countries. Once these models are there, it's going to be nearly impossible to catch that back and to really, really, harmonize it in a strong way." QUOTE 55: "We don't make the same gross profit or margin, as for example, H&M is doing with the new articles. For post-consumer end of life garments, the margins are very slim." QUOTE 56: "Local/decentralized decision making in terms of sorting criteria, when and what to donate, and in what volume, when to contact logistics operator for picking up, etc. poses a challenge to standardize operations and launch sustainability program ... sometimes less effective and efficient." QUOTE 56: "... which kind of waste do we want to ship outside Europe? So what should be the quality of those waste streams? ... convinced we need the global trade also for waste. But it's a question of the quality. And when we talk about high quality, sorted secondary raw materials for examples, why we shouldn't ship it to China, if China wants to have it? So the question how the waste is prepared in Europe." QUOTE 58: "We realize that we can do collaborations but we will not invest money from ourselves because we don't have an investment company in our back to go into the market." QUOTE 59: "If I am a store manager, I prefer to take care of the people in work practice. And I and our manager would say no, you have to focus on the customer."

Note(s): All VU antecedents evident in multiple cases (> 1) are highlighted in green

Source(s): Authors' own work

Table A1.

Table A2.
VO strategies and their
influence on
sustainable value from
the TBL perspective

Appendix 2

COLLECTION					
VO No.	Thematic categories of strategies for enhancing VO	Specific explanation of strategies for enhancing VO	Result of VO captured	Type of VO	Evidence from
2	Establish higher process control/coordination	Customized collection programs via dedicated collaborations and contacts via controlled locations	Improving customer convenience and ensure better collection quality	Economic (incl. Customer)	Cases 3; 10; 14
3	Running innovative experiments/projects	Innovation projects on collection and disposition systems; Building awareness of donors through nudging	Improving consumer knowledge/awareness to explore new collection systems	Economic (incl. Customer); Environmental	Cases 4; 9
5	Finding/offering new collaborations	Finding new collaboration partners, such as food and fashion retailers, real estates	Improving customer convenience and ensure better collection quality	Economic (incl. information)	Cases 10; 17; 19
4	Process optimization	Transportation route optimization; Green logistics	Cost efficiency; improving eco-effectiveness	Economic; Environmental	Cases 8; 18

Descriptive and representative quotes

QUOTE 1: "Donators donate in person and not via bins. Personal contact is important to improve quality of donated goods." (Case 3)

QUOTE 2: "... the reason why we chose to establish in-store take back program is to make it very convenient for the customer. So the idea was to set up a bin in each retail store where the end customer can put their used garment. It depends on the country but they (consumers) get a voucher for their used garment." (Case 14)

QUOTE 3: "By engaging in various innovation projects aimed to communicate and develop consumer awareness on how to sort at disposal into different disposition streams.... it's important for us to get the customer to know the difference between what is for reuse, what is to be sold in a second-hand shop and what is textile waste." (Case 4)

QUOTE 4: "... collaborations with food stores that would go to people with the food and can bring back the bag with the (used) clothing. We are exploring different collaborations to make it easier for people." (Case 10)

QUOTE 5: "... we saw that there are so many people who don't have the possibility to go to the recycling place and we saw to collect nearby your home, it's so much better. We talked with some real estates, and they told us that there's a lot of clothes in their garbage. So today we work with some real estates." (Case 17)

QUOTE 6: "... we need to really make transportation process very lean, and use all the capacity. So we really need a certain truckload or a certain volume to make the shipment work." (Case 8)

7	Optimal supply chain design	Avoid collecting from low value markets	Cost efficiency	Economic	Case 1	QUOTE 7: "The aim is to find collected quantities with a high percentage of reuse. For example, we are not cooperating with someone from Eastern Europe, where we are quite good knowing that the quality is quite low. So that would mean that with our sorting infrastructures, we cannot produce the value to have a positive economic value at the end."
8	Develop knowledge and competences	Developing consumer surveys to design convenient collection channels	Create customer understanding	Economic (incl. information)	Case 10	QUOTE 8: "... because both collecting and consumer markets are changing, we did a big survey about the market and the customers, what the customer prefers. So we realized a long time ago that to give something to us, the trigger for people is not the non-profit. It's like a very nice value. So we have to make it easier to buy, easier to give."
SORTING						
VO No.	Thematic categories of strategies for enhancing VO	Specific explanation of strategies for enhancing VO	Result of VO captured	Type of VO	Evidence from	Descriptive and representative quotes
6	Process technology intervention	Automatic sorting and AI-based material recognition and pre-sorting	Managing processes and identifying flows to valorize textile waste in a cost efficient way	Economic	Cases 4; 8; 13; 14; 18; 19	QUOTE 9: "... we have identified very early in 2016 that (automatic sorting) will become most important in achieving a closed loop recycling. And that's why we've invested the money into that technology for identifying the material flows." (Case 8) QUOTE 10: "Based on our partners' requirements, we are focusing on new solutions. "that's why we invested for example, in material recognition process; i.e. into a fully automated AI driven pre-sorting routine to substitute the high labour costs by modern smart technology." (Case 14)
5	Finding/offering new collaborations	Partnering with sorting services globally; Develop collaborative sorting infrastructure for recycling fraction	Improve process and cost efficiencies; Increase economies of scale and scope	Economic	Cases 7; 8; 20	QUOTE 11: "We have a role of an innovation facilitator in the system. I think it's much harder for entrepreneurs to go (established players) to get 10 kilos. Instead they can visit us and we can discuss with them." (Case 20)
		Finding the right suppliers and buyers for sorted materials	Secure supply and demand	Economic	Case 13	QUOTE 12: "The key for our commercial success is to find the right suppliers or the right feedback for the plant and establish the right collaboration and contracts. And the same on the buyer side... If you're a brand trying to secure the business case around a recycling technology and get a scale, you quickly realize that this looks promising, that is we are increasing the value of a very low value waste stream or even a negative value waste stream and transforming into higher value."

Table A2.

Table A2.

8	Develop knowledge and competences	Sorters' knowledge building of customers via education	Customer/Market-oriented learning	Economic (incl. Information and customer)	Cases 10; 11; 20	QUOTE 13: "... we have a concept where employees travel across Sweden and try to educate the sorters." (Case 11) QUOTE 14: "There is a potential value to work more across industries. A sorter has a very important role to play in the system, who knows where the customer needs are." (Case 20)
4	Process optimization	Specialized sorting; Determine correct process granularity in global operations	Process efficiency; Increase economies of scale and scope	Economic	Cases 4; 13	QUOTE 15: "The legislation would create a lot of opportunity to get the waste companies to take care of the textile waste, so that we can concentrate on reuse part where we have our infrastructure and all our possibilities to take it further." (Case 4) QUOTE 16: "... we are trying to sort the high values items more local and the low value ones because these will be thriving only on the basis of value; they need to be more centralized. ...So you have to have some sort of reasonable scale to it." (Case 13)
7	Optimal supply chain design	Search and organize local/regional sorting	Economies of scale; Avoid waste trading	Economic; Environmental	Cases 8; 20	QUOTE 17: "... we are always working on identifying key sorting partners, at least in certain areas. We are defining areas/regions where it makes sense to consolidate the volumes and process them. Our setup for Europe is pretty good. Because the more volumes we have, it's an economics of scale, the better we are at planning these volumes and we can achieve better prices." (Case 8)
12	Business model change/addition	Offering sorting services for wide spectrum of fractions; Sorting for recycling as a service	Offer open innovation service; Offer wide range of innovative solutions to increase scope	Economic; Social	Cases 3; 20	QUOTE 18: "We have a role of an innovation facilitator in the system. I think it's much harder for entrepreneurs to go to (established players) to get 10 kilos. Instead they can visit us and we can discuss with them." (Case 20)
1	Process capacity expansion	Build capacity for sorting for recycling	Economies of scale	Economic	Case 12	QUOTE 19: "We should have an automatic sorting facility in the port for all the stuff that's been deemed to be exported. We should run those bales through the machine and output is our pile and the rest goes baled up again and then to wherever it's sold."
10	Information transparency/management	End-of-life product information management for designing for circularity	Higher circular design possibility	Economic (incl. Information and customer)	Case 8	QUOTE 20: "we do have knowledge about a product that our client's designer created 5 or 10 years ago. And I think this is very important information that should go back and forth. ... we did start projects in order to set ground for such information flows [...] the feedstock and the collection volumes that we are processing is very interesting, because it tells so much about your customer in the end."

3	Running innovative experiments/projects	Joint sorting projects	Process an cost efficiencies	Economic	Case 4	QUOTE 21: "we are involved in a number of projects. Involved in innovation project in collaboration with waste company to collect waste and recycle quality of post-consumed textiles as separate streams, and concluded pilot analysis to test if end consumers manage to offer."
RESELL AND TRADING						
VO No.	Thematic categories of strategies for enhancing VO	Specific explanation of strategies for enhancing VO	Result of VO captured	Type of VO	Evidence from	Descriptive and representative quotes
12	Business model change/addition	Selling second-hand items under various business models (e.g. pay/kilo, outlet, remake re-commerce)	Increase scope of solution	Economic (incl. customer)	Cases 2; 11; 15; 18	QUOTE 22: "we have the spread, we can say now to the customers ... the customers can buy remake, but at the same time, they can go to our outlet and buy per kilo, or do their own remake." (Case 15) QUOTE 23: "will propose a platform which will allow customers to join, donate or sell the used clothes. Customers can choose one of the solution after donation. In the simplest model it can be money in the account or some special points for our loyalty program which we have in our network of own shops." (Case 18) QUOTE 24: "New collection of party items later in 2022 of ~1000-2000 pieces, but a little bit costlier, with resale, upcycle and renting in that collection ... if you want to do something really extravagant, it's super costly for our customers, then it's really nice to offer them renting."
7	Optimal supply chain design (retail) Optimal supply chain design (export)	Developing 'right mix and balance of different sales channels Optimizing global operations with optimal transportation	Customer convenience: Maximise profit by capturing the best of each channel strategy; Increase scope of solution Cost efficiency: Closer to clients	Economic (incl. Brand/Image, customer) Economic	Case 5 Case 10; 11; 15 Case 1	QUOTE 25: "Sell via Instagram, on the webshop but deliver from the stores. But it has to be made more like a concept and better set up. It cannot be too complex and tedious for the customers. Now we have trial-and-error and have to learn from it. ... we have also discussed to have a platform that offer people to trade themselves." (Case 10) QUOTE 26: "So buying on internet make it much easier. So we will broaden and deepen this possibility for the customers. For now Tradera is working very well. We also (started) with Blocket." (Case 11) QUOTE 27: "... when it comes to waste streams, it is a global market at least when you see our production value chain. And so that means that also recycling to

Table A2.

Table A2.

							provide new raw materials to the production sites, that must be global at the end. And from that point of view ... we ship or transport the right secondary raw materials or second-hand products to markets who needs that stuff, and can use it as a resource or to reduce other materials." QUOTE 28: "It's a mix of all. Both for cheap clothes for making good for the environment but also the brand value. ... If we are going to increase the numbers of people buy in our shops, we have to make shops that people love because they like what they see and find what they want to buy. And not necessarily because it's second-hand or they are supporting social work. So, we have now started a new concept and it doubled the turnover in the first month compared to that in 2019. So, therefore, we make concepts and see that you have to make second-hand stores easy to find, have assortment that people want to buy and find it easily." (Case 4) QUOTE 29: "we have a really strong brand, we are very good at running our stores. We started a new store at the very center of Stockholm, in the H&M area in their own building. So the customer is there, we have to be there. [...] we meet people that want to buy second-hand, so we are in front of them, they will come to us." (Case 10) QUOTE 30: "When we have done something wrong, we have to take it back and do better. So the shop managers are extremely important to quickly change our sorting routines. ... the pricing, it's extremely important. Since we are working in retail business, it's the key to our success the last 10 years." (Case 2) QUOTE 31: "... move slow selling products from stores to production center for online sales in Bords. So, the local shops can sort goods also for the online shop." (Case 3) QUOTE 32: "... second-hand, it's a very unique business. People who wear a second hand, don't want to see 20 white shirts, or T-shirts, they would like to have the variety. And that's also the reason why there is no specification at the end, important thing is that we catch the needs of the clients. And normally we know very well, what the customers would like to buy." (Case 3)
11	Sustainability branding & communication	Retail store development for e.g. communicate social value, environmental benefits, sustainable brand building	Enhance market positioning by communicating sustainability and offering sustainable purchase options	Economic (Brand and image; Customer); Social	Cases 3-4; 10; 15		
4	Process optimization	Change work routines; Redirecting non-selling items	Market and customer orientation to maximize sales	Economic (incl. Brand)	Case 2; 3		
8	Develop knowledge and competences	Training to interpret market cues to understand client needs	Market and customer orientation by offering variety and uniqueness	Economic (incl. customer)	Case 1; 2		

2	Establish higher process control/coordination	Deploying Code of Conduct and CSR routines	Good working conditions, wage etc.	Social (incl. CSR)	Case 4	QUOTE 33: "So we are doing checklists, every time we visit a client to see that fire exits are clearly marked, its safe, but also ethical ... People working have good conditions, and the wage, of course, if it's over minimum ... we see that all products are sorted for the African market legally in the right sizes of the bale. They don't have to bribe to bring it into Africa. And everything is for reuse and they pay for everything." "Consumers already started putting their clothes on internet and get price quotes. But this is very hard to proceed for a lot of customers because many of the customers don't want to put the T-shirt for e-buy, wait and answer hundreds of questions of other buyers for five years ... consumers send us photo of their clothes, and we will tell them how much they are worth, before they decide on whether to send us or not. So, introducing the different kinds of identification schemes/systems will help us and our clients." QUOTE 34: "we are sharing a lot of data; which styles are selling, which one is more profitable. So there's a lot of data involved [...] we try to normalize the flow, and and make it visible, and we exchange data to learn from each other."
6	Process technology /intervention	Deploy AI enabled services	Enhance customer/user service experience	Economic (incl. customer)	Case 18	
10	Information transparency/management	Information/data sharing with collaborating re-commerce platform	Enhance visibility and optimize flow	Economic (incl. information)	Case 5	
RECYCLING/REMANUFACTURING AND CIRCULAR PROCUREMENT						
VO No.	Thematic categories of strategies for enhancing VO	Specific explanation of strategies for enhancing VO	Result of VO captured	Type of VO	Evidence from	Descriptive and representative quotes
5	Finding/offering new collaborations	Upscaling remanufacturing through diverse collaborations, globally or locally	Create economies of scale and scope of solution	Economic (incl. image/brand)	Cases 5; 10	QUOTE 35: "If we do upcycling in Sweden, it's a huge workmanship that can't compete in terms of profitability with our normal quotes. So in that perspective upcycling cannot be as much volume as our normal linear production. So we need to have upcycling prices as equally to normal production, but with suppliers that can't compete with our regular suppliers. ... with our collaboration the price is more or less the same compared to a new item. So it means that our upcycle collection can compete with new collections in the sense of profitability." (Case 5) QUOTE 36: "We make remake in collaborations with others. But we cannot stay by ourselves with all the cost to make remake." (Case 10)

Table A2.

Table A2.

		Attract retailers as buyers of cascaded product innovation	Market potential	Economic (incl. Brand); Environmental (incl. image)	Case 18	QUOTE 37: "Exploring more collaboration with retailers before the beginning of the 2023 to market the mechanically recycled product innovations from post-consumer textile wastes collected in-store."
7	Optimal supply chain design	Build new circular supply chains, e.g. by finding global suppliers, acting as supply chain intermediary	Cost efficiency; Economies of scale Market positioning	Economic (incl. image/brand)	Cases 5; 14	QUOTE 38: "we are important part in the puzzle ... (we are) in good position when the volume of flow increases, as they can increase the margin through economies of scale, and also due to upcoming legislation driving retailers and brands to collaborate more with us, such collection and sorting partners." (Case 14)
8	Develop knowledge and competences	Create learning for entire value chain, through educational activities	Market or customer orientation; New market potential	Economic (incl. image and information)	Cases 15; 19	QUOTE 39: "We do classic target group work, know what the customers wants and expects from us. Like, you can see we were first selling in this second-hand shops. And then when we moved to retail mall, we saw a totally new customer group beginning to buy from us. This is about where we sell them, which target group or customer group, etc." (Case 15)
9	ESG reporting and compliance	Align to industry norms and use arguments to evaluate impacts of using circular materials	Define KPIs; Market positioning	Environmental and Social (image)	Cases 5; 6	QUOTE 40: "... we have some (compliance) demands, follow the same standards and contract as our regular suppliers. And we're doing monitoring, and unannounced audits." (Case 5)
						QUOTE 41: "Have clear KPIs (e.g. related to amount of recycled materials used). On quarterly and seasonal basis measure how much has increased in terms of recycled material content in the collection, e.g. recycled polyester." (Case 6)
11	Sustainability Branding & Communication	Providing increased sustainability image for collaborating brand partners, to book circular procurement capacity	Securing stable demand volume; Cost benefit and image; Efficient scaling by booking capacity	Economic (incl. image and customer)	Case 12	QUOTE 42: "we're signing offtake agreements with them (brands). Their function is to signal demand in the value chain for our product. So that we can get into the value chain, and actually scale up, attract the capital needed, with the promise of offtake agreements in the future and attract the (brands) needed to build more plants. ... we offer them (brands) reductions in climate and environmental impacts. ... because we have renewable energy, and we have waste as input ... Remaining climate hotspots are limited..."
1	Process capacity expansion	Expand recycling capacity	Early market positioning	Economic	Case 12	QUOTE 43: "We have a goal of going to 250,000 tonnes by 2026 times that is 360,000 tonnes by 2030, and we want to or maybe accelerate that if markets there."
4	Process optimization	Increased flexibility in up taking recycling feedstock	Economies of scale	Economic	Case 12	QUOTE 44: "Our spec for the new plant is a bit more permissive. We're currently sourcing 95% cotton purity and any colour basically because we've done additional investments in bleaching and decoloration process."

Table A2.

Table A2.

12	Business model change/addition	Changing overall business model towards becoming more competitive and profit-driven	Profitability	Economic	Cases 4; 10	QUOTE 53: "... we are working like a regular retail company. We started to make a business plan, work with KPIs, employ controllers. So we did a big change in our structure where we just focus on everything to be profitable. ... because our reason to make profit that goes to social work. We have a lot of business people in our board, from e.g. IKEA. ... we will run our business by our own employees, we will still offer work practice." (Case 10)
		Creating socially-driven business models by focussing on work practices	Job creation; Create new revenue streams	Economic, Social	Case 10	
4	Process optimization	Building process effectiveness, e.g. by focusing on value rather than volume during collection, through decentralized logistics and handling	Process and cost efficiencies; Economies of scope	Economic	Case 4; 10	QUOTE 54: "... we try to see what's the most cost efficient way continuously. So we will look upon where is it possible and smart to have these hubs without combined to our own locations." (Case 4) QUOTE 55: "Since 2015, we have changed focus from volume to quality. We can collect the bad quality, but somebody else has to take care of it. If it goes to recycling, for example, we have to have a cover for our assets. ... If we realize that we can do collaborations but we will not realize them, they form obstacles in recycling, that's not a good business." (Case 10)
8	Develop knowledge and competences	Engagement in circular initiatives together with other actors	Create learning	Economic (incl. Information and brand)	Case 6; 11	QUOTE 56: "... we want the first mover advantage. It's not just learning to get into the market, but what is published and what role we should have here, because we need to test them to get an understanding because it's something completely new." (Case 6)
7	Optimal supply chain design	Global-Local sourcing of sorted textile waste as feedstock	Availability and cost efficiency; Environmental and social sustainability	Economic; Environmental (incl. customer and image); Social	Case 12	QUOTE 57: "Europe is good. But there's immediate availability in India, Pakistan and Bangladesh. So our biggest supply contract is in India with a sorter and grader of donated textiles. So they manage a global flow of textiles and they do their main postconsumer sorting. ... But less processing chemical and transports, that we have to keep pushing down, which will give us a better advantage, and better value delivery to our customers. So for that reason alone, we will keep pursuing closer to home sourcing of textile waste." "
9	ESG reporting and compliance	Align to industry norms and use metrics to evaluate impacts	Define KPIs; Market positioning	Environmental (image)	Case 5	QUOTE 58: "... we have same (compliance) demands, follow the same standards and contract as our regular suppliers. And we're doing monitoring, and unannounced audits. ... The expectations are to align the company goals and actions more with science and climate goals."
13	Work integration	Increasingly engage local volunteers	Job creation; Social entrepreneurial development	Social (incl. CSR) value	Case 3	QUOTE 59: "We are engaging and empowering local volunteers like a grass-root movement. The current way of operation in a decentralized manner brings a lot of value to the volunteers in terms of work opportunities."

Note(s): All VO strategies evident in multiple cases (> 1) are highlighted in yellow
Source(s): Authors' own work

Case labels	Description on CSC activities
Case1	One of Europe's largest sorting and recycling business group with main operations in Germany and Benelux. Includes 3 collection-, 7 sorting- and 1 recycling organization, including one innovative recycling platform. Collection takes place through various channels such as door-to-door, in-store and via collection bins placed at locations such as charities, municipalities and real estates. Sorting is organized for reuse (into >300 articles), for recycling (into >25 articles) and for energy recovery. Each sorting organization sorts approximately 30–50 tons a day. Nearly 40% of the sorted items are exported while a small fraction is also sold via own vintage shops. Some of the sorting companies also purchase collected goods from other partners. Recycling includes both mechanical and experimental chemical recycling, with end products as wipers, recycled yarns and non-woven
Case2	A non-profit association with over 50 years of experience in second-hand business and solidarity work. Its collection takes place via various channels, such as via collection bins placed at locations such as charities, municipalities, recycling stations and real estates, and also in-store. In total collection is about 3,300 tonnes annually. It owns six second-hand shops and together with several municipalities in south-west Sweden runs 12 buddy shops. It also has two sorting facilities and two warehouses. Fraction that is not sold in own store is exported - one which is mixed at 10 euro cents/kilo, and the other which is sorted at 50–60 euro cents/kilo
Case3	Children's rights organization with a non-profit second-hand operation. Main operations include collection, sorting and resale of donated second-hand items. Collection takes place using own logistics operator from donors' homes, but also includes other collection channels such as in-store or via donation centres. Resale channel includes 60 stores (12 are self-owned) in Sweden, and online shop. Traditional format includes large stores having around half dedicated to sorting and inventory, and other half for retail. However, recently it has started centralizing its operations by developing 3 e-commerce hubs for warehousing and logistics for webshop and specific shops. The largest one located in west Sweden handles approximately 200 tonnes annually, of which about 7.5% are sold in own-stores or online while about 35% are resend to collection partner. Over 450 tonnes of used clothes are annually donated to its main collection partner
Case4	Largest collector with over 3,000 containers in Norway, and a part of an international charitable organisation. Subsequently involved with all the operations related to the reuse part. Sorting volume is about five and three tonnes in respective sorting facilities, per day. Sorting in Norway is done only that is needed for selling in own stores, while the rest is exported by sister trading organization. About 10% of the incoming volume (into the sorting facilities) is sorted in Norway of which about 21% is Norwegian reuse quality. Of the rest 79%, the reuse quality is also exported while the textile waste is given to the waste management companies. Rest unsorted 90% that cannot be sold in Norway are loaded directly from the 15–20 loading places by its trading organization. The main export markets are: (i) the unsorted items mainly going to Eastern Europe/Baltics, (ii) sorted second grade (ABC grades) items going to Pakistan, and United Arab Emirates and (iii) in Iraq only for reselling in the local market
Case5	Swedish clothing brand operating 155 stores in five Nordic countries. Its current circular initiatives and collaborations focus on product and production, and also circular design. It collaborates with aid organizations to handle used products returned by customers. It also operates online second-hand sales by partnering with a re-commerce platform. In addition, several other collaborations includes: selling leftover and vintage as per-kilo in other EU markets, renting at physical stores, upcycling/remanufacturing in collaboration with a global partner located in India and procuring recycled materials from textile recyclers for developing collections

(continued)

Table S1.
Detailed case
overviews

Case labels	Description on CSC activities
Case6	Swedish internationally operating clothing retailer with over 4,000 stores in 54 markets. Its circular activities include collaborating with an international sorter to engage with in-store take back program, and running various second-hand concepts of different scale, in different geographies and with different partnerships, along different circular loops, e.g. own resell brand, standalone brand with major stake, etc. Other circular initiatives include offering repairing care and remake options by collaborating with charity organizations
Case7	International aid organization with second-hand business with about 2,500 boxes deployed in communities and at recycling stations, in collaboration with municipalities or private landowners, in central and south Sweden. Annually it collects about 13,000 tonnes, of which around 1,000 tonnes are sorted in one of its four sorting facilities. From this, suitable textiles go for sale in 10 of its own second-hand stores or for humanitarian efforts mainly in Africa, Eastern Europe and the Middle East. The remaining unsorted textiles are exported to sorting companies in Eastern Europe, which are divided into different classes for reuse and recycling. It also collects from other organizations by entering into collaboration that want help with collection, packing and logistics
Case8	Subsidiary of a global sorting and recycling company, it collects about 90,000 tonnes of used clothes annually. It runs as a garment collection program by partnering with fashion retailers and brands to facilitate in-store collection. Consumers bring in their used clothing or shoes directly to the participating stores and are given a reward incentive. Collection can be carried out using collection bins individually designed according to the partner's wishes. Normally used clothes are picked up from partner's distribution centres in full truckloads
Case9	Upper class municipality in west Sweden, which has adopted several initiatives when it comes to handling textile waste streams. Currently it locates three recycle centres for collecting textile waste, where private entrepreneurs run collection operations, based on certain agreement. The agreement allows NPO to place bins in the municipality. The municipality also gathers waste statistics, to inform other actors about the waste volumes
Case10	Sweden's oldest chain of second-hand stores and is owned by an international charity organization. Currently it organizes collection, sorting and reselling of used clothes. Different collection channels include unguarded boxes in municipality's recycling centres, via own stores and collecting at home, and by partnering with different clothing retailers. Annual collection is about 7,000 tonnes of which 10–20% are resold in Sweden. Currently it organizes three sorting facilities in Sweden. Clothes that cannot be sold via own store, and also unsorted items are traded via a trading organization to different parts of the world, such as to Eastern Europe, Asia and Africa. It operates 32 second-hand retail stores including webshop
Case11	Part of an international humanitarian organization, the second-hand clothing business is organized. In Sweden they have around 250 shops, each decentrally organizing collection, sorting and reselling activities. Collection also occurs in collaboration with fashion retailers, and real estate companies to collect in their laundry rooms. Clothes that cannot be sold in own store are sold to partnering large European integrated sorter-recyclers for exports. Overall, about 30–40% of what is collected is resold in own stores, and about 40% is sold for subsequent exports. A small fraction is resold via re-commerce platforms
Case12	Swedish chemical recycler, which converts cellulosic-rich textiles into fibre pulp as raw material for viscose and lyocell. Recycling is conducted in a Swedish facility producing about 60,000 annual tonnes of pulp. The company has developed a patented dissolving mass using dry-wet processing and then drying again, and then sell it as dissolving pulp as a drop-in substitute for conventional wood pulp. Currently it works with about 50–50 post-industrial and post-consumer waste streams
Case13	Automatic sorting facility using near-infrared technology for sorting large volume of used clothes into colour and material composition. It is a public-private joint venture, as the sorting machine is funded through public investment, while the facility is provided by a Swedish waste management organization. The plant has a yearly capacity of handling 24,000 tonnes, and current clients includes textile recyclers

Table S1. (continued)

Case labels	Description on CSC activities
Case14	German sorting and recycling company. Collection is either conducted in cooperation with charities, through commercial and municipal collections and by engaging in take-back programs, via its daughter company. After collection the used clothes are consolidated in a local distribution centre in each country, before it is transported to one of the two sorting facilities located in Germany and in Dubai. Sorting takes place based on ~45 different criteria, 16 different garment types and 3 different grades of quality, e.g. reuse or recycle, based on the EU waste hierarchy. Reselling is operated through different sales channels, such as for selling vintage second-hand or under the concept of “per-kilo”. The remaining items that cannot be sold through own second-hand channels are exported based on quality to different markets, such as Africa, Eastern Europe, Russia. If the garment is not reusable or wearable (about 56%), they will go to the recycling streams of different kinds (~30–35%); cotton items are cut into rectangle pieces and sold as wipers. The second line is mechanical recycling if it’s a blend. Customers of recycled fibres are automotive and the construction industries, and also for chemical recycling
Case15	Swedish social enterprise, it organizes a second-hand business along with an upcycling concept. Main modes of collection is donation via stores, but also municipality collection. Some kerbside collection is also conducted through recycling stations. The collected volume comes to a central warehouse which then gets sorted manually, valued and price marked and finally sent off to the second-hand stores or for upcycling. About 40–42 tonnes of textiles are received weekly. Stores are of two types, the classic second-hand shops and then a couple of outlet shops where clothes are sold per kilos. Those which cannot be sold in the stores are exported in collaboration with a Norwegian organization. Second-hand items are recently sold online by partnering with re-commerce platform
Case16	Swiss company engaged with collection, sorting, reselling and recycling of used clothes. It operates in Germany, Austria, Bulgaria, Hungary, Spain and the USA. Annual collection is about 75,000 tonnes, and this is organized mainly through own collection channels via collection bins. Other collection channels are in collaboration with retail brands as take-back systems, and by offering online collection option directly to consumers via free-parcel shipment. Approximately one-third of the collected volume is processed at own facilities, of which ~60% is reusable and ~30% recyclable. Sorting takes place into 300+ product groups. The resale portfolio consists of different concepts such as vintage stores, online shops and thrift stores. For the wholesale part, the main markets are eastern Europe, but also includes Sub-Sahara, South America, Pakistan and India
Case17	Social enterprise that manages the collection of clothing, textiles and shoes for reuse by having bins and collection boxes placed in collaboration with municipalities and real-estate companies at their recycling facilities. Annually it collects about 400–500 tonnes. Everything collected in the boxes are taken to the inventory in south Sweden, and from there transported to a partner who is one of Europe’s largest sorters. No own sorting is made, except for taking out pillows and blankets which are donated to homeless shelters. As a social enterprise, its goal is to generate jobs for people who are far from the labour market
Case18	Polish company with current operations consisting of collection, sorting, gradation and then reselling used clothes. Annual collection is about 95,000–100,000 tonnes, mainly via 3,000+ boxes installed in Germany, Poland and Czech Republic. The transportation to its Polish sorting facility is organized by own fleet of 75 trucks. In-house sorting takes place in two different lines, one installed with more automation such as speech-recognition system. Annually about 300 million pieces are sorted, of which about 80–85% are resold, of which 30% is resold in EU, while the rest are traded abroad (Asia, Africa, South America). The company is also experimenting with new recycled material innovations

(continued)

Table S1.

Table S1.

Case labels	Description on CSC activities
Case19	Dutch company working with the entire recycling supply chain, from collection, sorting, recycling (own mechanical recycling) and creation of new textiles by spinning and weaving the recycled fibres. Collection takes place in collaboration with municipalities in Netherlands and Belgium, and in recent years also started partnering with fashion retailers. Sorting for reuse is conducted at own facility in Netherlands, but also in Morocco. Sorting is made into 10 fractions that includes reusable clothing and shoes, industrial wipes, non-wearables, blankets and waste; overall this accounts for 250+ product categories. The non-wearable fraction is mainly recycled into yarn then made into woven fabric at own facility. Overall reusable and recyclable ratio is about 50–50
Case20	Swedish sorting organization with a semi-automated pilot line for textile sorting since 2018. It operates both sorting for reuse and recycling purposes and handles about 2 tonnes on a weekly basis. It operates like a sorting R&D facility with collaborations with NPOs and brands in experimenting novel sorting solutions
Source(s): Authors' own work	

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