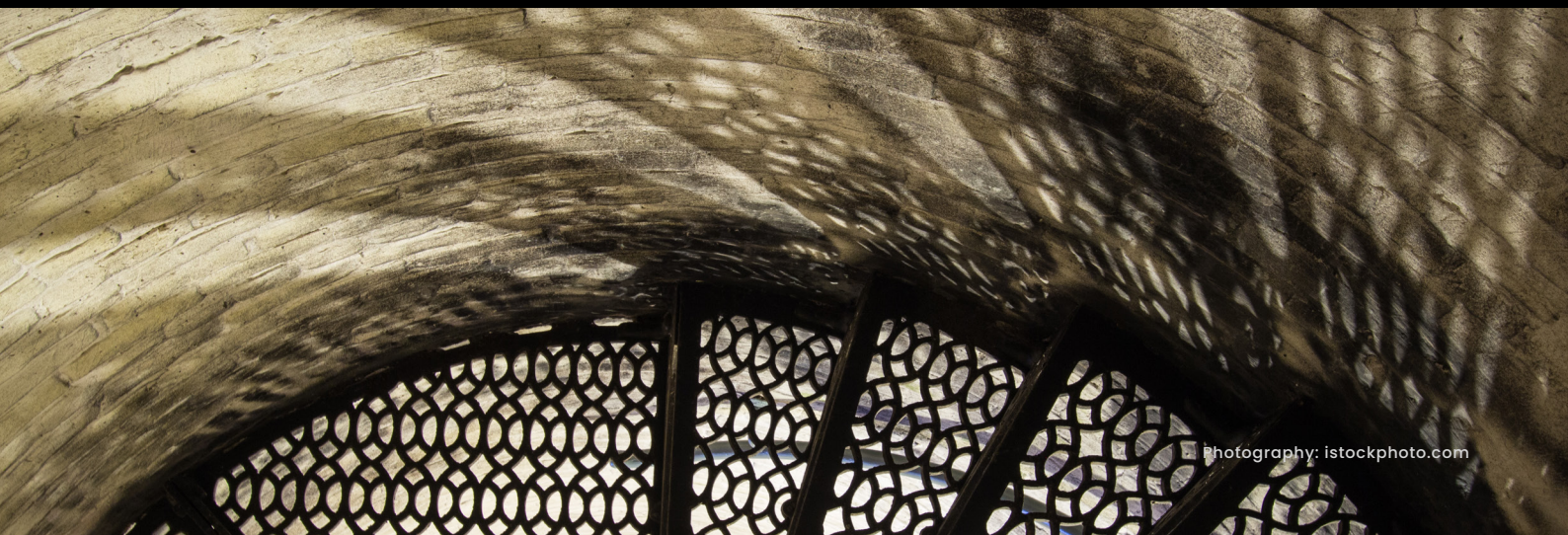




# **Circular Textile Data for the Public and Private Sector**

**Accelerate Estonia Experiment Report**

June 2022



# Authors and Acknowledgements

The TEXroad concept was first initiated from the work of **Reverse Resources** and was further developed through a collaboration with **REvolve Waste**. We then assembled the **TEXroad team** who provided their time, insights and expertise during our Accelerate Estonia experience.

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# Linear to Circular

Textiles are an incredible resource filled with economic, environmental, and human value. At least 5,4 million tonnes of clothing and household textiles are purchased within the EU-27 every year, and unfortunately, over half are thought to be thrown away as mixed household waste.<sup>[1]</sup> Europeans' consumption of clothing and textiles has a staggeringly high environmental cost,<sup>[2]</sup> the textile industry has serious social concerns, including child labour<sup>[3]</sup> and the linear system has paved our race to the bottom.

The circular economy is the answer to this problem, and data is crucial to the transformation from a linear to a circular textile industry. In a world where textile data is flowing and accessible, businesses successfully implement and scale circular models, policy supports and accelerates this transition and individuals have access to high quality, affordable products.

Today, critical data is inconsistent, inaccessible and it does not flow. TEXroad eliminates these barriers to enable circular textiles.

- 1 European Commission, JRC Technical Report: Circular economy perspectives in the EU Textile sector, 2021
- 2 European Environment Agency, Textiles and the environment: the role of design in Europe's circular economy, 2022
- 3 European Commission, Communication: EU Strategy for Sustainable and Circular Textiles, 2022

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# Policy Context

The European Union is developing policy for a digitally connected, circular textile industry to become reality.



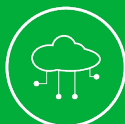
Member States shall set up separate collection at least for paper, metal, plastic and glass, and, by 1 January 2025, for textiles.

- **Waste Framework Directive Update, 2018** <sup>[4]</sup>



By 2030 textile products placed on the EU market are long-lived and recyclable, to a great extent made of recycled fibres, free of hazardous substances and produced in respect of social rights and the environment. Consumers benefit longer from high quality affordable textiles, fast fashion is out of fashion, and economically profitable re-use and repair services are widely available. In a competitive, resilient and innovative textiles sector, producers take responsibility for their products along the value chain, including when they become waste. The circular textiles ecosystem is thriving, driven by sufficient capacities for innovative fibre-to-fibre recycling, while the incineration and landfilling of textiles is reduced to the minimum.

- **EU Strategy for Sustainable and Circular Textiles, 2022** <sup>[5]</sup>



The European Commission has proposed new rules on who can use and access data generated in the EU across all economic sectors. They aim for Business and industrial players to have more data available and benefit from a competitive data market and include means for public sector bodies to access and use data held by the private sector that is necessary for exceptional circumstances [...] or to implement a legal

4 European Parliament and Council of the EU: Waste Framework Directive (2018/851), 2018

5 European Commission, Communication: EU Strategy for Sustainable and Circular Textiles, 2022

mandate if data are not otherwise available. Data insights are needed to respond quickly and securely, while minimising the burden on businesses.

– **Proposal for Data Act, 2022**<sup>[6]</sup>

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6 European Commission, Proposal: Regulation of the European Parliament and of the council on harmonized rules on fair access to and use of data (data act), 2022

# Introduction

TEXroad was inspired by X-Road, an open-source software and ecosystem solution that provides unified and secure data exchange between organisations. It prioritizes inclusiveness, openness and reliability. Security and transparency, data ownership and the once-only principle are central concepts that provide value for users of the system. These concepts are precisely what is needed to enable the flow of data for the circular economy, and TEXroad applies the once-only principle for data entry and secure data exchange to address the information gaps creating bottlenecks for circular textiles. <sup>[7] [8] [9]</sup>

## Why

- Available textile data is poor, outdated or inaccessible
- Policy and business decisions are disconnected and involve too much guesswork
- Public and private sectors are not aligned in how to shift toward the circular economy
- Current tendency is to measure “end-of-pipe” impacts of textile waste instead of building a new, digitally supported circular supply chain for endless circulation of textiles

## What

TEXroad is a developing concept for a digital infrastructure to connect other digital platforms for two purposes:

- Enable effective B2B and B2G data exchanges to promote circular economy policies and market activities
- Provide comprehensive data of circular textile flows on a country and international level

This approach empowers private sector platforms to have a better offering for their users due to secure access to a larger network of databases and insights. It also empowers the public sector to support the textile industry in the shift toward the circular economy through access to relevant statistics and increased operational efficiency. As a result, individual trade

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7 <https://x-road.global/>

8 [https://www.ted.com/talks/anna\\_piperal\\_what\\_a\\_digital\\_government\\_looks\\_like/transcript?language=en](https://www.ted.com/talks/anna_piperal_what_a_digital_government_looks_like/transcript?language=en)

9 <https://ec.europa.eu/digital-building-blocks/wikis/display/DIGITAL/Once+Only+Principle>



secrets can be protected while better alignment between the public and private sector speeds up the circular transition.

## **How**

Our application of the once-only principle means companies do not need to enter the same data into multiple digital platforms to be able access a broad range of services. TEXroad will enable the exchange of approved data, such as materials available for sale or quantities of textiles recycled, so companies can spend less time finding access to new markets and reporting for regulatory compliance. Data will be available as needed through a secure exchange, so the entity providing the information retains ownership of it and does not need to disclose sensitive data unnecessarily. TEXroad can enable this by working through developed infrastructures and standards such as X-Road and Gaia-X.

Reliable, publicly available statistics will be possible with an increasing amount of data exchanged through TEXroad. This will be enabled by B2G exchanges for regulatory compliance and B2B exchanges for access to circular textile market opportunities.

## **Where**

Estonia has several textile industry manufacturers and an active post-consumer textile collection infrastructure. Estonia is also a pioneer in digitization and is located between the Finnish textile recycling hub and the rest of Europe. These factors combined make it the perfect place to develop and launch such a digital infrastructure. This development is important not only for Baltic and Nordic states. It is a critical piece of realizing the new Sustainable and Circular Textile Strategy. This system is also needed to secure the transition toward a global circular textile industry. Therefore, continuing to work within Estonia and expanding to other EU member states are important priorities for TEXroad.

## Currently

Private sector entities use a range of digital tools (e.g. ERP systems, accounting platforms, etc.) which do not usually exchange detailed information between organizations, such as the type and quantity of materials moving through supply chains or amounts of post-consumer items going to reuse markets. Circular textile opportunities are interesting to these entities, but there is still not a strong enough business incentive for the majority to change current behaviours.

Emerging digital services and platforms for the textile sector face high barriers to market entry and lack a systemic framework to connect to a comprehensive network that will enable circular textiles at a much larger scale. Many are still early stage, developing their concepts and aiming to carve out their own market segment and value proposition. The need for them to connect, form a larger network and create consistent digital coverage for complete material circulation is gathering momentum, but it is not immediate.

Public sector actors are still figuring out how to design and implement the circular economy across a variety of sectors and competing priorities. Data for decision making are limited, and there is a significant lack of information to support the separate collection of textiles in 2025 and the 2030 ambitions of the EU Strategy for Sustainable and Circular Textiles.

## TEXroad's Role

To realize a truly circular flow of textiles, there must be a focus on efficient and transparent collaboration to build a feasible case for the circular system and a secure digital infrastructure to support it. This can only be enabled by broad digitization. Additionally, the public and private sector need to be mutually engaged and aligned on common goals and how we measure progress.

**TEXroad's role today is to build the incentives and engagement to get materials and the most critical data flowing in the right direction.**

## This Document

In the following pages, we draw on our exploration and pilot within the Accelerate Estonia program to provide a general overview of Estonian textile stakeholders and materials, highlight considerations for collection infrastructures and make recommendations for the public sector. We use the Estonian example to define the critical data needed to achieve the policy ambitions of the transition to a circular textile industry across the EU. Finally, we identify the next steps toward developing a viable post-consumer textile management infrastructure, achieving better reuse and recycling rates for collected materials and creating a digital infrastructure to exchange data and support circular textile flows for the long term.





# Abstract

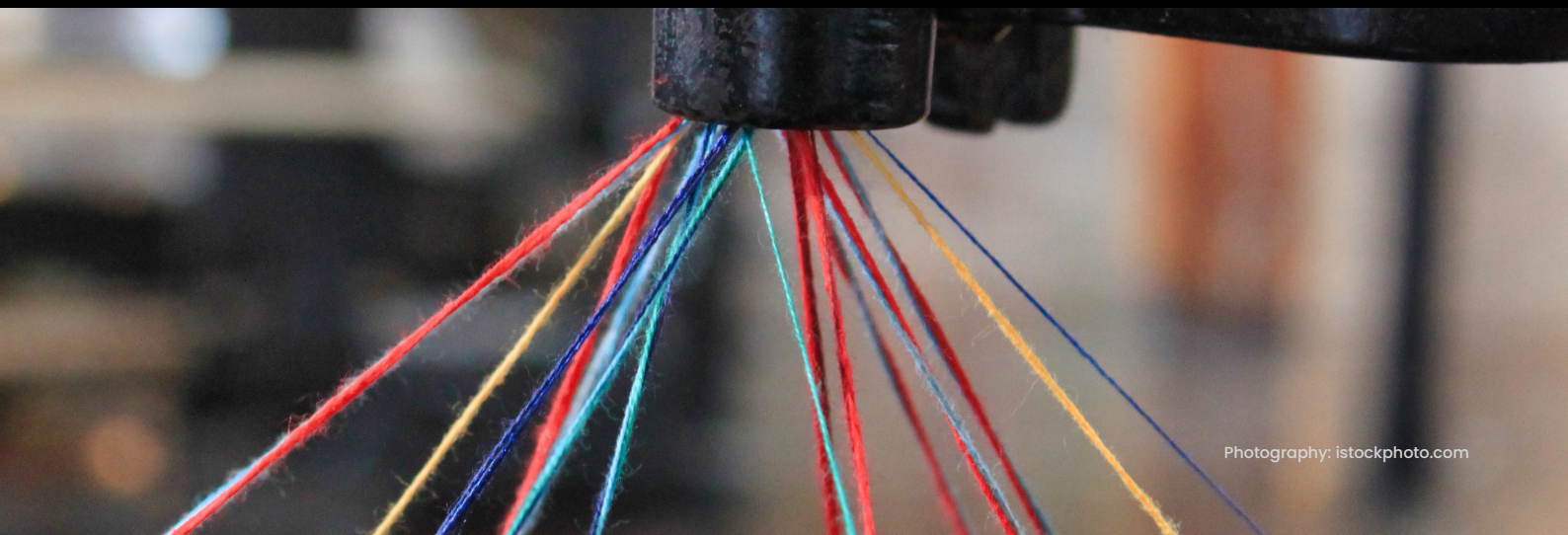
TEXroad launched through the Accelerate Estonia program in May 2021. Our hypothesis was that data driven policies and business decisions would enable a circular textile value chain, and our focus was to get the data flowing between the public and private sector to develop a digital infrastructure for circular textiles.

We evaluated trade and regulatory compliance data, engaged manufacturers and post-consumer textile entities in Estonia to collect materials data directly from the source, mapped the data models of 3 digital platforms and conducted basic data exchange tests, and finally we completed a textile sorting and recycling pilot to demonstrate connected data and materials flows for the circular economy. The Estonian public sector also shared insights into waste regulatory data and systems, and we discussed their needs looking ahead to 2025 when the separate collection of textiles will be mandatory across the EU.

We conclude that before an effective digital infrastructure for circular textiles can be established, everyone must first have a common understanding of the data that is needed, be digitally connected and contribute accurate data to the system. Today, the available data on textile resources and waste is limited. Economic incentives are needed, in the form of market opportunities, funding programmes and policies, to enable data flow and facilitate the transition to circular textiles. Engagement and alignment of the public and private sectors are critical next steps.



# 1 Textile Industry





# 1 Textile Industry

## 1.1 Overview

TEXroad's focus started with manufacturers, as post-industrial textiles (PIT) are the most recyclable in current markets, and our partner platforms Reverse Resources and Materjalivoog are already focused on these materials. Our goal was to engage manufacturers, collect detailed data to get an overview of post-industrial materials flows in the country and connect companies and their data to our partners moving forward. More details about Reverse Resources and Materjalivoog are available in ANNEX 5.

We compiled a database of 2156 companies whose activities consist of yarn spinning, textile manufacturing, printing and finishing or making finished products. Producers of textile-based furniture, housewares and footwear are included in this list; however, fur and leather goods producers were excluded. A brief overview of the Estonian textile industry is available in ANNEX 1.

Basic information was collected from 32% of the market, including a handful of market leaders and many small companies. Most survey and interview respondents provided information about their products and common fibre compositions. About half provided rough estimates for production quantities and percentage of by-products from materials sourced for production. More detailed information was requested from 9 entities, 2 of whom provided enough meaningful data for further analysis and completion of a data exchange test.

## 1.2 Insights

TEXroad's experience attempting to collect detailed data from the Estonian textile sector and the feedback from an advisory board with leading manufacturers indicated that there must be an economic incentive to change how things are currently done.<sup>[10]</sup> It was difficult for even the most interested companies to

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10 TEXroad Manufacturers Advisory Board Meeting, 2021

allocate the time to supply detailed textile data that would help us evaluate recycling opportunities. Simplifying our data input process would make it easier for manufacturers to supply data. However, without a concrete economic reason, it is difficult for them to spend enough time gathering and entering data to take full advantage of a digital platform.

For many materials, the cost of separating waste from recyclables, warehousing and handling costs are higher than the economic value of recyclable materials in the market today. There are a few great examples of Estonian manufacturers working hard to recycle their by-products, but this data is not consistently captured.

Understanding the make-up of the Estonian textile industry, fibre compositions commonly used and materials quantities that are circulating can help the public and private sectors identify industrial symbiosis opportunities. Policy incentives such as environmental fee reductions for recycling production by-products, tax reductions for including recycled content in new products and sustainable financing opportunities will help to unlock this data.

# 2

# Post- Consumer Textiles





## 2 Post-Consumer Textiles

The current system for managing post-consumer textiles (PCT) in Europe is operated by commercial and charitable entities (PCT entities) who collect and sort items for sale into secondary markets. Reusable items have more market value than non-reusable items that must be downcycled or recycled. Non-reusable items can also be sold to offset some of the transport and labour cost associated with collection, sorting and waste management as long as they are dry and relatively clean. PCT entities must pay close attention to the ratio of reusable to non-reusable items they manage and quantities of materials going to landfill or incineration to generate enough revenue to sustain business activities. This is true of both for and non-profit entities.

PCT is also generated by the public sector and commercial entities (e.g. hotels, hospitals, etc.), however, these materials were not the core focus of our work in 2021. More information on the PCT collection actors and infrastructure active in Estonia today is listed in ANNEX 6.

### 2.1 Materials

The separate collection of textiles will be mandatory across the EU in 2025, and member states must be evaluating their current textile management infrastructure, trends in materials quantities and end-market potential to meet upcoming requirements. Significant changes to the system will take years, therefore, it is critical to be engaged in this process now.

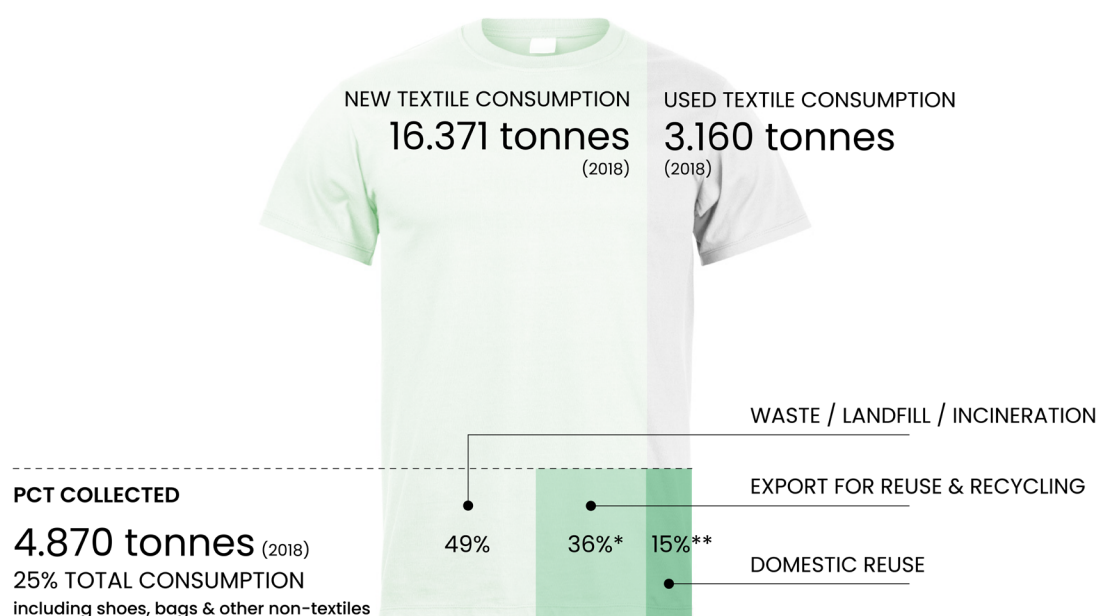
While 25% of Estonian PCT is collected, the amount that is reused and recycled is very poor. Nearly half of separately collected PCT goes directly to landfill or incineration. Part of this is due to the quality of collected materials. The EU Joint Research Commission's 2021 report shows reuse figures ranging from 50–75%<sup>[11]</sup>. The 2020 report on Estonian PCT concluded 14% of items collected in Estonia were suitable for reuse domestically and 36% were saleable in global reuse and recycling markets.<sup>[12]</sup>

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11 Data collected between 2016 and 2019; European Commission, JRC Technical Report: Circular economy perspectives in the EU Textile sector, 2021

12 Data collected between 2017 and 2018; Stockholm Environmental Institute: Estonia post-consumption clothing and textile flows, 2020

Based on the limited available information, and considering all PCT collection channels, Estonia seems to have a reuse rate below the European average. This has negative implications for its economic value.



\* Moving forward, it is important to quantify reuse and recycling exports separately.

\*\* Includes 1% sold to a local wholesaler. TEXroad assumes this goes to domestic reuse markets, however, it is left out of the domestic reuse figure in the paragraph below.

**Figure 1. Materials figures and Estonian estimates** <sup>[13]</sup>

The post-consumer textile data in the sections above are from previous research. We did not repeat these studies, as they are still considered reasonably reliable, and the purpose of TEXroad is to provide tools to capture this data from business activities in real time in the future.

## 2.2 Insights

A potentially low reuse rate considered together with 49% of all separately collected PCT going to landfill or incineration means evaluating opportunities for increasing reuse (e.g. cleaning and repair) and textile recycling feedstock development should be a high priority for circular textiles in the country. A characterization of Estonian PCT is needed to complete feasibility studies. This information must be made widely available, and the costs to develop a good data set can be too much for a single entity. Public sector support for a robust PCT characterization study is an important next step.

Until this is available, a look at trade data provides a first glance at the types of products on the market, which will eventually end as PCT. The table below is an excerpt from trade data showing product types that are (1) imported in higher quantities than others and / or (2) have a large share of the total imports that are made with >50% cotton content. High cotton content is an important characteristic for recycling in current markets.

PRODUCT GROUPS	2018 New textiles consumption (in tonnes and as % of product group)			2020 New textiles consumption (in tonnes and as % of product group)		
	TOTAL CONSUMPTION	MAJORITY COTTON CONTENT	MAJ. COTTON FRACTION OF TOTAL CONSUMPTION	TOTAL CONSUMPTION	MAJORITY COTTON CONTENT	MAJ. COTTON FRACTION OF TOTAL CONSUMPTION
Suits, blazers, trousers, shorts, dresses and skirts	2.265	825	36%	2.223	953	43%
Underwear, T-shirts, vests, socks and nightclothes	2.630	1289	49%	1.927	1.252	65%
Sweaters and cardigans	836	243	29%	839	354	42%
Baby clothes	253	89	35%	262	174	66%
Bedlinen, tablecloths, towels and cloths	1.612	1051	65%	1.517	1.196	79%

**Table 1. Trade data – Select products, tonnes consumed and >50% cotton** <sup>[14]</sup>

The data above is slightly different than data from reports referenced. This is likely due to updates made in the trade data or differences in rounding.

<sup>14</sup> Comtrade and Eurostat databases: New textile products imported, exported, and produced in Estonia in 2018 and 2020

These figures do NOT provide any clear estimates of how much PCT collected in Estonia is recyclable. This is because they are not specific enough to match actual feedstock specifications and because PCT contains items that may be 50 years old or 5 months old. What they do show is the types of items PCT entities should pay closer attention to within their materials streams if they want to participate in European recycling markets in the coming 2–3 years. High quantities of materials with >50% cotton content are worth quantifying in current operations until more detailed characterizations of Estonian materials have been complemented.

## Recycling Feedstock Opportunities

For Europe based textile to textile recycling technologies such as Renewcell, Södra, Infinited Fiber, Worn Again, SaXcell, Recover and others, PCT feedstocks are a highly marketable concept to investors and brand partners. Reverse supply chains must develop alongside the technologies to fulfil their promise of circular textiles.

There was evidence of this in December 2021 when Renewcell announced multi-year purchasing agreements with two of the largest post-consumer textile sorters in Europe and a new sorting facility in Sweden. Reverse Resources also reports new demand in 2022 for 5.000 tonnes of 95–100% cotton recycling feedstock, preferably PCT and PIT from European sources. Based on current agreements and discussions, they expect demand for these and other materials to grow in the short term.<sup>[15]</sup> Recent announcements by Renewcell, Södra and Infinited Fiber support this position, with estimates of 175.000 – 400.000 tonnes of combined capacity in 2025.<sup>[16] [17] [18]</sup>

Today, there are still challenges to supply consistent, high volume PCT feedstocks, such as a lack of business incentive for PCT entities to sort for recycling instead of reuse. Data is needed to reshape materials flows and develop economically viable models to collect, sort and supply non-reusable textile items to recycling technologies. As the separate collection mandate looms and recycling technologies state ambitions goals for 2025 production capacity, we must act quickly to establish the data flows so the public and private sectors can work together to find solutions.

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15 Interview with Ann Runnel from Reverse Resources, 2022

16 <https://www.renewcell.com/en/year-end-report-2021/>

17 <https://www.lenzing.com/sustainability/sustainability-management/circular-economy>

18 <https://infinitedfiber.com/blog/2021/07/05/infinited-raises-eur-30-million-adidas-and-bestseller-among-new-investors-hm-group-leads-financing-round/>

# 3

# Separate Collection of PCT and the Public Sector



## 3 Separate Collection of PCT and the Public Sector

The public sector has the authority and the imperative to address the textile waste problem. The EU Waste Framework Directive update in 2018 mandated the separate collection of textiles in 2025,<sup>[19]</sup> and target setting is planned for 2022.<sup>[20]</sup> Ministries must set national policies to meet this requirement and forthcoming targets, and municipalities are ultimately responsible for implementing effective collection schemes at the local level.

PCT entities are the cornerstone of today's separate textile collection infrastructure, and they will continue to have a critical role to play in the collection and circulation of textiles in the long term. Economic viability will remain the deciding factor for whether their networks will expand, and this is influenced by many factors. Municipalities must understand the basic economics and influences on the business of PCT entities to develop good public-private partnerships for collection.

Transparent, data-driven relationships between municipalities and PCT entities are necessary to quickly define the limits of what is possible within PCT entities' current models and identify what else is needed to meet the EU's 2025 mandate. Below we look at some of the key data and metrics that influence these relationships.

PCT generated by residences, the public sector and commercial entities (e.g. hotels, hospitals, etc.) and PIT are all included in the 2025 separate collection requirements. This document focuses on PCT from residences to provide a concrete example in line with our research and pilot conducted in 2021.

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19 European Parliament and Council of the EU: Waste Framework Directive (2018/851), 2018

20 European Commission, Communication: EU Strategy for Sustainable and Circular Textiles, 2022



## 3.1 People and materials density data

Post-consumer textiles are generated where people are concentrated, and population density has implications for the collection infrastructure. This is one of the most important considerations when designing or updating a PCT infrastructure.


	Population	km <sup>2</sup>	people/km <sup>2</sup>	Est. PCT generated/yr (tonnes)
Harju maakond (outside Tallinn)	156.682	3.519	45	2.300,1
Hiiu maakond	9.348	1.023	9	137,2
Ida-viru maakond	133.086	2.489	53	1.953,7
Järva maakond	29.995	2.674	11	440,3
Jõgeva maakond	28.262	1.963	14	414,9
Lääne maakond	20.365	1.816	11	299,0
Lääne-Viru maakond	58.632	3.671	16	860,7
Pärnu linn	50.777	858	59	745,4
Pärnu maakond (outside Pärnu)	35.195	4.552	8	516,7
Põlva maakond	24.560	1.823	13	360,5
Rapla maakond	33.199	2.766	12	487,4
Saare maakond	33.058	2.938	11	485,3
Tallinn	437.980	159	2.755	6.429,5
Tartu linn	95.776	154	622	1.406,0
Tartu maakond (outside Tartu)	153.615	3.113	49	2.255,1
Valga maakond	28.083	1.917	15	412,3
Viljandi maakond	46.019	3.420	13	675,6
Võru maakond	35.156	2.773	13	516,1

**Table 2. Estonian population density and PCT generation estimates**  
Per capita PCT generation using new + used consumption estimate – 14.68 kg/pers. <sup>[21]</sup> <sup>[22]</sup>

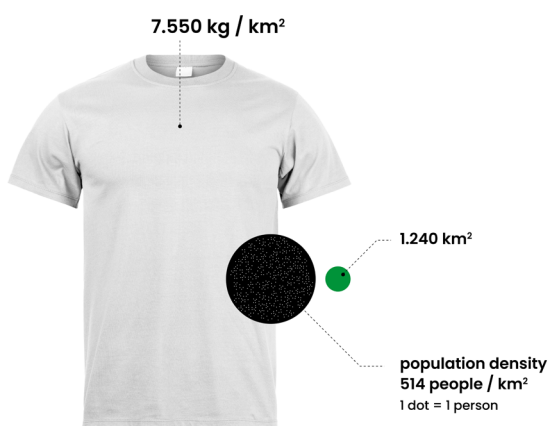
21 Stockholm Environmental Institute: Estonia post-consumption clothing and textile flows, 2020

22 Comtrade and Eurostat databases: New textile products imported, exported, and produced in Estonia in 2018 and 2020

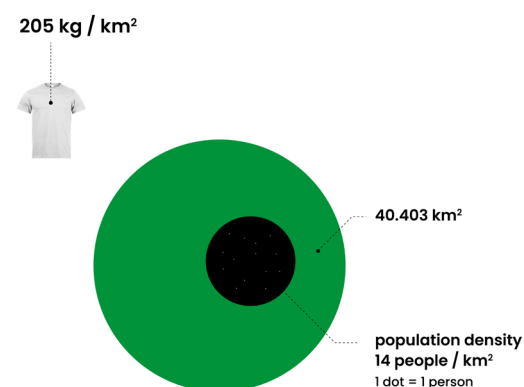
#### LEGEND

- Land area
- Population density per 1 km<sup>2</sup>
-  PCT generated

**48%** of Estonians live in Tallinn, Tartu, Pärnu, and Narva in a total area of 1240 km<sup>2</sup>



**42%** of Estonians live in municipalities of less than 17.000 inhabitants in a total area of 40.403 km<sup>2</sup>



**Figure 2. Infographic of PCT generation estimates.**

The remaining are in Saaremaa vald (2,5%) Kohtla-Järve linn (2,5%) or the areas surrounding Tallinn (5%). <sup>[23]</sup>

Collection solutions that are used in high-density urban areas are less cost-effective in rural areas where pick up points are fewer and farther between. Therefore, there is not a one size fits all model for managing PCT in Estonia. <sup>[24]</sup> Bins and similar drop off points, reuse stations at waste drop points, scheduled pick-ups, clothing drives and other methods are all being used today.

Estonian municipalities and PCT entities must consider population density and materials availability along with collection infrastructure data (see section 3.2 below) and materials data (see section 4 - Data) as they work together to develop a new collection infrastructure or adjust the existing system.

<sup>23</sup> Statistics Estonia, population statistics by city, 2020

<sup>24</sup> Interviews and data collected from Estonian PCT entities, 2021-2022

## 3.2 Collection infrastructure data

One of the most important factors in PCT collection is how accessible drop off points are to citizens. In order to build win-win partnerships for PCT management, municipalities and PCT entities should be paying attention to the estimated amount of materials in circulation within a specific area, the density of collection points and the number of people served per collection point.

### Fixed clothing drop off points

	Waste plant / drop site	Containers, Lockers, Bins, Cabins	Reuse store drop off	Brand / Retailer	Other (ie: consignment)	Container density km <sup>2</sup> / collection point	Container density people / bin	Est. PCT generated / yr (tonnes)
Harju maakond (outside Tallinn)	11	31	1			82	3.644	2.300,1
Hiiu maakond	1	7	1			114	1.039	137,2
Ida-viru maakond	2		5			356	19.012	1.953,7
Järva maakond	3	3	2			334	3.749	440,3
Jõgeva maakond	3					654	9.421	414,9
Lääne maakond	1	3				454	5.091	299,0
Lääne-Viru maakond	10	5	2			216	3.449	860,7
Pärnu linn	2	1	7	1	3	61	3.627	745,4
Pärnu maakond (outside Pärnu)	2					2.276	17.598	516,7
Põlva maakond	2	1	1			456	6.140	360,5
Rapla maakond	1	1	1			922	11.066	487,4
Saare maakond	2	8	1			267	3.005	485,3
Tallinn	4	60	13	5		2	5.341	6.429,5
Tartu linn	2	19	7	2	7	4	2.589	1.406,0
Tartu maakond (outside Tartu)	1					3.113	153.615	2.255,1
Valga maakond	1		2			639	9.361	412,3
Viljandi maakond	1	1	3			684	9.204	675,6
Võru maakond	5		2			396	5.022	516,1

**Table 3. Textile drop off points, density, and estimated amount of PCT generated**

Small charity shops are excluded from the following analysis, due to lack of available data.

PCT entities should track the quantity (tonnes) of materials coming through each collection point and report aggregated figures to the municipalities where they operate. They should also do periodic sampling to determine the quality (% reusable, recyclable or waste) of the collected materials within a municipality or at a country level to inform collection relationships and report for national statistics. According to municipalities, PCT entities are already supplying quantity information upon request.

Granular information on bin level collection quantities help identify conditions that yield the best results so they can be replicated. This information can also be used to troubleshoot issues as they arise. In some cases, municipalities can help address issues to improve the quality of materials, for example through citizen communication campaigns or recommending where to relocate collection points, if needed. In other cases, evidence to support decision making helps maintain good relationships when changes are needed to maintain economic viability. See the section 4 – Data and ANNEX 2 for more details.

Once collection, people and materials density and collection infrastructure data is available, it is possible to have data-driven negotiations for who should cover the cost of setting up collection points, emptying bins, warehousing, and other handling costs. As relationships and data sets develop, further analysis of collection methods and PCT entity partnership opportunities would be useful to define guidelines and best practices for Estonian municipalities. Municipalities need guidance to develop effective PCT collection infrastructures.<sup>[25]</sup> It is especially important to define this in the context of rural and urban areas for Estonia.

More details on the current Estonian PCT collection infrastructure are available in ANNEX 6.

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25 Interviews with the Estonian municipalities, the Environmental Board, and Environmental Ministry advisors

## 3.3 Painpoints

Interviews with ministries, municipalities and private sector entities combined with our research have identified a number of specific challenges for increasing the separate collection of post-consumer textiles in Estonia.

1

It is often not cost effective for PCT entities to collect in rural areas, yet it is an increasingly important topic for citizens and rural municipalities.

2

Municipalities who are motivated to implement separate collection for textiles have limited time and financial resources. Environmental specialists are experiencing an increase in expectations around the circular economy from the environmental ministry, yet there is a lack of funding, expertise, guidelines and other support measures stopping many from moving forward.

3

Citizen participation in separate textile collection schemes is increasing by as much as 40% in recent years, but textiles are not a high priority for target setting and dedicated action for some municipalities and KEM at this time.<sup>[26]</sup>

<sup>26</sup> Interviews with stakeholders in footnote 25; interviews and data collected from Estonian PCT entities, 2021–2022

4

The quality of collected materials and a lack of end markets is another issue across Europe, however it is especially challenging in Estonia where the percentage of non-reusable items is above average. The public sector is largely aware of this and cites it as a barrier to increasing collection efforts.

5

Visibility into the end use of collected textiles is a two sided issue for citizens and the public sector. First, there is a lack of transparency in materials flows, which raises concerns about grey markets and non-compliant disposal practices. Second, citizens who learn their separately collected PCT goes straight to waste are less motivated to use separate collection systems.<sup>[27]</sup>

Supporting details for this information can be found in ANNEX 3.

## 3.4 Insights

### Biggest short term barriers

There are two big missing pieces for municipalities aiming to develop relationships with PCT entities and collect more materials.

1. Textile specific knowledge and guidance to better understand the options and what's feasible specifically for them
2. Markets for collected items to replace waste as the end point

Data and insights are the most effective ways to close these gaps, and more details are available in section 4 – Data. Aligning municipalities and PCT entities with the

<sup>27</sup> Interviews with the Estonian municipalities, the Environmental Board, and Environmental Ministry advisors



same materials and infrastructure data is important, as there is not a one size fits all solution for a PCT infrastructure. With the same information at hand, successful public-private partnerships will be supported by data driven decisions.

Specific information about data and suggestions for using them in partnerships is included in section 4 – Data and ANNEX 2.

## 3.5 Recommendations for Ministers

The separate collection mandate mentioned above and the EU Sustainable and Circular Textile Strategy<sup>[28]</sup> have outlined high ambitions for changing how textiles are created, used and cycled at the end of their useful life. In order to meet expectations for 2025, action is needed at the ministry level to increase the rate of reuse and recycling for currently collected PCT and to develop an economically viable infrastructure to collect, reuse and recycle more PCT in line with the waste hierarchy<sup>[29]</sup> in the future. The recommendations below were provided with supporting details to the Estonian environmental ministry (KEM). They were also informed by working sessions with them, advisory board feedback, lessons learned from our recent pilot, public sector and other data, recent reports, others' recommendations for the Estonian and EU public sector and industry stakeholder interviews.

### Address the Data Issues and Opportunities

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- Prioritize accurate reporting on the separate collection of textiles by waste permit holders, including economic incentives
- Support regular data collection with guidelines and economic incentives in order to develop a circular textile infrastructure
- Aggregate data for Estonia and share publicly
- Publish a national standard for PCT reuse, recycling and waste disposal data model and test B2G and G2G data exchange between digital platforms to improve

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28 European Commission, Communication: EU Strategy for Sustainable and Circular Textiles, 2022

29 [https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index\\_en.htm](https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index_en.htm)

environmental data quality

- Test simple data collection systems and exchanges to improve reliability of available data

## **Develop Know-How and Guidelines**

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- Continue the municipality working group, and use it to identify opportunities, prioritize knowledge gaps and identify trials for textile management models
- Support public-private partnerships to develop best practices; create and maintain reference documents to harmonize circular textile practices

## **Improve Funding Relevance and Accessibility**

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- Provide funding to
  - Map industrial symbiosis connections and characterize PCT
  - Test basic circular textile practices and explore feasibility of technologies and products in Estonia
- Use data to develop targeted circular textile funding packages for SMEs and municipalities
- Set highest possible support rate for projects for municipalities to maximize accessibility

## **Include Textiles in Green Public Procurement**

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- Develop textile specific language to include in procurement documents
- Develop simple guidelines and support for implementation

## **Set Targets**

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- Number of municipalities reporting textiles figures
- Include country level and city level targets
- Number of rural areas with active collection schemes
- Set targets for Green Public Procurement

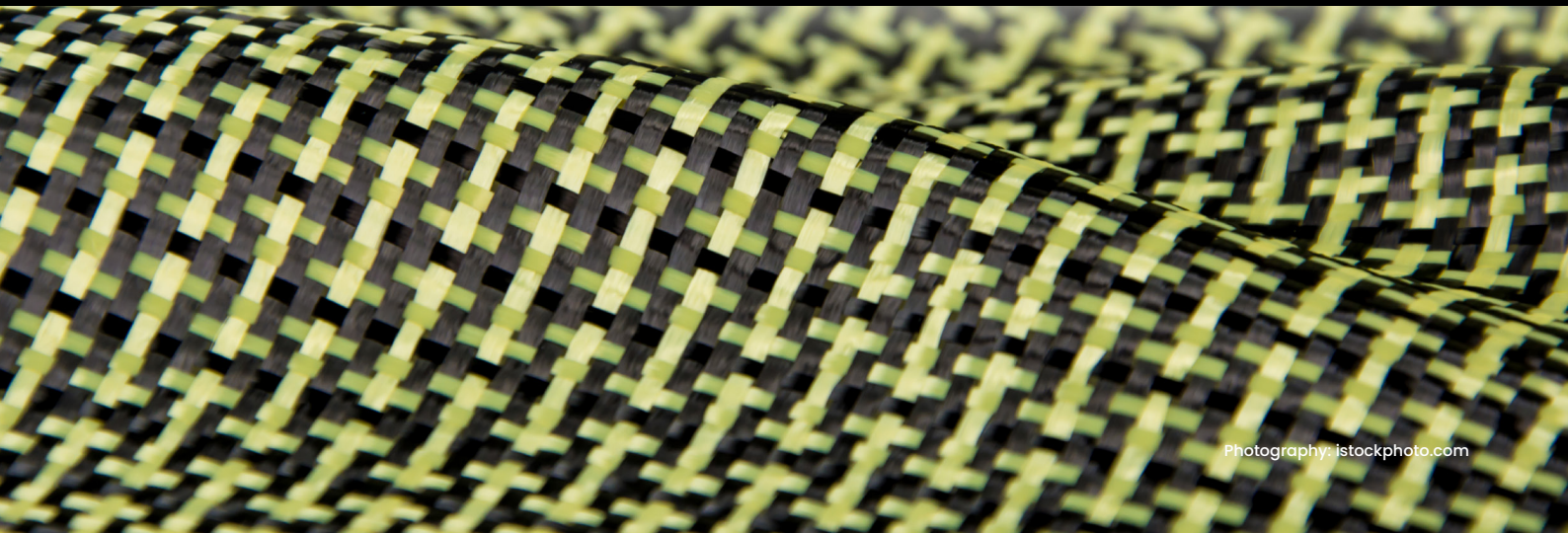
## **Be Bold: Partnerships, Innovation, and Policy**

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- Collaborate with Economic and Education ministries to develop “triple helix” innovation programs
- Use policy instruments to give an economic incentive for companies to reuse or recycle their by-products (environmental fees, tax policies, extended producer responsibility)

# 4

# The Data





# 4 The Data

Data is critical for businesses to transition from a linear to a circular textile industry, and it is the key to supportive policies and programmes from the public sector to make the transition effective. Data on PCT and PIT, reuse and repair cycles are all needed. This section focuses on PCT data in order to provide specific examples by building on the work of our pilot in 2021.

## 4.1 Purpose of data collection

1

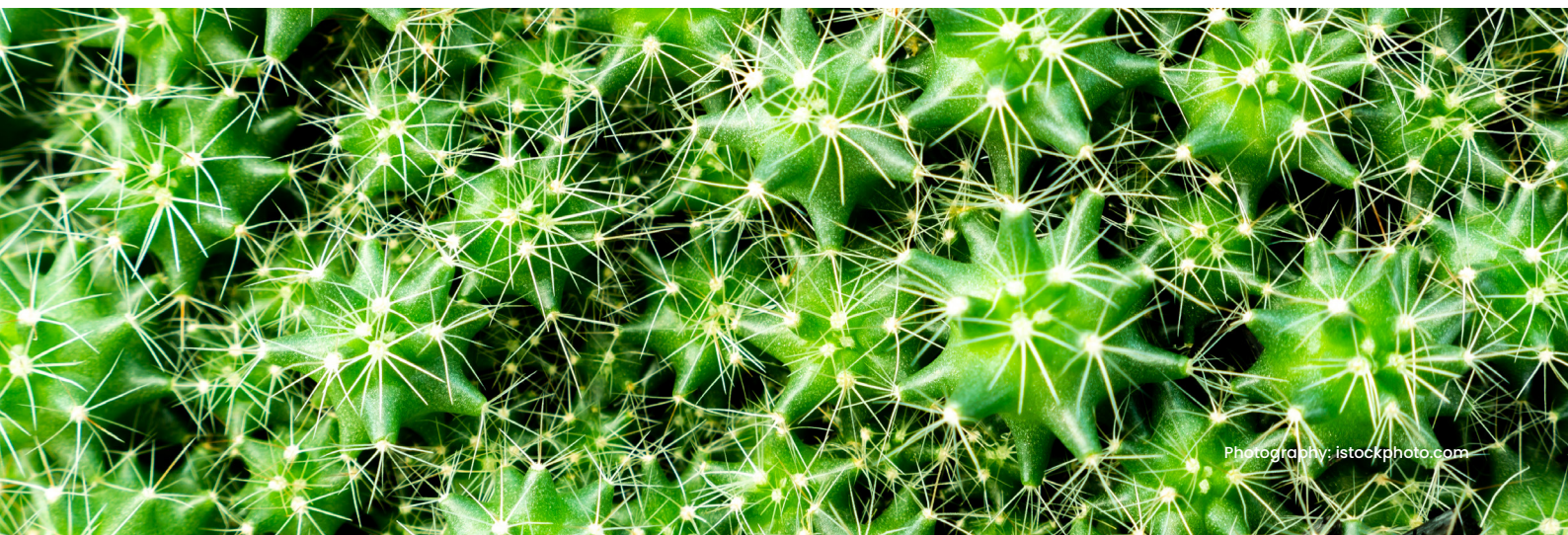
Set realistic targets for separate collection in 2025 and a circular textile industry in 2030, and measure progress over time

2

Develop and scale circular textile businesses

3

Introduce effective policy measures and funding mechanisms to accelerate the transition and make it permanent





## 4.2 Levels of data

In simple terms, there are two levels of data needed in the short term.

### 1. GRANULAR

#### Individual company and municipality level data

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- Develop effective public-private partnerships
- Calculate the viability of infrastructure developments and business opportunities
- B2G exchanges for regulatory compliance and national statistics
- B2B exchanges for market access

### 2. AGGREGATED

#### Combined data from multiple sources

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- Provide an overview of a larger geography or market segment
- Inform publicly available statistics, target setting, and significant policy developments (e.g. EPR, tax policy, product performance requirements, etc.) at the national and European level

## 4.3 Current data sources, quality, availability

There is a range of publicly available data currently being generated, including trade data and some regulatory compliance information. Other data has limited public access, but more details can sometimes be accessed or requested by the public sector. Studies and reports are occasionally commissioned by the public sector to fill in the gaps and inform policy making. These studies can be quite good, however, they are not repeated frequently in the same region. Age and quality of the data is also a problem, as they typically use data that is a year old (or more) and some figures still have to be estimated.

Data point	Source	Accessible 1 – publicly available 2 – only public sector	Consistent	Accurate
PCT in circulation collected, reused, recycled, landfilled, incinerated	Studies and reports	1	Depends on the methodology and source data	Limited by what PCT entities will disclose
	PCT Entities	3	Yes – within an entity Data between entities is not always comparable	Yes – within data collected Not all entities collect detailed data
	JATS (KOTKAS)	1,2	No	No
	Municipalities	2	Depends on the data requested	Depends on the data requested
	Digital platforms	3	Depends on the methodology and source data	Limited by what platforms will disclose
PCT not collected	Studies and reports	1	Depends on the methodology and source data	Depends on the methodology and source data
Materials on the market	Trade data	1	No	Unknown

**Table 4. Data available, sources, accessibility, and quality information**

## Issues with the numbers

In a preliminary analysis of past textile waste data, JATS figures between 2017–2019 show inconsistencies in reporting between years and between municipalities. More details are available in ANNEX 4. While some of this variation may be legitimate, one preliminary investigation found that approximately 400 tonnes of textile waste “disappeared” between 2019 and 2020. This is about 20% of the total Estonian textile waste reported in 2019.<sup>[30]</sup>

Data gaps and inconsistencies make it difficult for municipalities and KEM to understand the options and take action on the separate collection of textiles. It also makes it challenging for the private sector to evaluate opportunities for circular business models without a significant up-front investment. This is a problem that must be addressed.

<sup>30</sup> JATS textile waste data 2017–2019, interview with municipality in Harju county

## 4.4 Separate collection: critical data in 2022–2024

Alignment between the public and private sectors are needed in order to set realistic targets and identify roadblocks and opportunities leading up to the separate textile collection mandate in 2025 and to achieve the EU's 2030 ambitions.

At this point, the shortcomings of the data are so severe, the immediate focus must be on widespread and consistent collection, aggregation and exchange of basic information in order to establish a minimum viable data flow.

PCT entities, municipalities and ministries are the first priority stakeholders for alignment. Data and developments should also be made available to the European Commission in the short term to inform policy development and with textile to textile recyclers as they develop their supply chains.

Data point	Private sector use (PCT entities, recyclers)	Public sector use (munis, ministries, EU)
PCT in circulation (tonnes)	Estimate size of the business opportunity	Quantify the amount of materials that needs to be addressed
PCT collected separately (tonnes) <ul style="list-style-type: none"> <li>• % reused</li> <li>• % recycled</li> <li>• % incinerated</li> <li>• % landfilled</li> </ul>	Evaluate current operations  Calculate handling costs on increasing collection  Refine estimates for size of the business opportunity	Set realistic targets  Design policy and funding programmes for separate collection  Measure impact of policy and funding programmes over time
Reasons textiles are not reusable or recyclable	Evaluate feasibility of new business models (e.g. repair)	Set realistic targets  Design policy and funding programmes for separate collection
Characterization of items collected <ul style="list-style-type: none"> <li>• Fiber composition per material</li> <li>• Number of different materials per item</li> <li>• Embellishments and hard points (e.g. zippers, buttons, sequins, prints)</li> </ul>	Estimate amount of available recycling feedstocks for current and near-term markets  Evaluate feasibility of sorting for recycling	Set realistic targets  Design policy and funding programmes for separate collection

Data point	Private sector use (PCT entities, recyclers)	Public sector use (munis, ministries, EU)
Infrastructure <ul style="list-style-type: none"> <li>• People per square km</li> <li>• Collection points per square km</li> <li>• People per collection point</li> <li>• Collection network productivity by area</li> </ul>	Identify new locations and / or consolidation areas  Inform public-private partnership opportunities	Pin-point infrastructure strengths and weaknesses  Inform public-private partnership opportunities  Set realistic targets  Design policy and funding programmes for separate collection

**Tabel 5. Critical data for development of PCT collection infrastructure in the short term**

## Roles, responsibilities and exchange

The minimum requirement for the private sector is to report basic collection and end point data regularly so it can be aggregated for broad use. The public sector has a responsibility to incentivize basic and more detailed reporting in order to improve the availability, consistency and frequency of this critical data. The data must be used to create statistics, metrics and publicly available information.

**The public and private sector need to be engaged and aligned with common goals and metrics to measure progress. Therefore, TEXroad's role in the short term is to:**

- Work with the public and private sector to develop an understanding and agreement on the goals, metrics and data to exchange
- Enable B2G data exchanges to supply statistics and update metrics that validate progress toward those goals
- Support the public and private sector to collect and utilize data for the development of a viable separate textile collection infrastructure and supportive policies

This will build the incentives and engagement to get materials and the most critical data flowing in the right direction.

## 4.5 Circular transformation: critical data 2022–2030

After the initial data is flowing, additional details are needed in order to support businesses and policymakers in achieving the 2030 ambitions of the Sustainable and Circular Textile Strategy.

Market leaders including brands / retailers, manufacturers, recycling technologies, PCT entities, and digital platforms have a responsibility to make the first steps in this area now so the rest of the industry can follow. Frontrunning ministries and municipalities must also start providing an example of good data practices for the rest of the public sector right away.

Data collected should include product and company level information as well as details about materials flows and chain of custody. The table below is focused on PCT for use as a recycling feedstock to provide a simple example of detailed data usage building on our experience from the pilot. There are many applications beyond this simple example. Even in this simple example, there are many more applications than listed in the table.

Data point	PCT entity use	Recycler use	Public sector use
Trends in PCT collected separately (tonnes, over time and by geography) <ul style="list-style-type: none"> <li>• % reused</li> <li>• % recycled</li> <li>• % incinerated</li> <li>• % landfilled</li> </ul>	Evaluate current operations  Calculate handling costs on increasing collection by region and season  Refine estimates for size of the business opportunity	Develop or adjust materials sourcing strategy	Measure progress against targets  Design policy for EPR, export regulations, product performance requirements, procurement, etc.  Update funding programmes for separate collection



Data point	PCT entity use	Recycler use	Public sector use
Detailed characterization of items collected <ul style="list-style-type: none"> <li>Fiber composition per material</li> <li>Number of different materials</li> <li>Embellishments and hard points (e.g. zippers, buttons, sequins, prints)</li> <li>Textile construction / format (e.g. knit, woven, fibre, etc.)</li> <li>Chemical compliance</li> <li>Print / dye stuff</li> <li>Finishes</li> <li>Certifications</li> <li>Manufacturer</li> <li>Chain of custody</li> </ul>	Estimate size of the business opportunity to sort for recycling <ul style="list-style-type: none"> <li>Evaluate / implement augmented sorting technologies</li> <li>Increase value of low-value streams</li> </ul> Access new market opportunities on digital platforms Verify provenance for recycler customers	Identify recycling feedstock sources <ul style="list-style-type: none"> <li>Suppliers</li> <li>Geographies</li> </ul> Verify provenance for manufacturer and brand customers	Measure progress against targets Design policy for EPR, export regulations, product performance requirements, procurement, etc. Update funding programmes for recycling and circular business models
Company information <ul style="list-style-type: none"> <li>Location</li> <li>Registry / VAT number</li> <li>Activities / services</li> <li>Capacity</li> <li>Output material specs</li> </ul>	Create profiles on market and service platforms Communicate efficiently with potential customers	Identify potential suppliers Communicate efficiently with potential suppliers	Inform funding programme access / applications Inform procurement and regulatory requirements <ul style="list-style-type: none"> <li>Company and activity information</li> </ul>
Individual and aggregated transaction information <ul style="list-style-type: none"> <li>Includes company, quantity, and characterization</li> </ul>	Increase accuracy, reliability and availability of publicly available statistics Automate regulatory compliance and procurement validation and audits Inform impact quantification (CO2, tonnes reused and recycled) Provide evidence for sustainable finance applications Satisfy validation requirements for chain of custody and environmental and social fairness within the supply chain		

**Tabel 6. Critical data for mid and long term transformation** <sup>[31]</sup>

## Roles, responsibilities and exchange

As textile to textile recycling technologies scale, the need for textile waste as feedstock will increase. Today there is a small but growing handful of digital tools and platforms private sector entities can use to find reuse and recycling channels for their secondary textile products. B2B data exchanges between digital platforms can increase market access for their users and create a powerful network effect for circular textile flows. This will become increasingly important in the coming few years.

<sup>31</sup> Data standards from circular.fashion, Reverse Resources, EON-ID; own analysis

Stepping out of the recycling example for a moment, forthcoming policies such as digital product passports, PCT export restrictions, product performance requirement validation, public procurement verification, traceability and transparency<sup>[32]</sup> and other areas will need to be data driven.

**High levels of digital connectivity and a secure digital infrastructure to exchange data is critical to a future of circular textiles. Therefore, TEXroad's role in the future is to:**

- Connect a robust network of digital platforms for B2B and B2G data exchanges through a secure digital infrastructure
- Enable the private sector to use the once-only principle to access a range of services and satisfy regulatory requirements while maintaining ownership of their data
- Translate data from a range of digital platforms into statistics and metrics for the industry and the public sector

## 4.6 Insights

### Future data flows

Who must supply the data and how often it should be reported within the PCT recycling example is listed in the table below. This assumes private sector entities are using a digital platform to track some form of this data (e.g. ERPs, accounting software, waste to recycling marketplaces, regulatory compliance reporting platforms, etc). It also assumes these platforms are able to exchange data across a secure network (e.g. through API connections). In this context, reporting means allowing permission for the exchange of relevant information between:

- The digital platform in use and TEXroad to generate industry level statistics and metrics
- The digital platform in use and public sector platforms via TEXroad for access to programmes, regulatory compliance reporting or generating country level statistics and metrics

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32 European Commission, Communication: EU Strategy for Sustainable and Circular Textiles, 2022

Data point	Data supplier	Initial reporting frequency	Target reporting frequency
Amounts of PCT collected	PCT collection entities	Quarterly	Near real-time
Fate of PCT (reuse, recycling, waste)	PCT sorting entities PCT reuse entities Recyclers Waste managers	Quarterly	Near real-time
Detailed characterization of items collected	PCT sorting entities (support from public sector funding)	Per project	Quarterly
Company information	PCT entity	Annual	Annual
Country level overview: PCT collected, reused, recycled, wasted	Ministry	Quarterly	Near real-time
Country level overview: Textile characterization	Ministry	Per project	Quarterly
Industry level overview: PCT collected, reused, recycled, wasted	TEXroad	Quarterly	Near real-time
Industry level overview: Textile characterization	TEXroad	Annual	Quarterly


**Table 7. Critical data and reporting frequency for maintaining circular textile flows**

Practical information for the public and private sector on collecting and using data to develop separate collection infrastructures is available in ANNEX 2.

## Increasing value with data exchange

In the ideal scenario, the private sector is digitally connected and data enables operational efficiency, reduces administrative burden, increases market access and keeps everyone up to date on the most relevant topics for them. In reality, the disconnect between the large number of digital applications and platforms that are either required to do business or aim to make business better is at risk of slowing down progress.

It is currently possible to exchange specific data over a secure network of digital tools and platforms to achieve the ideal scenario and improve public sector services, statistics and policy. TEXroad performed very basic data exchange trials during a recent pilot and learned it is not technically difficult to collect and format the data for this purpose (more details are available in section 5 – Pilot and the forthcoming full pilot report). There are also existing data exchange networks (such as X-Road) that are designed to improve the quality and accessibility of data.



**To realize the full value of data exchange within the public sector in the short term, testing should be done with public sector data to validate and improve the current waste and recycling statistics. Testing should also include working with public and private sector data to develop reuse statistics and improve waste and recycling statistics.**

In the mid term and beyond, connections to utilize the once-only principle to access sustainable financing opportunities and fulfil forthcoming sustainable textile regulations should be developed.

In order to get the most value from data exchange for the private sector in the short term, market platforms should explore exchanging data with one another to offer a broader range of opportunities to their users. In the mid term, B2G exchanges for statistics and regulatory compliance as well as data exchanges between market and business management platforms (e.g. accounting software or ERPs) will increase the operational efficiency for the private sector. It will also increase their access to decision making data and market opportunities for circular textiles.

# 5 Pilot



Photo credit: Joosep Kään

# 5 Pilot

## 5.1 Purpose and scope of work

The pilot was designed to get the data flowing in the circular textile value chain starting from the collection of secondary materials and continuing through recycling. This includes both collecting data and testing the exchange of it between private and public sector digital platforms. The focus was on 2 distinct materials streams: post-consumer (PCT) and post-industrial textiles (PIT). This is because the actors and materials in the majority of the circular supply chain are distinct for each of these streams. The information below focuses on PCT streams.

Pilot activities helped define which data points are critical and whether they are currently collected. They also helped identify difficulties with collection, which data is important to whom and barriers and opportunities to start the data flowing from the private sector.

In-scope activities included collecting data on companies, processes and materials flows within circular supply chains and translating and exchanging it between digital platforms. Validating scanning technologies and creating representative data samples for business case assessments and similar activities was out of scope.

Partners included Humana, Uuskasutuskeskus, Lounais-Suomen Jätehuolto, TalTech, Reverse Resources, textile to textile recyclers and a scanner technology supplier.



## 5.2 Processes

### LEGEND

#### Data collected

- ✓ Tonnes of materials
- ✓ Other quantitative and qualitative data

\* Waste and recycling data from pilot participants was collected in TEXroad format, translated and uploaded into Reverse Resources. Data was then extracted from Reverse Resources (RR) and translated into the KOTKAS import template to validate it is technically possible to create regulatory compliance data for textile recycling using our data model. In the real world, RR would not be required to complete such a report for these transactions.

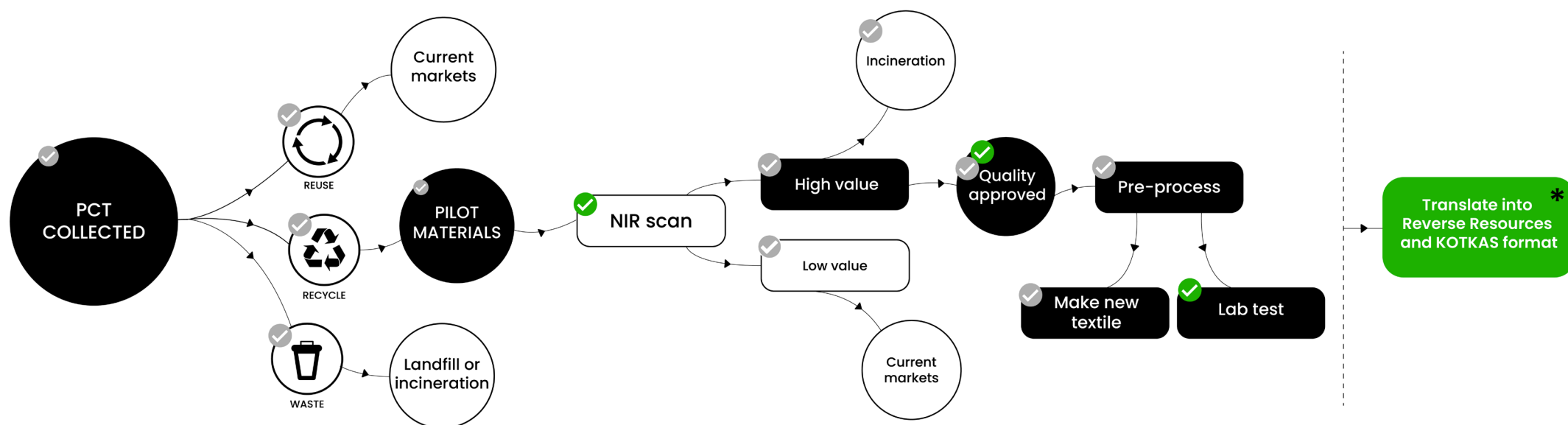



Figure 3. Pilot materials flow and data

## 5.3 Insights

### Data + tools today

The pilot tracked PCT company information, processes and materials flows data across three different entities with different data management systems. Data collection, translation and exchange activities identified areas TEXroad can address directly in the short term, such as data support for small to medium sized PCT entities leading up to 2025. It also highlighted opportunities for TEXroad to develop a digital infrastructure and enable data to flow at a larger scale, for example between private sector and regulatory compliance platforms in multiple countries.


Pilot PCT suppliers and the pre-processor already collect and manage the data they need to carry out their own business activities. This includes the most important data for this pilot, though in some cases it was incomplete for our purposes. All three entities operate differently, and they do not track their data in the same way. This will cause inconsistencies in circular textile data flows unless key details are standardized at the time of collection or as they are reported outside the entity generating the data.



Textile data analysis, aggregation and exchange from the material source through shipment to recyclers is needed to have good statistics for the public sector. Today this requires working across multiple disconnected systems in a very manual process.



## Other pilot insights

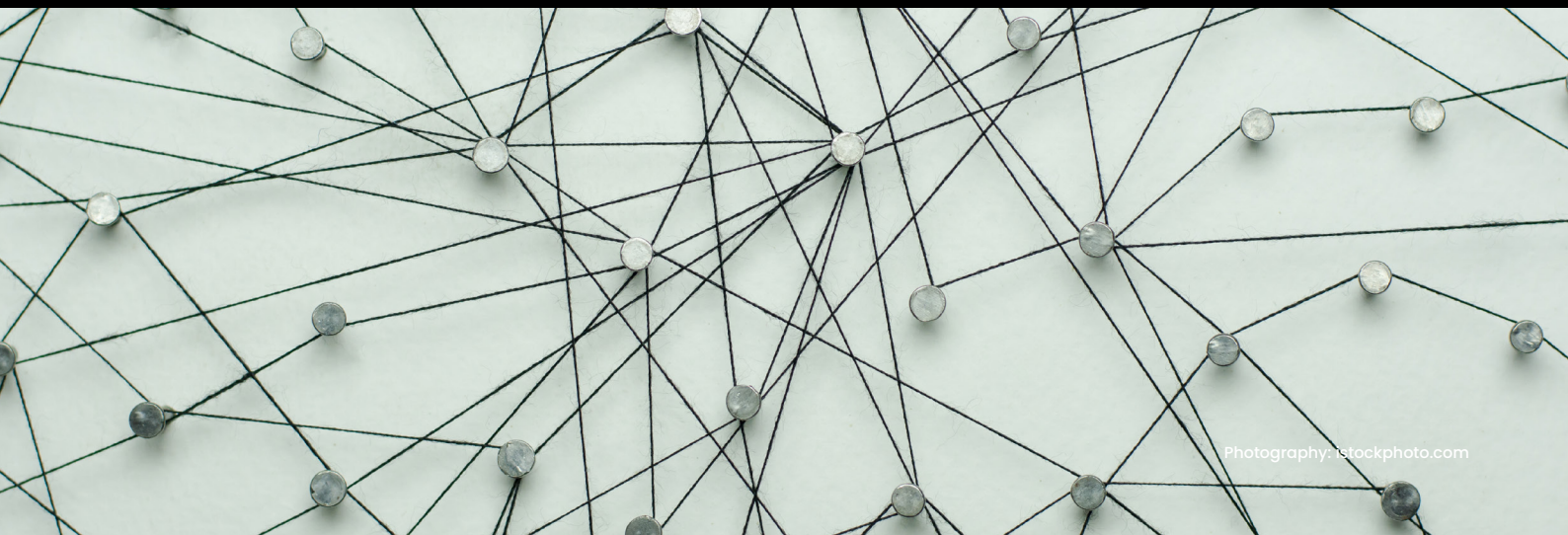


Current digital tools have a scope that is too limited to be a complete solution for all actors, for example marketplaces, traceability tools, carbon footprint measurement tools, etc. This underscores the need to develop a textile data taxonomy, ontology and network of digital platforms. This will allow us to collectively standardize data across the circular textile chain and exchange it securely and broadly for the benefit of all.

TEXroad recognizes the significant effort across the EU to create textile data standards, product passports and digital networks. Moving forward it is important to connect our work with other initiatives to avoid duplication.

# 6

# Conclusion





## 6 Conclusion

Through our work in Estonia in 2021, TEXroad has identified opportunities for data to improve the domestic PCT management infrastructure and facilitate a quicker, more effective transition to a circular textile industry internationally.

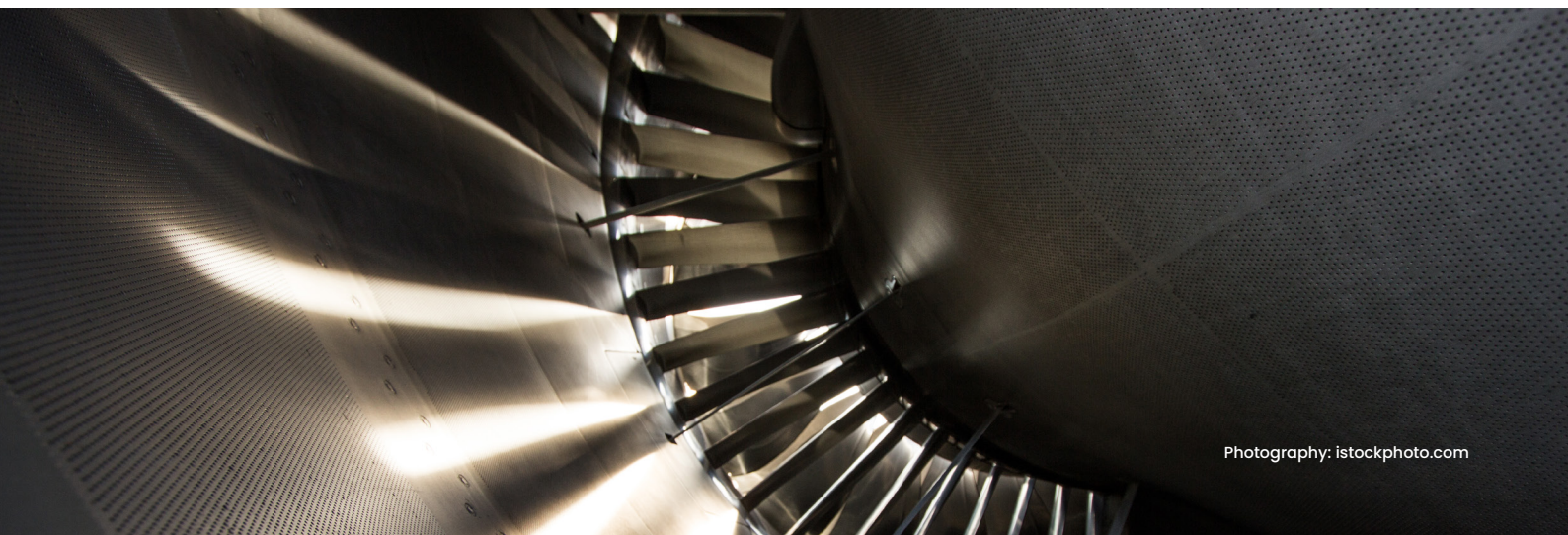
Developing a digital infrastructure for circular textiles must have two focus areas:

Data to optimize and transform the current materials management system  
Existing PCT entities serve an important function in reuse and recycling today, and it is very unlikely a truly circular textile industry will exist without them. Municipalities are responsible for implementing separate textile collection by 2025, and PCT entities are a key resource. Data is needed to develop highly effective public-private partnerships within the current collection for reuse model.

New models for managing high quantities of PCT are also needed as soon as possible. Developing reliable materials quantification, characterization and flow data to support technology assessments and feasibility studies for this purpose is critically important.

Data exchange to improve data quality, open up market access, and decrease costs  
Waste compliance reporting is a permit holder's responsibility, but other data exists to validate what is entered into the reporting system. B2G and G2G data exchanges are needed to cross reference regulatory data as well as provide new circular economy metrics such as reuse.

The once-only principle is important for businesses, and especially for SMEs. A network for secure B2B and B2G data exchanges will open access to new markets and services while reducing the amount of time providing the public sector with data.



## Moving Forward

In 2022–2023, TEXroad is implementing v1 of our data management tools and services by working with municipalities and PCT entities to launch a pilot program for circular textiles data. We are also continuing to test and develop our data exchange infrastructure components to maximize the value of being digitally connected. These activities will take place in Estonia and other strategic areas. Finally, we aim to remain connected and share knowledge with Estonia's KEM so domestic solutions scale up quickly for the benefit of all.

### Goals

- Shift to a data driven approach that will help to build strong public-private partnerships
- Increase the effectiveness of the PCT handling infrastructure
- Improve the reuse and recycling rate of separately collected textiles

### Scope

- Support municipalities to identify and fix the most immediate data issues in their area
- Provide data management and support services for municipalities and PCT entities as they develop relationships and best practices for handling PCT
- Support textile quantification and characterization studies and their use in feasibility assessments
- Continue data exchange trials and develop the data exchange infrastructure needed to support circular textiles across Europe

**Textile data quality and availability are lacking in many EU member states, and there is not a tried and true model for managing the quantities of PCT that will need to be collected separately in 2025 and beyond.**

**By getting the data flowing between PCT entities and municipalities and developing a digital infrastructure to network public and private sector platforms in Estonia, TEXroad will be able to scale across Europe and cement the shift from a linear to a circular textile industry.**



# Glossary

**By-products** – Something that is produced as a result of making something else.<sup>[33]</sup> In this report, by-products refer to textile materials and products in production facilities that can be reused, recycled, or will become waste.

**B2B** – Abbreviation for business-to-business: describing or involving business arrangements or trade between different businesses, rather than between businesses and the general public.<sup>[34]</sup>

**B2G** – Abbreviation for business-to-government: relating to trade in products and services between businesses and government, especially trade over the internet.<sup>[35]</sup>

**Commercial entities** – For-profit businesses who are involved in the management of post-consumer textiles (e.g. post-consumer textile collectors and sorters), or for-profit businesses who generate post-consumer textiles as part of their activities (e.g. hotels, industrial laundries, etc.).

**Downcycling** – Downcycling begins the same way as recycling: products are broken down into their constituent materials and remade into something new. When those new products have less value than the original product, this is

referred to as “downcycling”.<sup>[36]</sup>

**ERP** – Abbreviation for enterprise resource planning: a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management and compliance, and supply chain operations.

**G2G** – Abbreviation for government-to-government: relating to trade in information between government offices, services or regulatory compliance systems.

**Gravitational hubs** – Geographic locations such as cities and towns where people living in rural municipalities regularly drive for work or other daily business, such as shopping.

**JATS** – Abbreviation for Jäätmearuandluse Infosüsteem: Estonia’s former waste data management system. KOTKAS has been updated to incorporate critical features from JATS.

**KEM** – Abbreviation for Keskkonnaamet: Estonia’s Environmental Ministry

**MKM** – Abbreviation for Majandus- ja Kommunikatsiooniministeerium: Estonia’s Economic Affairs and Communications Ministry

**KOTKAS** – Environmental decisions

33 <https://dictionary.cambridge.org/dictionary/english/by-product>

34 <https://dictionary.cambridge.org/dictionary/english/b2b>

35 <https://dictionary.cambridge.org/dictionary/english/b2g?q=B2G>

36 <https://www.metabolic.nl/news/recycling-downcycling-and-the-need-for-a-circular-economy/>

information system used by KEM, which includes permitting and reporting information.

**Once-only principle** – The Once-Only Principle [enables] public entities to share citizen data with each other, so that people using any public services only have to enter their information once.<sup>[37]</sup> TEXroad applies this concept to a network of private and public sector digital platforms to enable data exchange for the circular economy.

**PCT** – Abbreviation for post-consumer textiles: refers to used clothing and household items made from knitted, woven or non-woven fabrics, leather and synthetic leather and that are from household or commercial business sources. Commercial sources include hotels, industrial laundries and other companies using textiles in their business activities, but they do not include by-products from textile manufacturing. Footwear and accessories are excluded from figures whenever possible.

**PCT entities** – Companies and non-profit / charity organizations who collect, sort, resell, or otherwise handle PCT for all or a large share of their business activities.

**PIT** – Abbreviation for post-industrial textiles: refers to by-products from textile manufacturing businesses, including fibre, yarn, clippings, rolled goods, second quality finished products, etc.

**Public sector** – Government-owned or controlled activities, services, businesses and industries.

**Private sector** – For-profit businesses, non-profit / charity organizations, and other legal entities and their activities that are not controlled by the government.

**Recycling** – In the regulatory context, recycling is defined as a waste recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. This does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.<sup>[38]</sup> TEXroad expands this definition to post-consumer and post-industrial textiles that are broken down into raw materials such as fibres, pellets, polymers, monomers or other chemical building blocks which can be used to make a new material or product. Our use of this term applies whether or not textiles are technically classified as waste.

**Reuse** – In the regulatory context, re-use is defined as any operation by which products or components of products that are not waste are used again for their original purpose.<sup>[39]</sup> Our use of the term reuse applies whether or not textiles are technically classified as waste, though if textiles are technically classified as waste before reuse, they will also be considered under the activity of preparing waste for reuse.

**Waste managers** – Companies who collect, sort, recover, recycle, incinerate and / or otherwise dispose of waste from residences or businesses.

<sup>37</sup> <https://ec.europa.eu/digital-building-blocks/wikis/display/DIGITAL/Once+Only+Principle>

<sup>38</sup> <https://www.riigiteataja.ee/en/eli/531052021002/consolide>

<sup>39</sup> Ibid, footnote 67

# ANNEX 1

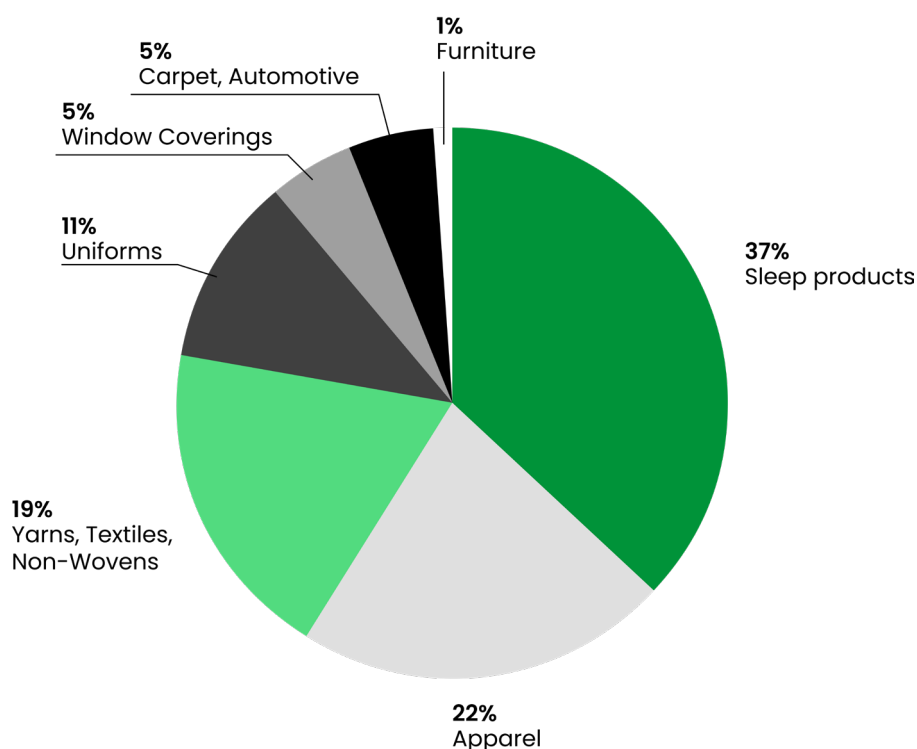
## Estonian Textile Industry

When considering market segments with possibilities for recycling, the total amount and type of potentially available materials, homogeneity of those materials and average company size should be considered. An overview of the Estonian textile sector is provided below.

Estonia's textile sector is worth an estimated €857M, which is earned by 706 companies. The analysis below covers nearly 90% of the market and approximately 65% of the companies generating revenue. Companies were assigned to one category, even if they produce multiple products. The figures listed below are based on market share by revenue.

Categories are rough groupings to provide a general idea of the Estonian industry, and the information below are presented as estimates. Business decisions should not be made based on this information. The methodology is available following the analysis below.

**Textile Industry Make Up**



**Graph 1. Segments of Estonian textile industry**

**Sleep Products – 33%, €280M**

Companies producing mattresses, mattress coverings, pillows, quilts, duvets and related items make up the largest fraction of the Estonian textile industry. There are 25 entities in this group with an average size of €11,2M in annual turnover. 9 of these companies have an annual turnover of more than €12M.

**Apparel – 20%, €169M**

Cut and sew facilities producing garments are the second largest group. There are 268 entities with an average size of €631K in annual turnover. Only 33 of them have an annual turnover of more than €1M. Apparel manufacturers in this case exclude companies whose main production is commercial uniforms, workwear, and emergency uniforms.

**Yarns, Textiles, Non-Wovens – 17%, 146M**

Materials producers are the next largest group. It is made up of 19 entities with an averages of €7,7M in annual turnover, 5 of whom earn more than €12M. This group includes a range of different types of products, such as yarn for apparel and industrial applications, lace and ribbon, knit and woven textiles, printing and finishing operations, non-wovens producers, etc.

**Uniforms – 10%, €82M**

These cut and sew facilities are a significant segment of the Estonian textile industry. This group includes 63 entities with an average turnover of €1,3M, which is significantly more than the those producing standard apparel. 13 of them earn more than €1M, and there are a small handful of higher earners. Production is focused mainly on commercial uniforms and workwear, as well as uniforms for police, military and other emergency services.

**Window Coverings, Furniture, Carpet, and Automotive Textiles – 10%, €86,5M**

This group makes up the remaining fraction of our analysis. Curtain and blind manufacturers are 5% of the total with an average turnover of €801K. Carpet and automotive textile manufacturers make up 4% with an average turnover of €5,5M. Other furniture manufacturers are the remaining 1% with an average of €1,4M annual turnover.

## Simple Methodology Overview

A list of 2162 companies was compiled using desk research, information provided by partner platforms and an export from the Teatmik database.<sup>[40]</sup> The Teatmik request included companies registered under EMTAK codes 13 (textile manufacturing) and 14 (clothing manufacturing).<sup>[41]</sup> Teatmik data was cleaned up to remove obvious non-textile industry companies and those who did not have reported taxes for the previous year.

Next, this company list was expanded with more relevant details. Validation of company activities and product types was carried out through interviews and surveys with 31 revenue generating companies. Interviewees and survey respondents represent 32% of the Estonian market. Publicly available data was used to identify primary activities and product types for non-survey respondents. Through this process, we were able to categorize 65% of the revenue generating companies, which make up nearly 90% of the Estonian market. Companies in the remaining 10% were assigned an activity based on the first EMTAK code in their Teatmik database entry.

Each company on the list was assigned a primary market segment based on their activities and products, even if they were active in several. In some cases, the information from interviews, surveys or publicly available sources made this clear, and in others, best guess estimates had to be made. For the purposes of the assessment above, only companies with available revenue figures above €0,00 were evaluated. The primary market segment was used as the basis for total revenue, total number of companies and average turnover per company included in the information above.

The average turnover is a basic calculation of total revenue divided by total companies. Each segment has outliers and nuances that are not obvious from a simple average turnover, and therefore more details are provided for additional context.

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40 <https://www.teatmik.ee/>

41 <https://www.rik.ee/et/e-ariregister/emtak-tegevusalad>

# ANNEX 2

## Examples for Collecting and Using Data

### Collecting PCT Data

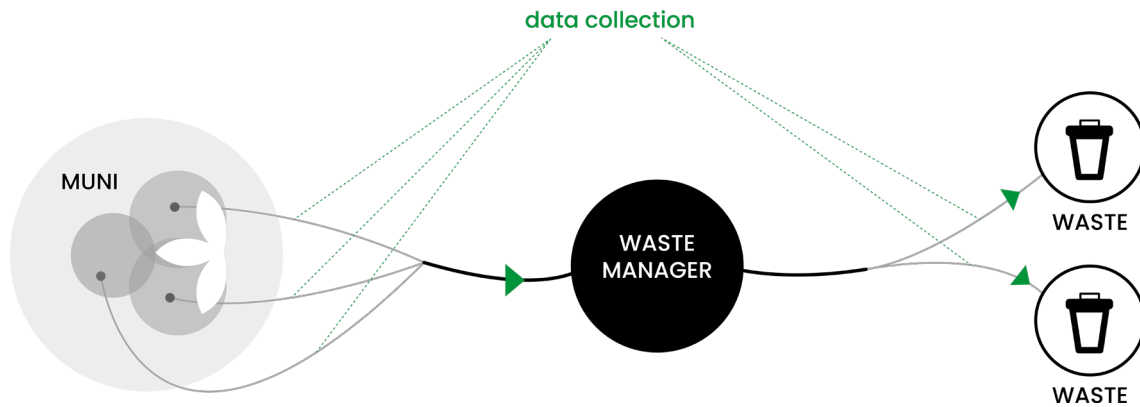
Ideally, detailed data is collected at every step of the textile management process, from collection through end market. This is difficult to do today because it requires significant behaviour change on the part of materials handlers, and it is a largely manual and time consuming process. Therefore, simple and consistent data collection at strategic points in the materials flow should be the near-term priority. Post-consumer textile data is the most accessible for the public sector in the short term, and therefore it is the focus for our recommendations to the Estonian public sector.

Municipalities who have prioritized circular textiles should request data from waste management and post-consumer textile collectors on a quarterly basis or implement basic digital tracking tools to record the weight of materials collected at each bin. These reporting requirements can be written into public procurement agreements to ensure expectations are set from the beginning of the contractual relationship.

Waste management companies who share this information with municipalities will be able to complete their regulatory compliance reports quickly and accurately, as it is data currently required in KOTKAS reports. Post-consumer entities are already tracking data for their own operations and providing basic figures to municipalities upon request. This applies to textiles collected under procurement agreements and collection points located on private property.

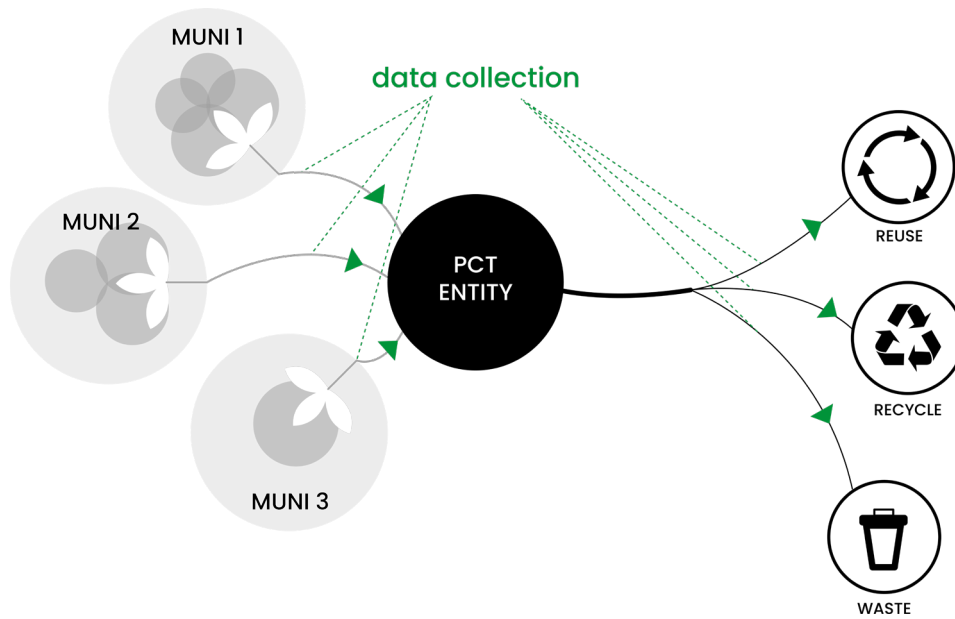


## Data collection points for waste permit holders



**Figure 4.** Data collection from a single municipality by a waste permit holder

## Data collection points for PCT entities



**Figure 5.** Data collection from a network of textile drop off points by a waste permit holder

Data Requestor	Data Source	Data Point	Reporting frequency
Municipality	PCT entity	Total amount collected from municipality <ul style="list-style-type: none"> <li>• % reuse*</li> <li>• % recycled*</li> <li>• % waste*</li> <li>• Number of collection points</li> </ul> * % figures can be average for all Estonian materials	Quarterly
	Waste Manager	<ul style="list-style-type: none"> <li>• Amount collected from municipality</li> <li>• Quantity per collection location</li> </ul> Figures should be textile only, not mixed materials	Quarterly
Ministry Permit holder reports	Waste Manager	Amount collected from municipality or permit area  Final destination(s) and amounts	Yearly

**Table 8.** Data requests, sources, information reported, and reporting frequency in examples in figures

## Using Textile Data

Municipalities, waste management companies, and PCT entities need to work together to develop effective ways to collect, sort, and redistribute textiles leading up to 2025. Data is the basis for creating an economically viable system for all parties, and municipalities have the ability to bring all of the relevant data together. Below is a list of key data points and a few examples of how they can be used by the public and private sectors to build a circular textile infrastructure.

User	Data point	How to use it
Municipality	Amount collected	<p><b>Baseline to measure effect of programs and partnerships to increase separate collection</b></p> <p><b>If this is too low, PCT entities cannot afford to collect</b></p> <ul style="list-style-type: none"> <li>Partner with nearby areas to increase amounts available to PCT entities</li> <li>Collect and warehouse materials for PCT entity to pick up</li> <li>Schedule clothing collection days as events 2-4 times per year instead of installing bins</li> </ul> <p><b>If this is high or growing rapidly, consider whether current infrastructure is sufficient</b></p> <ul style="list-style-type: none"> <li>Work with collection partners to determine if number of collection points or frequency of pick-up needs adjustment</li> <li>Test additional reuse and collection methods</li> </ul>
	% Reuse % Recycled % Waste	<p><b>Indicates quality of materials overall and influences feasibility of PCT partnerships</b></p> <p><b>If the amount of reusable items is high</b></p> <ul style="list-style-type: none"> <li>May be able to increase collection points</li> <li>Consider reuse-based events, such as clothing swaps or repair cafes</li> </ul> <p><b>If the amount of reusable items is too low or the amount of waste is too high</b></p> <ul style="list-style-type: none"> <li>PCT entities may wish to relocate bin due to contamination</li> <li>Implement citizen level communications to target the issue</li> <li>Consider different collection models, such as staffed collection points or scheduled events</li> </ul> <p><b>NOTE:</b> It may only be possible to get the Estonian average for these figures in the beginning, depending on the partner and collection model. This is OK. Work with partners to get more specific data over time.</p>
	<p>Reasons textiles are not reusable or recyclable</p> <ul style="list-style-type: none"> <li>Available in pilots or from some PCT entities by request</li> </ul>	<p><b>Details to help address specific problems</b></p> <ul style="list-style-type: none"> <li><b>Use to inform citizen level communications to improve quality of materials streams</b></li> <li><b>Used to inform future textile management strategy, for example:</b> <ul style="list-style-type: none"> <li>Many desirable items that just need simple repairs supports a need for repair cafes or renewal based business models</li> <li>Lots of really worn out items supports the need for Estonia to investigate technologies, processes, and business models within the textile recycling value chain</li> </ul> </li> </ul>

User	Data point	How to use it
KEM	Amount collected <ul style="list-style-type: none"> <li>Country level</li> <li>County level</li> </ul>	<b>Baseline to measure performance of infrastructure for separate textile collection</b> <ul style="list-style-type: none"> <li>Inform realistic targets for circular economy policy and separate collection of textiles</li> <li>Measure progress to achieving targets and identify areas who are advanced or lagging behind               <ul style="list-style-type: none"> <li>Use citizens' interest in the topic as a gateway to larger circular economy initiatives in advanced areas</li> <li>Develop and share best practices from advanced areas to help those lagging behind</li> </ul> </li> <li>Use to identify potential data reporting issues from waste permit holders</li> </ul>
	% Reuse % Recycled % Waste <ul style="list-style-type: none"> <li>Country level</li> <li>County level</li> </ul>	<b>Indicates quality of materials over all and influences feasibility of collection strategies in different areas</b> <ul style="list-style-type: none"> <li>Inform realistic targets for circular economy policy and separate collection of textiles</li> <li>Compare Estonian figures to other countries to identify the most likely viable circular textile businesses and technologies               <ul style="list-style-type: none"> <li>Reusable fraction of Estonian PCT is approx. 50% (low end of average for other EU countries<sup>[42]</sup>)</li> <li>Consider what types of business activities are feasible for Estonian materials and what can bring a competitive advantage over others in the region (e.g. reuse vs. recovery activities)</li> <li>Conduct / fund materials characterization studies to support feasibility assessments</li> </ul> </li> <li>Track recycled and waste over time to show whether recovery focused initiatives are working</li> <li>Use to identify potential data reporting issues or problems in materials handling practices from waste permit holders</li> <li>Identify needs and opportunities for designing funding programme and other targeted support measures for circular textiles</li> </ul>

User	Data point	How to use it
PCT Entity	Amount collected – own activities <ul style="list-style-type: none"> <li>By municipality, collection point, collection method</li> <li>Total</li> </ul>	<p><b>Co-develop partnerships and new programs with municipalities</b></p> <p><b>If it is too low in an area, discuss options with potential partners</b></p> <ul style="list-style-type: none"> <li>Quantify number of tonnes (or range) over a specific time frame that would make partnership feasible</li> <li>Suggest nearby areas who could share collection locations</li> <li>Identify additional support measures municipalities can provide, such as covering transport costs or providing collecting and warehousing services themselves</li> <li>Consider alternatives to installing bins, such as clothing collection events</li> <li>Use the data to support communication with partners about changes or issues to address moving forward</li> </ul> <p><b>If this is high or growing rapidly</b></p> <ul style="list-style-type: none"> <li>Adjust number of collection points or frequency of pick up</li> <li>Consider new programs to increase access for citizens and optimize transport quantities</li> <li>For over the counter drop offs at charity shops: create a plan to manage materials effectively, such as partnerships with other PCT entities, communicating to citizens specifically the types of items that you can resell, etc.</li> </ul> <p><b>NOTE:</b> This is a key business metric already in use by most PCT entities. If some information is missing (e.g. quantity of materials dropped off at stores), consider a simple unit such as number of bags to identify trends over time.</p>
	% Reuse % Recycled % Waste <ul style="list-style-type: none"> <li>Own activities</li> <li>By municipality, collection point, collection method</li> <li>Country level</li> </ul>	<p><b>Manage partner expectations and explore new business opportunities</b></p> <ul style="list-style-type: none"> <li><b>If the amount of reusable in items you handle is high</b> <ul style="list-style-type: none"> <li>May be able to increase number of collection points</li> <li>Consider what is working in the area where these materials are collected and identify anything that can also be done in other areas</li> </ul> </li> <li><b>If the amount of reusable items is too low or the amount of waste is too high</b> <ul style="list-style-type: none"> <li>Consider reasons why and identify small adjustments that can be made (e.g. bin relocation)</li> <li>Work with municipalities on citizen level communications to target the issue</li> <li>Consider different collection models, such as staffed collection points or scheduled events</li> </ul> </li> </ul> <p><b>NOTE:</b> Help your municipality partners to understand the specific benefits and challenges of the materials in their area and make suggestions to improve what's not working. They are not textile experts, and they do want solutions for their citizens' textiles.</p>

User	Data point	How to use it
	<p>Reasons textiles are not reusable or recyclable</p> <ul style="list-style-type: none"> <li>Available in pilots or from some PCT entities by request</li> </ul>	<p><b>Details to help address specific problems</b></p> <ul style="list-style-type: none"> <li><b>Work with municipalities to create citizen level communications to improve quality of materials streams</b></li> <li><b>Used to make adjustments</b> <ul style="list-style-type: none"> <li>Increase pick-up frequency if items are sitting too long</li> <li>Change style of collection locations to better protect materials</li> </ul> </li> </ul>

**Table 9.** Users of data, relevant data points and how to use them



# ANNEX 3

## What Municipalities Want

Last year, KEM conducted a survey of municipalities to get a better picture of the challenges and opportunities around PCT. In total, 32 respondents provided perspectives on the collection and handling of PCT, challenges, partnerships and other related topics. Out of those, 29 were municipalities with fewer than 17,000 inhabitants.

- 88% of survey respondents indicated citizens expressed interest in textile collection
- 34% of survey respondents said citizens ask about this often

Several are prepared to take the initiative to promote textile collection, and some indicate they would take more than one of the steps below.

- 59% are willing to purchase collection containers for PCT entities to empty
- 34% would pay the costs of emptying the container
- 25% would empty containers and store materials in a central location for PCT entities to pick up

The top shortcomings in the textile collection systems include

- Lack of support measures
- Lack of funds to purchase containers
- Dirty or broken clothing or other waste being put into containers
- Lack of information about what happens to the collected textile

Additional comments highlighted the need for recommendations on how to organize collection effectively and a universal system for use across the country.<sup>[43]</sup>

KEM sent out a brief follow up survey on TEXroad's behalf, and we received insights from an additional 20 municipalities, out of which 17 were municipalities with fewer

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43 KEM, Survey: Survey on local governments and recycling organizations to harmonize textile collection in Estonia, 2021

than 17.000 inhabitants, and there was no overlap between the respondents.

- 75% gave textiles a medium to high priority ( $\geq 3$  on a scale of 1-5, 5 being high priority)
- 90% indicated they wanted or needed help in order to better manage their textiles

The findings above were further supported in interviews with municipalities and TEXroad's advisory board meeting at the end of 2021. Additional feedback from larger municipalities was that their collection systems are already well developed, and there was not a need to do more at this time. Setting targets for PCT collection would motivate them to pick up the topic again. <sup>[44]</sup>

Overall, textiles are clearly on the minds of citizens and municipalities, and there are some concrete needs that can be addressed in the short term.

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44 PCT entity + Municipality advisory board session, 2021; footnote 36 also applies

# ANNEX 4

## Data Problems

106 distinct areas (listed as a uniquely named linn or vald) reported textile waste data into JATS between 2017 and 2019, and 53 reported more than 1 year of data. Only 7 of these areas had data for all 3 years and reported figures within a 50% range of the 3 year average ( $\pm 25\%$  deviation or no more than 50% total range between figures).

Considering the 53 areas with multiple years of data, it is troubling to see a mere 13% showing a reasonable level of consistency. While figures can be expected to change from year to year, sometimes even drastically, it is very unlikely either an increase in the amounts of post-consumer textiles collected or drastic changes in the Estonian textile sector can account for such significant inconsistency.<sup>[45]</sup>

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45 JATS textile waste data 2017-2019

Municipality	JATS Separately Collected Textiles (tonnes)				% Change from Average		
	2017	2018	2019	Average	2017	2018	2019
Anija vald	3,22	3,4	0,66	2,427	-33%	-40%	73%
Antsla vald		3,147	23,18	13,164		76%	-76%
Häädemeeste vald	0,18	0,1		0,140	-29%	29%	
Haapsalu linn	1,52		3,8	2,660	43%		-43%
Haljala vald	1,367	8,445	30,48	13,431	90%	37%	-127%
Harku vald	3,447	5,96	12,955	7,454	54%	20%	-74%
Ida-Virumaa määramata vald	6,06	1,94		4,000	-52%	52%	
Järva vald		1,48	3,24	2,360		37%	-37%
Jõelähtme vald	122,79	186,207	354,14	221,046	44%	16%	-60%
Jõgeva vald	0,02	7,49	58,925	22,145	100%	66%	-166%
Jõhvi vald	0,08	10,124	30,965	13,723	99%	26%	-126%
Kadrina vald	0,24		16,71	8,475	97%		-97%
Keila linn	0,72	0,64	0,62	0,660	-9%	3%	6%
Kohtla-Järve linn	1,8	0,06	1,38	1,080	-67%	94%	-28%
Kose vald	0,32	8,06	1,54	3,307	90%	-144%	53%
Lääne-Harju vald		10,421	9	9,711		-7%	7%

Municipality	JATS Separately Collected Textiles (tonnes)				% Change from Average		
	2017	2018	2019	Average	2017	2018	2019
Loksa linn	1,58	2,44	4,04	2,687	41%	9%	-50%
Luunja vald	44,92	42,361	38,34	41,874	-7%	-1%	8%
Maardu linn	5,883	22,463	0,88	9,742	40%	-131%	91%
Muhu vald	0,137	1,398	0,666	0,734	81%	-91%	9%
Mustvee vald	3,54	3,72	7,96	5,073	30%	27%	-57%
Narva linn	43,139	43,93	0,429	29,166	-48%	-51%	99%
Narva-Jõesuu linn		34,51	11,86	23,185		-49%	49%
Nõo vald	21,042	14,38	10,678	15,367	-37%	6%	31%
Otepää vald	12,476	11,741	21,993	15,403	19%	24%	-43%
Paide linn	49,62	31,32	13,46	31,467	-58%	0%	57%
Pärnu linn	3,9	6,708	25,165	11,924	67%	44%	-111%
Põhja-Sakala vald		5,385	63,151	34,268		84%	-84%
Põltsamaa vald	24,97	1,187	27,16	17,772	-40%	93%	-53%
Põlva vald		0,64	1,16	0,900		29%	-29%
Raasiku vald	1,46	26,18	1,44	9,693	85%	-170%	85%
Rae vald	50,66	46,98	45,815	47,818	-6%	2%	4%

Municipality	JATS Separately Collected Textiles (tonnes)				% Change from Average		
	2017	2018	2019	Average	2017	2018	2019
Rakvere linn	0,34	0,58	3,74	1,553	78%	63%	-141%
Rakvere vald	12,613	4,788		8,701	-45%	45%	
Rõuge vald		8,44	23,99	16,215		48%	-48%
Saarde vald	0,26	0,16	0,12	0,180	-44%	11%	33%
Saaremaa vald		1,601	2,027	1,814		12%	-12%
Saku vald	475,2	582,82	418,02	492,013	3%	-18%	15%
Saue vald	102,82	22,575	38,06	54,485	-89%	59%	30%
Tallinn	380,646	314,033	261,376	318,685	-19%	1%	1%
Tapa vald	0,36	10,14	33,245	14,582	98%	30%	-128%
Tartu linn	133,703	101,452	182,411	139,189	4%	27%	-31%
Toila vald		0,067	1,315	0,691		90%	-90%
Tori vald	0,64	2,32	0,08	1,013	37%	-129%	92%
Tõrva vald		0,34	0,431	0,386		12%	-12%
Türi vald	31,76	33,66	50,24	38,553	18%	13%	-30%
Väike-Maarja vald		0,38	24,49	12,435		97%	-97%
Valga vald		88,54	84,529	86,535		-2%	2%



Municipality	JATS Separately Collected Textiles (tonnes)				% Change from Average		
	2017	2018	2019	Average	2017	2018	2019
Viimsi vald	35,131	40,52	29,6	35,084	0%	-15%	16%
Viljandi linn	8,26	4,82		6,540	-26%	26%	
Viru-Nigula vald		0,22	1,36	0,790		72%	-72%
Võru linn	14,654	11,082		12,868	-14%	14%	
Võru vald		10,26	15,64	12,950		21%	-21%
<b>Grand Total</b>	<b>1754,298</b>	<b>1797,265</b>	<b>2001,629</b>	<b>5553,192</b>			

**Table 10.** Analysis of JATS textile waste data reported by environmental permit holders ANNEX 5 – Partners and Collaborators.

2017 data on separate lines in JATS report have been combined in this table.

# ANNEX 5

## Partners and Collaborators

### **Humana**

Humana Estonia was established in 2000 with a goal to support global development projects through the trade of second-hand goods. Main activities in Estonia are collecting, sorting and retail sale of second hand clothes to give them longer lifecycle. Collection network of 80 locations in 7 counties is saving 1800–1900 tons of PCT from landfills and incineration. Annually 7000 tons are sorted in Humana sorting centre to give PCT longer lifespan in reuse or in recycling.

23 Humana retail shops operate in 11 cities providing quality second hand clothes on affordable prices.

All these activities contribute to generate funding for development projects implemented by partner organisations.

### **Lounais Suomen Jätehuolto**

Lounais Suomen Jätehuolto (LSJH) is a forward-thinking waste management company owned by 18 municipalities in southwestern Finland. In addition to hauling and handling residential waste and recyclables, they are building a full-scale end-of-life textile refinement plant in Topinpuisto in Turku. When the plant is ready, Finland will be the first country in the world where post-consumer textiles are obtained nationwide for reuse and recycling.

The refinement plant will process household end-of-life textiles that the local waste management companies have collected and pre-sorted in collaboration from their respective regions. LSJH is responsible for organising the collection within Southwest Finland as well as for the coordination and development of the national operations model for collection and sorting of post-consumer textiles, together with other municipality owned waste management companies in Finland.

### **Materjalivoog**

Materjalivoog is a business-to-business collaboration platform that allows manufacturers to either add value to their material residues or find other material as input for production. Upon registration of the user, the suitability for the platform is

checked and in case the seller is approved, they can start posting the materials for the buyers.

In addition, Materjalivoog also helps to strive for a circular economy by cooperating with local regional institutions and mapping the materials.

At present, it is the only business-to-business industrial waste brokerage platform in the Baltics, involving all industries with an interest in it. The goal is to bring knowledge to companies – the circular economy has come to stay. The platform must become a matter of course before the company contacts the waste manager.

## Reverse Resources

Reverse Resources is a SaaS platform for management of textile waste from source to recycling for the global fashion industry. It connects fashion brands, textile waste suppliers (e.g. garment factories, fashion stores, collection points), waste handlers (sorters, pre-processors, traders) and textile-to-textile recyclers to collaborate around setting up closed-loop material flows of textile flows. The platform offers following services:

- **waste mapping** – profiling who has which materials at hand;
- **matchmaking** – which waste is best for which recycling purposes;
- **supply chain management** – which parties and which processes enable setting up most cost-efficient routes for the waste;
- **order management** – help manage agreements, documentation, and process status updates between parties
- **transparency by setting up a creating a digital chain of custody** – verify the actual material flows from source to recycling, provide background information of the waste to recyclers, and end-users;
- **data aggregation across large number of organisations, reporting, statistical analytics** – supporting brands and recyclers with learning how much progress has been made, setting targets and forecasting volumes of available materials for recycling.

Reverse Resources is working with several largest global fashion brands (incl. H&M, M&S, Next, Teddy SPA, etc). In their first target market, Bangladesh, RR has shown best

results in impacting the waste management system in the country to get formally organised and set up transparent processes around textile waste management.

The platform creates a disruption to support the waste trading sector to move away from traditional brokering business model to a service model when delivering waste from source to recycling. This is an important step to switch the waste management from being the hidden back end of the industry to become the front-end of the raw material sourcing that is needed for an efficient circular economy. RR platform already includes users from 23 different countries across Europe, Asia and Northern Africa. The platform works currently with 50+ recyclers and 20+ waste handlers, representing demand for over 50,000 tonnes of textile waste per month, and growing fast.

Matching the high demand of waste segregated by material type, composition and color, the supply of the waste on the platform is much lower (~1000 tonnes / month) due to lack of segregation practices from among the suppliers. So far the focus has been more on the industrial waste as a low-hanging fruit for scaling up textile-to-textile recycling (easy to segregate by composition), pilots around management of post-consumer waste (focusing more on Europe) are now starting from May 2022 with the introduction of fiber-detection sorting devices in post-consumer sorting sites.

## **Uuskasutuskeskus**

The non-profit organisation Uuskasutus is an independent social enterprise established in 2004 by the Good Deed Foundation, the Estonian Fund for Nature, the Caritas Foundation and two individuals: Rasmus Rask and Priit Mikelsaar. Its objective is to put used things back in circulation and to make re-use and re-design easily accessible and commonplace for everyone in Estonia.

We want to reach a point where Estonian people consider (at least partial) re-use an obvious choice when they buy and use things. This can be achieved by making re-use easy for ordinary shoppers, and second-hand products must be able to compete with cheap new products in terms of quality.

Uuskasutuskeskus mostly uses two approaches to promote re-use: we put clean and usable things back into circulation and we find ways of giving new life to old things. We believe that nothing that is still usable should end up in landfill.

# ANNEX 6

## PCT Entities, Waste Managers and Infrastructure

### Actors

Post-consumer textile collection in Estonia is largely carried out by PCT entities or waste management companies. PCT entities can be charities, social enterprises, or commercial companies, and they typically collect through bins or bring-banks placed on public and private property, including at civic amenity sites and over the counter drop off at reuse stores. Some entities also hold clothing drives, provide pick-up services, and are exploring other alternatives to the traditional bin and retail collection model. Following standard practices across Europe, Estonian textiles collected by PCT entities are sorted for local and international reuse and recycling markets. Reuse is maximized and waste is minimized to generate enough economic value to support collection and sorting activities. A report released in 2020 estimated 63% of Estonia's separately collected PCT comes through PCT entities.<sup>[46]</sup>

Most collection containers are owned by municipalities but operated by a private collector and are only meant for reusable textiles. In data collected for 2017 and 2018, there were 65 public containers operated by this municipality-private collector model and 45 public containers from a charity. The majority of containers were located in and around Tallinn and Tartu.<sup>[47]</sup> TEXroad's research in 2022 identified a total of 140 total public containers in Estonia whose contents are managed by PCT entities.

Waste management companies place collection containers at civic amenity sites and are responsible for managing these materials after collection. An estimated 37% of Estonia's separately collected PCT comes through these channels. Currently, none of these materials are reused or recycled but end up in landfill or incineration. This is partly due to items being contaminated with dirt or mould and partly due to the lack of recycling options.<sup>[48]</sup>

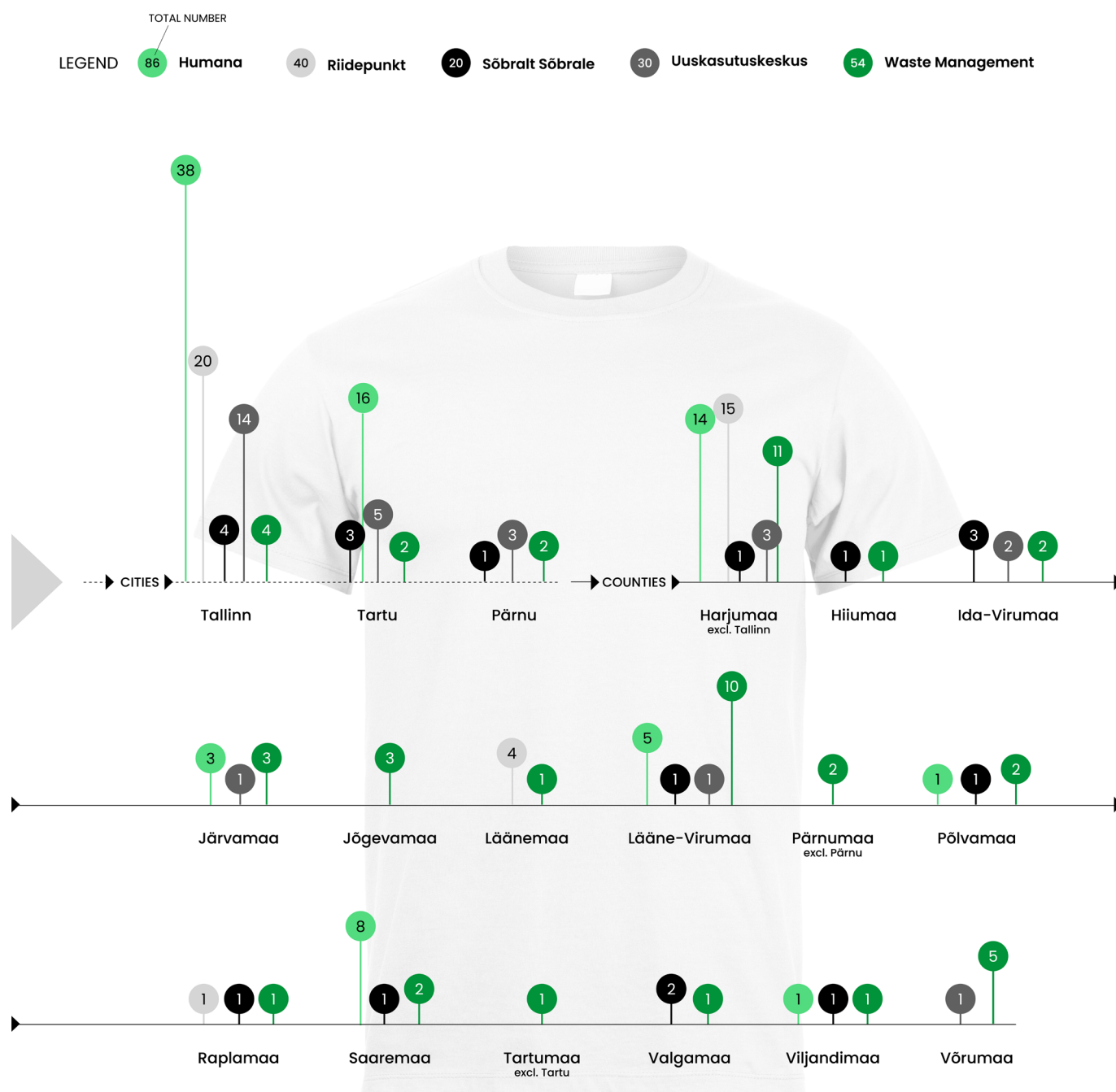
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46 Stockholm Environmental Institute: Estonia post-consumption clothing and textile flows, 2020

47 Ibid

48 Ibid

## Collection points of PCT entities by area



**Figure 6.** Number of collection points of most prevalent PCT entities <sup>[49]</sup>

49 Company websites, internet searches, information supplied by PCT entities

H&M's take-back scheme is also operating in Estonia. In reality, this channel is managed by I:CO, a subsidiary of SOEX, one of the largest PCT entities in Europe.<sup>[50]</sup> Their estimated contribution to total collected amounts in 2017–2018 is approximately 2%. While textiles collected by PCT entities are sorted within Estonia (with the exception of one small private collector), brand-sponsored collection outsources the sorting by exporting all their textiles to Germany for further processing.<sup>[51]</sup>

Total Textile Consumption – 19.531 tonnes

Includes new and used textiles on the market

Total Collected – 25%<sup>[52]</sup>

Collector type	Est. amount collected (2017–2018 data) <sup>[53]</sup>	Responsible for materials (2021–2022 data) <sup>[54]</sup>
Charity / Social Enterprise PCT	44%	Humana, Uuskasutuskeskus, Riidepunkt, Sõbralt Sõbrale, other smaller entities
Commercial PCT	17%	
Waste Management Company	37%	Ragn-Sells, Epler & Lorenz, Eesti Keskkonnateenused, Maardu Linnavarahoodus, AV Velko, Võru Jäätmekeskus*, Paikre, Amestop, Väätsa Prügila, Hiiu Jäätmejaam, Hiiu rural municipality
Brand / Retailer	2%	H&M, managed by I:CO/SOEX

**Table 11.** Collection channels and responsible parties

## Collection infrastructure data

Note: Small charity shops are excluded from the following analysis, due to lack of available data.

One of the most important factors in PCT collection is how accessible drop off points are to citizens. The two biggest population centres in Estonia, Tallinn and Tartu, have an active PCT collection infrastructure. The most active PCT entities operate a network of bins located at most of the bigger grocery stores and districts in these cities. Residents can also drop off items at civic amenity sites and waste stations,

50 <https://www.ico-spirit.com/en/referenzen/partner/>

51 Stockholm Environmental Institute: Estonia post-consumption clothing and textile flows, 2020

52 Ibid, footnote 44

53 Ibid, footnote 44

54 Ibid, footnote 42



commission resellers, H&M stores and in some charity shops.

Tallinn and Tartu are responsible for an estimated 40% of all PCT generated in Estonia.<sup>[55]</sup><sup>[56]</sup> A very rough estimate with the available figures indicates approximately 50% or more of all PCT collected in Estonia comes from these two municipalities.<sup>[57]</sup> Not surprisingly, our research shows these are the two largest municipal collection networks in the country in terms of number of collection points. Harju county (outside of Tallinn) has the second largest over all collection network.<sup>[58]</sup>

Gravitational hubs have an important role in collection infrastructures, as well. These are places where people living in rural municipalities regularly drive for work or other daily business. This makes them ideal locations for collection points. Key gravitational hubs in Estonia are Rakvere city in Lääne-Viru county, Pärnu city for Pärnu county, Tartu city for Tartu county, Võru city for Võru county, Narva city in Ida-Viru county and Tallinn city for Harju county.

In order to build win-win partnerships for PCT management, municipalities and PCT entities should be paying attention to the estimated amount of materials in circulation within a specific area, the density of collection points and the number of people served per collection point. Quantities collected from each municipality by each PCT entity is an equally important data point for municipalities to track, and according to municipalities, PCT entities are already supplying this information upon request.

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55 Stockholm Environmental Institute: Estonia post-consumption clothing and textile flows, 2020

56 Comtrade and Eurostat databases: New textile products imported, exported, and produced in Estonia in 2018 and 2020

57 Quantities of collected textiles provided by municipalities and PCT entities; rough estimates due to incomplete or non-comparable data

58 Company websites, internet searches, information supplied by PCT entities

## Fixed clothing drop off points

	Waste plant / drop site	Containers, Lockers, Bins, Cabins	Reuse store drop off	Brand / Retailer	Other (ie: consignment)	Container density km <sup>2</sup> / collection point	Container density people / bin	Est. PCT generated / yr (tonnes)
Harju maakond (outside Tallinn)	11	31	1			82	3.644	2.300,1
Hiiu maakond	1	7	1			114	1.039	137,2
Ida-viru maakond	2		5			356	19.012	1.953,7
Järva maakond	3	3	2			334	3.749	440,3
Jõgeva maakond	3					654	9.421	414,9
Lääne maakond	1	3				454	5.091	299,0
Lääne-Viru maakond	10	5	2			216	3.449	860,7
Pärnu linn	2	1	7	1	3	61	3.627	745,4
Pärnu maakond (outside Pärnu)	2					2.276	17.598	516,7
Põlva maakond	2	1	1			456	6.140	360,5
Rapla maakond	1	1	1			922	11.066	487,4
Saare maakond	2	8	1			267	3.005	485,3
Tallinn	4	60	13	5		2	5.341	6.429,5
Tartu linn	2	19	7	2	7	4	2.589	1.406,0
Tartu maakond (outside Tartu)	1					3.113	153.615	2.255,1
Valga maakond	1		2			639	9.361	412,3
Viljandi maakond	1	1	3			684	9.204	675,6
Võru maakond	5		2			396	5.022	516,1

**Table 12.** Textile drop off points, density, and estimated amount of PCT generated

PCT entities should track the quantity (tonnes) and quality (reusable, recyclable or waste) of materials coming through each collection point so conditions that yield the best results can be identified to troubleshoot issues as they arise. In some cases, municipalities can help address issues to improve the quality of materials, for example through citizen communication campaigns or recommending where to relocate collection points, if needed. In other cases, evidence to support decision making helps maintain good relationships when changes are needed to maintain economic viability. See section 5 – Data and ANNEX 2 for more details.

Once collection data is available together with people and materials density and collection infrastructure data, further analysis of collection methods and PCT entity partnership opportunities would be useful to define guidelines for Estonian municipalities in developing separate collection capacity.

Waste management companies operate 54 textile collection points at civic amenity sites and waste facilities in Estonia. This excludes collection points at these types of locations which are operated by PCT entities. Unfortunately, none of the items collected by waste managers are reused or recycled, and quantity data reported (a regulatory requirement) by waste permit holders are very inconsistent.<sup>[59]</sup><sup>[60]</sup> This should be addressed by the Environmental Ministry right away to improve statistics for policymaking and transparency of waste handling for citizens.

Across Estonia, Humana has the biggest presence with 80 collection sites, Riidepunkt has 40, Uuskasutuskeskus 28 and Sõbralt Sõbrale 19. Excluding locations in Tallinn, Tartu and the rest of Harju county, Humana has 17, Sõbralt-Sõbrale 12, Uuskasutuskeskus 8 and Riidepunkt 4.

When counting the total number of municipalities each PCT entity covers, the dynamic changes. Humana is represented in 19 municipalities today, Sõbralt-Sõbrale in 15, Riidepunkt in 13 and Uuskasutuskeskus is represented in 10.

Waste managers operate 54 drop off points across Estonia.<sup>[61]</sup>

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59 Company websites, internet searches, information supplied by PCT entities

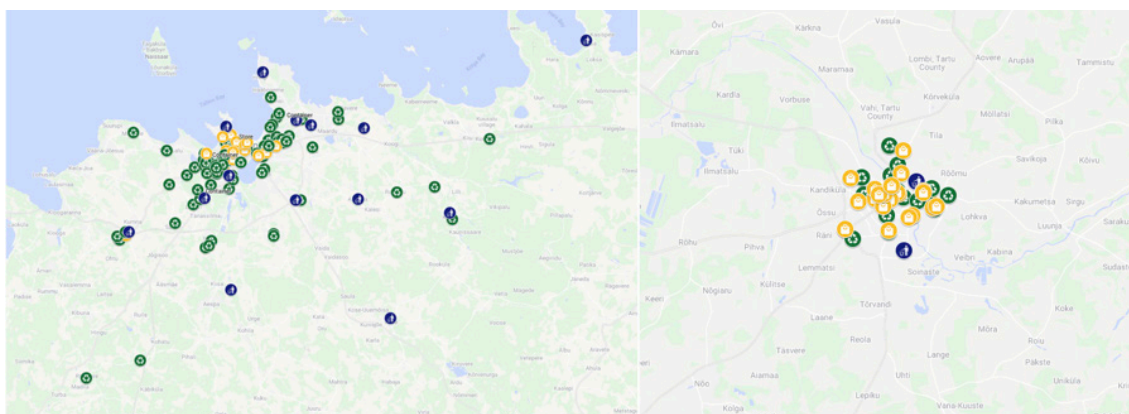
60 JATS textile waste data 2017-2019, interview with municipality in Harju county

61 Ibid, footnote 52

## Population centres and rural areas

Areas with higher population densities typically have more opportunities for PCT entity partnerships. In Tallinn and Harju county, collection points managed by the PCT entities are an average of 1 collection point every 2,2 square km in Tallinn and 1 every 110 square km in Harju county. In Tartu, collection point density within the city is 1 every 5,9 square km, however across the other 8 municipalities in Tartu county there are no textile collection points managed by the PCT entities covered in this report.<sup>[62]</sup><sup>[63]</sup> Citizens are asked to bring both reusable and waste textiles to Tartu city reuse bins and waste plants (with the exception of the waste plant in Peipsiääre, who has their own collection on site).

The situation in Tartu is also seen on a smaller scale in other counties. For example, Rakvere in Lääne-Viru county or Pärnu in Pärnu county, have been able to establish partnerships with PCT entities that serve the larger area. One such municipality reported the few bins that they are able to get fill up quickly, as people from the surrounding area are actively taking the opportunity to send textiles into reuse and recycling channels instead of the waste stream.<sup>[64]</sup> These are situations where data can pin-point the optimum number of bins and emptying frequency for a specific area in order to keep them from overflowing and maintain economic viability for PCT entities carrying out the collection.



**Figure 7.** Collection points in Tallin and surrounding area vs. Tartu and surrounding area

62 Ibid, footnote 52

63 Statistics Estonia, population statistics by city, 2020

64 Rural municipality info session, 2022

Outside of populated areas there are fewer textile collection options. Municipalities may be willing to invest in the bins and pay collection costs to partner with PCT entities for reuse options, but sometimes this does not provide enough economic incentive for PCT entities to expand deeper into rural areas. Post-consumer textile collection at waste management facilities and civic amenity sites has become the alternative, but if there is not a partnership with PCT entities, the textile immediately becomes waste.

For rural areas, the number of inhabitants in neighbouring communities, estimated amount of materials in circulation, presence of gravitational hubs and existing collection points in nearby municipalities are all important information to support new PCT collection infrastructure. Data should also be used in these scenarios to inform who is covering the costs of emptying bins, warehousing, and other handling processes.

## **Waste managers in the system**

Waste stations in Estonia are mostly managed by three biggest waste companies in Estonia – AS Keskkonnateenused, Ragn-Sells and Epler & Lorenz. Based on a brief look into the available data and a few discussions with municipal environmental specialists, it seems the methods used to collect and categorize textiles for regulatory reporting can vary between companies and locations. For example, one operator is thought to be collecting textile together with plastic. There are also municipalities who have waste management companies collecting textiles separately, but no textile data for these municipalities appears in the national statistics. Generally, the data on textile waste provided by waste management companies is very inconsistent. <sup>[65]</sup> <sup>[66]</sup>

## **Other gaps and insights**

According to our data, 21 out of 79 municipalities in Estonia do not have separate PCT collection points available to citizens. 19 of the 58 remaining municipalities only provide collection points through waste management companies, and therefore items are categorized as waste and sent to landfill or incineration. This means that about 50% of Estonian municipalities have partnerships that enable PCT reuse and

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65 Company websites, internet searches, information supplied by PCT entities

66 JATS textile waste data 2017-2019, interview with municipality in Harju county

recycling, while materials collected in the remaining 50% can only become waste. According to 2021 population data from these municipalities, 286.728 Estonians, or 22% of the population, lack textile reuse and recycling options in their local municipality.<sup>[67] [68]</sup>

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67 Company websites, internet searches, information supplied by PCT entities

68 Statistics Estonia, population statistics by city, 2020