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RESOURCE AND MATERIALS EFFICIENCY

PROJECT AREA

POTENTIAL BARRIERS

for long term implementation of the Fibersort

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Overview

The Fibersort is a technology that automatically sorts large volumes of garments and finished textile products by fibre composition. Once sorted, these materials become reliable, consistent feedstock for high-value textile-to-textile recyclers. When commercialized, the Fibersort will create a tipping point for a new, circular textile industry.

This report provides an overview of potential barriers for the implementation of Fibersort technology for collectors and sorters. The purpose of this document is to provide these stakeholders, as well as recyclers and other relevant actors, with the information needed to understand the importance, fit and potential of the Fibersort technology.

This analysis was based on publications from organisations working within the same focus areas and primary insights gathered through surveys and interviews to multiple value chain actors participating in the project including collectors, sorters, recyclers, manufacturers and brands, as well as industry and academic experts[1].

The Fibersort consortium of partners will continue to research and collaborate with other projects and industry stakeholders to grow our collective understanding of post-consumer textiles and the opportunities technology could provide to create a circular future. This report is part of a series of publications for the Fibersort, an Interreg North-West Europe funded project. Stakeholders involved in the project receive early access to information and more detailed findings. Sign up **here** to become a stakeholder.

For more information on the project, go to: **www.nweurope.eu/fibersort**

Introduction

Globally, less than 1% of textiles collected are recycled into new textiles[2]. Based on previous research conducted, it can be estimated that in NWE, 4700 kilo tonnes of post-consumer textiles, PCT, are generated annually. From this value, over half of it is currently being landfilled or incinerated directly. Nonetheless, from the post-consumer textiles that are collected in NWE at present, 24% of them are already suitable to be Fibersorted and therefore, have the potential to be used in textile-to-textile recycling[3]. Currently these textiles are being downcycled, landfilled or incinerated. The Fibersort can therefore enable textile resources regarded as low value waste (non-rewearable clothing) to cycle repeatedly through the supply chain, facilitating the flow into textile-to-textile recycling technologies. Once these recycling technologies are fully operational on the market, incentives for collection will increase, therefore the number of textiles available and suitable to be Fibersorted will be larger, hence, diverting into higher-value uses, textiles that are currently being downcycled, sent to landfill or incinerated.

Sorting is largely done manually within the industry. Manual sorting allows for experienced sorters to grade textiles into fractions according to their condition, their quality and their fit to domestic or international markets, all of which are relevant for rewearable clothing[4]. The speed and accuracy of the Fibersort technology, on the other hand, is essential to allow non-rewearable clothing to acquire their full potential by grading them into appropriate material fractions to enter textile-to-textile recycling flows. Still, barriers always exist when implementing a technological innovation. For Fibersort technology to be successfully implemented within the industry, a few identified socio-cultural, physical, economic and regulatory barriers must first be overcome.

1. Socio-cultural barriers

It is widely recognised that culture is extremely important when looking to successfully implement a technology. Culture, whether it is organisational, national or community-driven, shapes individual perceptions[5]. These in turn, have an impact on industry and consumer practices determining the success of the implementation of a new technology[6].

1.1 Consumption and disposal practices

The last decades have seen an exponential rise of textile consumption, reaching a peak in purchasing practices around the year 2007 and thereafter maintaining consumption levels with small variations in different countries[7]. Meanwhile average quality of textiles in circulation continue to experience a decline[8]. It is then more difficult to retain value in them, increasing the amount of non-rewearable clothing entering sorting facilities. At the same time, clothing disposal rates are accelerating, as global clothing utilisation has decreased by 36% since the early 2000s[9]. For instance, in the Netherlands, it is estimated that an average of 40 clothing items are annually disposed per person[10]. Mid and low quality PCT are therefore more readily available , and the potential of sorting clothing by material type becomes more attractive to offer accurate feedstock for textile-to-textile recycling.

1.2 Perception of textiles made from recycled PCT

While some brands are using recycled textiles on a small scale, most remain reluctant to use textiles made from recycled PCT. Concerns mostly relate to the price, quality, consistency and colour availability. For other brands, recycled textiles are yet not on their sourcing radar, neither are they considered nor measured within the companies' performance indicators.

On the other side of the value chain, the perception of consumers of recycled textiles is key

to generate value to this fraction of textiles[11]. Large numbers of consumers still perceive recycled and second-hand textiles as of lesser value than those derived from virgin sources, associating them with lack of quality and of cleanliness[12]. Though concerns on potential chemical contamination, lack of traceable origins and higher pricing than textiles from virgin sources are substantiated in some cases, there is still a need to improve the perception of recycled textiles. In this sense, educational opportunities for both consumers and brands should be readily available to support this shift, as well as conclusive testing to determine the accuracy of these claims.

1.3 Lack of urgency

The low-value perception of textiles made from recycled PCT is accompanied by a lack of urgency to develop the end-of-use value chain compared to other areas of the value chain. The lack of urgency in this particular matter hinders the possibilities to gain momentum to drive attention and investment to the collection, sorting and recycling practices. All in all, the awareness around the availability and potential of textiles made from recycled PCT is still not big enough to drive a shift in consumption and production practices.

2. Physical barriers

The Fibersort revolutionises sorting activities within the industry, as it allows to sort large quantities of clothing and textiles by fibre composition at an unprecedented speed. The theoretical estimation expects that with automated feed-in in place, a piece of textile could be sorted every second. Sorting by fibre composition through the updated NIR technology scanners will result in reliable outputs which are consistent input for textile-to-textile recyclers. The additional features of colour sorting and the detection of woven vs. knitted textiles to be integrated in the Fibersort in the coming months can only enhance the potential the technology has to support a new circular textiles industry.

2.1 Input consistency

One of the main physical barriers is that post-consumer textiles, PCT, which serve as input to the Fibersort, lack consistency. Textile feedstock collection varies between municipalities, regions or countries, and volumes are influenced by seasonality, economics or social contexts. Therefore, the unpredictability of these inputs leads to a challenge when estimating feedstock availability. Further, finished textiles, especially clothing, consist of an extensive array of blended materials. For the Fibersort technology to be both economically and physically feasible, all textile blends are not able to be sorted. Therefore, the selection on which fractions are to be sorted has to reflect the volumes collected of each material type as well as the end-market demand for these sorted textiles[13].

2.2 Output challenges

Being able to guarantee that sorted PCT are free from the presence of hazardous chemicals is a large barrier, especially for mechanical recyclers to safely purchase the outputs of the Fibersort. The lack of traceability of most textiles carries the risk of re-introducing textiles into the system which pose a threat to product safety due to chemical contamination. Currently, there is no single solution to tackle this challenge, and therefore, it is an area to be further explored to ensure the full potential for uptake of sorted PCT by recyclers. Another challenge of sorted PCT for recyclers is the presence of elastane in multiple blends[14]. Although the Fibersort technology can effectively scan and recognise elastane as a material type, the extensive use of it in clothing hinders the recyclability of sorted PCT. Collaboration with brands and manufacturers to review the extensive use of elastane in production, and to highlight the adverse effect it has on the cyclability of clothing might prove valuable[15].

Additionally, when mechanically recycling PCT, the performance of the fibres still remains lower than those from virgin sources, mainly due to fibre length shortening. In order to comply with industry requirements, PCT fibres are being mixed with virgin fibres and re-spun intro threads that prove the necessary performance. Trials conducted recently by ECAP indicate that although PCT fibres can be used to create new textiles, the recycled content may only represent a fraction of the total[16]. Cross chain collaboration to determine and test the necessary developments to improve quality of mechanically recycled PCT is key to its success in the market.

2.3 Transportation and logistics

Missing or underdeveloped infrastructure hinders the smooth flow of textiles into developing PCT markets. Further, inputs for the Fibersort can sometimes reach the sorting facilities in a poor or compromised condition. Geographical location of sourcing and selling of PCT is another barrier. There is a demand for local sourcing, which could in turn increase the compliance of textiles in the market with local regulations as well as increasing responsibilisation of the society over its own waste[17]. However, in the context of local PCT sourcing, the volume of the supply may not always meet the capacity requirements or technical specifications of recyclers in the area. Moreover, different markets call for different material requirements and technical specifications. Sourcing and selling globally may present opportunities for sorters to be able to increase sales of their sorted PCT stock, though this may bear higher logistics and transportation costs as well as its related environmental impact.

3. Economic barriers

The success of the Fibersort depends on the conditions and context under which the technology is implemented. Accordingly, it is of significance to be aware of the market demand, costing and pricing for sorted PCT.

3.1 Lack of demand for sorted PCT

Currently, there is no certainty on the size and demand of all PCT end-markets. This arises both from the relative immaturity of some recycling technologies as well as from the lack of awareness of availability and potential of recycled fibres and fabrics made from PCT by brands and consumers. Nevertheless, since the starting date of this project there has been significant advancement in textile chemical recycling technologies which now can be expected to reach the market at full scale in the next 3-6 years[18]. Some PCT outputs already have an end-market, such as wool, however, for other PCT materials there is still great uncertainty on future industry requirements. Hence, there is no standard information on what to sort for and who to sell to. An increase in demand for recycled post-consumer fibre from spinners, fabric mills, brands, retailers and consumers, is needed in order to start providing more certainty to collectors, sorters and recyclers in the value chain. Another issue which decreases the attractiveness of sorted PCT for recyclers is the lack of technology present at sorting facilities to remove hardware and tags at efficient speed, comprehensive with the sorting speed provided by the Fibersort.

3.2 Pricing and Costs of PCT

Certainly, demand is closely linked to pricing and costs of purchasing and investing in post-consumer textiles in comparison to those from virgin sources. The upfront investment-costs are still high for many collectors and sorters, and therefore the increase in the end-markets is necessary to justify the investment. The financial feasibility of the Fibersort technology is dependent upon the sale of its outputs: sorted PCT. The market for sorted PCT is contingent on textile-to-textile recycling technologies, or potentially other high-value recycling open-loops. To date, recycled fibre and fabrics made from PCT are priced higher, which is intimately related

to the higher costs required to process PCT. As the percentage of non-rewearables entering collection facilities continues to rise, further development of recycling technologies could spur the uptake of post-consumer textiles. In this regard, this may lead to economies of scale that will decrease price of recycled fibre.

4. Regulatory barriers

Although there are national and municipal policies in place tackling waste management procedures, such as the EU Waste Directives for separate textile collection by 2025[19], the lack of substantial legal framework for second-hand textiles and mandated policies for recycled textiles does not support the successful long-term implementation of technologies such as the Fibersort. Policy development such as the establishment of an Extended Producer Responsibility (EPR) approach for textiles throughout NWE countries, is recognised as a major area of improvement in the support towards the achievement of a circular textile industry. The only country that has implemented this approach so far is France[20], although countries such as the Netherlands[21] or the UK[22 23] are already looking into these opportunities. Other areas of support identified are related to tax incentives, dissemination and adoption of standards on recycled content and environmentally sound practices, and investment support for the private sector in order to achieve substantial change.

In addition, international trade law often acts as a barrier to the smooth flow of textiles, since import and export restrictions from production countries differ from each other. Regulatory differences between trading countries regarding chemical use and product safety also need to be assessed further to provide a feasible solution towards aligning the international flow of PCT with existing regulation.

Conclusions

This report outlines the main barriers which will impact the long term implementation of Fibersort technology. Main socio-cultural barriers are related to the current consumption and disposal practices, the negative perception towards recycled textiles derived from PCT as well as lack of urgency to address these issues. The consistency of input feedstock, the challenges related to the chemical and material requirements of the Fibersorted outputs and underdeveloped transportation and logistics are the main physical barriers that have to be addressed in the near future. Most relevant economic barriers are the current lack of demand, as well as the uncertain future demand from nascent recycling technologies. Further, a lack of legal frameworks and mandated policies such as EPR, tax incentives magnify the economic barriers for the long-term implementation of the technology as well as the uptake of recycled textiles. There is a need for investment support in the end-of-use value chain to enable substantial change. The Fibersort presents a technology-driven solution to support the shift towards a circular textiles industry. More extensive research reporting on key success factors, policy recommendations and case studies that demonstrate the Fibersort business case will be published in the coming months, building on the barriers identified in this study.

Stakeholders involved in the project will be the first to access this information. Your company insights and data can help develop future reports. It's not too late to become a stakeholder if you would like to participate. Want to help advance circular textiles by collaborating as a stakeholder?

Sign up **here** or visit **www.nweurope.eu/fibersort**

Endnotes

1. The research was supported by 46 participants (collectors, sorters, recyclers, brands, retailers, academic experts) which completed questionnaires in the form of surveys or interviews or participated of the Beyond Green Fibersort Workshop 2017 on the topic of the research. Within the scope of this project, participants remain anonymous and data was aggregated in order to present the general findings.
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6. Cultural and social perceptions are contextual, and therefore, it should be noted that this research is rooted in NWE, with the majority of stakeholders participating in surveys being from Europe. Therefore, it should be contemplated that research results may not be generalizable to any given context.
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16. Watson et al., 2018. Used Textile Collection in European Cities. Study commissioned by Rijkswaterstaat under the European Clothing Action Plan (ECAP)
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