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Increasing textile circulation—Consequences and requirements

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A B S T R A C T

The global textile fiber production, consumption of textiles and amounts of textile waste are constantly growing. The increase of textile waste has also been demonstrated in sorting studies performed for the municipal solid waste, where the share of textiles has grown. Ideally, recycling and, even more so, reusing textiles can reduce the production of new textiles from virgin materials and hence reduce the use of water, energy and chemicals in the production chain. The aim of the study was to ascertain the flows of textiles and textile waste currently in Finland and assess the environmental performance of the current system. In addition, the possible consequences of a significant increase in the reuse or recycling of discarded textiles were analyzed. Finally, an assessment on the policy measures available for increasing textile circulation was performed.

An account of the textiles and textile waste flows in Finland in 2012 showed that roughly 20% of discarded textiles were collected separately by charity organizations and directed mainly towards reuse. Only a few percent of the overall flow was recycled. The majority of the discarded textiles were collected in municipal solid waste (MSW) and incinerated with energy recovery. The life cycle assessment (LCA) of the current situation and two comparing scenarios showed that environmental benefits could be obtained by increasing the separate collection of discarded textiles and their reuse or recycling. The results were dominated by the benefits potentially obtained from compensating virgin textile production with reuse or recycling. However, it is not known how much textile reuse actually compensates virgin production, or whether it simply generates new markets and adds to the overall demand and consumption of textiles. Similarly, there are uncertainties about whether recycled fibers can replace virgin fibers due to the fact that chemical recycling processes are still being developed. Research and development activities are already in progress for increasing the circulation of textiles. While developing the textile chain it must be taken into account that the whole chain for collecting, sorting, separating and recovering needs to be developed simultaneously and the operations optimized in order to keep environmental impacts to a minimum.

Well-accepted voluntary producer responsibility could be one way to increase the collection of discarded textiles, but it requires the engagement of producers, operators and consumers. The use of recycling criteria in public procurements to enhance recycling requires an increase of recycled products in the market and advice for procurers.

Both increased reuse and increased recycling require major changes to the current system and the engagement of all operators of the textile chain.

Keywords: Textile; Textile waste; Reuse; Recovery; LCA; Policy measures

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1. Introduction

The global textile fiber production, consumption of textiles and the amount of textile waste are constantly growing. The global fiber production in 2013 was around 85.5 Mt, and by 2025 it is estimated to grow to 130 Mt (Yang Qin, 2014). In many European countries clothing has become cheaper over the past decade relative to many other consumer goods. Household spending on clothing in the EU-28 was 4.2% of the total household expenditure in 2012 (EEA, 2014) and 2.5% in Finland (Statistics Finland, 2012a). There are strong indications that Europeans today consume substantially more clothing than two decades ago (EEA, 2014). When household expenditure data are adjusted to reflect changes in the price of clothing, they indicate that the volume of EU-28 clothing purchases actually increased by 40% in the period 1996–2012 (EEA, 2014) and for Finland 26% (Statistics Finland, 2012a). The clothing consumption in Finland is smaller than in Europe and other Nordic countries, both in monetary and weight terms (e.g., Tojo et al., 2012). However, in Finland also the number of clothes that consumers own seems to have doubled since the 1990s (Aalto, 2014).

Reasons for the increase in consumption can be found in the changing consumption patterns of clothing such as fast-changing fashion (Niinimäki, 2011; Laitala, 2014). This has also been seen in e.g., the UK, where Defra (2007) concluded that increased clothing sales and rapid turnover of clothes had increased the amount of textile waste, with this trend expected to continue. The increase of textile waste has also been demonstrated in sorting studies performed for the municipal solid waste (MSW) produced within the Helsinki Metropolitan Area in Finland. The share of textiles in MSW was reported to have grown from 4%–6% in 2007 to 5%–8% in 2012 (HSY, 2013). On average, the share of textile waste in Finnish MSW is currently 5.8% (JLY, 2016). Currently, there are no specific targets for textile recycling, but increased textile recycling would help in reaching the recycling targets set for the MSW (currently 50% by 2020).

The consumption of clothing creates resource demands and environmental impacts at each life cycle stage of the textile production and consumption chain. The environmental impacts of textiles over the whole value chain are very case-specific and depend on the types and mix of fibers used and the associated production, use and disposal methods (EEA, 2014; van der Velden et al., 2014). van der Velden et al. (2014) concluded that the environmental burden of textile is not only a function of the base materials (cotton, polyester, nylon, acryl and elastane), but also of the thickness of the yarn and the textile fabric.

Cotton is associated with significant use of water and land resources, and application of pesticides and fertilizers. Synthetic fibers are often produced using non-renewable resources and toxic chemicals (Defra, 2011). The Swedish Chemicals Agency has identified more than 1900 chemicals used during the production of clothing. 165 of these are classified as hazardous to health or the environment in the EU (KEMI, 2013). The worst case – assessments of risks associated with chemicals in textiles by Assmuth et al. (2011) – showed that textiles can significantly affect hazardous substances flows and emissions in Finland. An assessment of life cycle impacts of textiles showed that the majority of toxic emissions and impacts were generated from the production phase (Assmuth et al., 2011). Assmuth et al. (2011) identified several approaches and instruments needed in order to manage and govern risks associated with chemicals in textiles. One of the instruments identified for the national level was increasing the recycling of textiles (Assmuth et al., 2011).

Ideally, recycling and, even more so, reuse of textiles can reduce the production of new textiles from virgin materials and hence reduce the use of water, energy and chemicals during the production chain. In addition, many risks associated with chemicals in textiles may be avoided by reducing superfluous consumption of textiles in the first place, especially those with unnecessarily dangerous chemicals (Assmuth et al., 2011). Currently, only one commercial company in Finland recycles textile waste into non-woven products, such as covering blankets, waddings, absorbing blankets, etc. Some of the worn-out clothes and textiles are recycled as raw material for cleaning rags by social organizations. Part of the textile waste is also converted to new textile products by ecodesign companies and small entrepreneurs (sewers) (Dahlbo et al., 2015).

The cradle-to-grave analysis from raw material extraction to discarded textiles by van der Velden et al. (2014) demonstrated that textiles made out of acryl and polyester have the least impact on the environment, followed by elastane, nylon and cotton. The use phase showed less relative impact than had been suggested in earlier literature (e.g., Steinberger et al., 2009).

However, in practice, due to their characteristics different fibers fit for different types of clothing, and hence the impacts from different uses, may vary. There are two main directions to reduce negative environmental impacts in the use phase: (1) to diminish the total amount of textiles by extending the lifespan of textiles and re-using the products, and (2) to reduce the consumption of energy, water and chemicals in laundering and drying the textiles (Fletcher, 2012; Laitala et al., 2015). Extending the lifespan of clothing can be achieved not only by increasing product durability through higher quality, but also by informing the consumers about the expected lifetime and by increasing product satisfaction (Niinimäki and Hassi, 2011). In addition, Laitala et al. (2015) concluded that besides the product features, consumer behavior is crucial both in acquiring the garments and in disposing of them. There are also indications that garments that were used longer were often better cared for (Fletcher, 2012).

In addition to extending the lifespan of textiles, the fashion industry is looking for solutions with which the short-life fashion can be maintained along with long-life fashion. The Mistra future fashion program considers how to best design materials and products which work with the current models for fashion consumption (Mistra future fashion, 2016). Radical ideas have been raised about making the short-life fashion ultrafast by designing light fabrics, e.g. paper-like fabrics, which one could wear just a few times. They would not be washed, so laundry impacts would not be created, and they could be recycled in the domestic paper-recycling (Hybrid talks, 2016). However, the overall environmental impacts of such fabrics and consumption patterns need to be assessed before introducing them to the market.

Governmental interventions are needed in order to create large-scale activities around textile waste recycling. According to a recent Nordic study (Watson et al., 2015), there is a need for well-functioning systems and business models to improve the reuse and recycling of textiles in

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