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May 2012

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Executive Summary

Textile is an indispensable element of human society throughout its history, and has been an important commodity traded globally over centuries. However, textiles exert various environmental impacts in their life cycle. In addition, the consumption of textile products has been growing over time, both globally and in Nordic countries. The increase in consumption has consequences both in terms of increased textile waste flows and in terms of the environmental impacts associated with production, use and end-of-life management of textiles. Prevention of textile waste is one angle to address these challenges.

This study, commissioned by the Waste Prevention group of the Nordic Council of Ministers, is conducted to enhance the concrete knowledge related to textile waste prevention in selected Nordic countries, which could be used for the development of effective policy measures for the enhancement of textile waste prevention.

The study looked into the following two questions:

1. What does the flow of textile products look like in three Nordic countries (Denmark, Finland and Sweden), from the time they are put on the market until their end-of-life?
2. What types of government interventions may be useful for the enhancement of textile waste prevention, with a focus on the possible application of interventions based on the concept of extended producer responsibility (EPR) in particular?

Among various types of textile products, this study focuses on clothes and home textile.

The study was carried out through collaboration of the following four organizations from four Nordic countries: Copenhagen Resource Institute (CRI), Denmark; National Consumer Research Centre (NCRC), Finland; Environice, Iceland and International Institute for Industrial Environmental Economics (IIIEE) at Lund University, Sweden. The study was primarily a desk-top study. In addition to review of various written sources, in total of 26 interviews in Denmark, Finland, Sweden and Japan were conducted.

The review of the flow of textile products in Denmark, Finland and Sweden reveal that the three countries share similar characteristics, although there are differences in details, as summarised below:

- Half of the textile products used by consumers (new products as well as second hand) are discarded as waste. The total amount in the three countries becomes close to 145,000 tonnes, and the vast majority of those discarded textiles are incinerated or landfilled
- Textile consumption has been increasing, , although it is only in Sweden that we have comparative information in quantity. In Sweden, the quantity of products put on the market increased by 40% from 2000 to 2009
- Charity organizations are the main entity in charge of collection of reusable textile products. Meanwhile, there have been growing interest among private consumers to reuse clothes in all three countries and these private transactions take place not only via charity organisations but increasingly via venues such as Internet and flea markets, without intermediate actors. However, there is no data regarding the magnitude of the exchange
- The estimated quantity of second-hand products is based on many assumptions. Despite the apparent activities carried out by charity activities, the information on the quantity of second-hand textile products (e.g. domestic purchase of second-hand products, the collection of used textile products by second-hand actors, and export of second-hand products) is somewhat unclear
- There are gaps between the total amount of textile used and those discarded and exported. In addition to a number of assumptions mentioned above, it may also have to do with the hoarding effects
- In all three countries there are institutional users as well as private users, although the amount of textile products going to the respective group of users is unclear
- In all three countries, the recycling of textile for purposes different from the original ones – such as industrial wipe used in mechanical workshops – takes place, although to a rather limited degree (negligible in Denmark and Sweden, and estimated to be 13% of the amount of textile products used in Finland). The high labour cost for sorting has been the main bottlenecks to increase this activity
- In both Denmark and Sweden, some recycling facilities for textile waste used to exist, but they have faded away over the years

- More than half of the textile products collected by second-hand actors are exported, but the flow of exported second-hand textile products is not well known

Existing government interventions that may have potential influence on textile waste prevention in the Nordic countries include the EU REACH Regulations on chemicals, the Stockholm Convention on Persistent Organic Pollutants and various labelling and certification schemes. The EU Waste Framework Directive and the EU Waste Shipment Regulation may also indirectly influence textile waste prevention. National policy measures identified outside of Nordic countries are extended producer responsibility (EPR) in France, and green public procurement legislation in Japan that includes the use of recycled materials and establishment of take-back system as part of the criteria.

Studies of existing EPR programmes for various products indicate that there exist a number of administrative, economic and informative instruments that can be used under an EPR programme. Based on the review of the textile flow in the three Nordic countries as well as the view of stakeholders, a total of 15 policy instruments which could be based on the concept of EPR are analysed in light of the two main goals of EPR policies – upstream improvements/waste prevention and downstream improvements. The latter – downstream improvements – is further divided into three sub-goals – effective collection, enhanced reuse and recycling, and environmentally sound treatment. For each policy instrument suggested, the typology of the instrument, the rationale for suggestion (including potential success factor) as well as issues that require careful consideration, are indicated. In addition, other policy measures that would facilitate the achievement of respective policy goals are discussed.

There are a number of areas where further studies are needed to fine-tune policy actions, such as:

- Quality and type of textiles currently discarded as waste in the Nordic countries: what are the proportions of reusable and non-reusable textile products respectively? Among the non-reusable yet recyclable textile products, what type of materials are there? What are the technological feasibility of sorting these materials?
- Cost benefit analysis of recycling the recyclables versus other means of treatment
- Paths and destinations for second-hand products that are exported

- Cost benefit analysis and life cycle analysis for various scenarios including the options of recycling outside of the Nordic countries: in analysing such scenarios, the potential social and economic impact on the recipient countries of second-hand products should be also considered

If the further research indicated above suggests that source separation and recycling in Nordic countries is environmentally beneficial, assigning responsibility for collection and recycling of textile waste to producers can be a policy option. In this case, in addition to the consideration that should be made with regard to existing initiatives (charity organisations and other legitimate actors on the second-hand market, individual producers who have established/will establish their own/alternative collection and recycling infrastructure), careful consideration should be made to ensure that producers receive some form of incentives in making upstream changes (= taking preventative measures). In addition, in case the responsibility for recycling is allocated to producers, means should be established so that municipalities do not hinder recycling of textile waste carried out by producers.

In terms of qualitative prevention, there exist a number of measures that have been in place or discussed. In case some qualitative standards are to be included in a prospective EPR program, synergy can be made with existing/discussed measures – such as harmonised EU legislation as proposed by Swedish Chemicals Agency or eco-labelling standards – by making reference to these measures. The Nordic countries can join forces in proposing such policy measures to the EU or in the international community.

In promoting second-hand products as well as enhancing recycling of textiles, the inclusion of second-hand products or recycled materials in the criteria for green public procurement can be considered. Setting up specific criteria for second-hand products and re-designed products, as found in the Swedish Good Environmental Choice label, can be further adopted in other eco-labelling schemes. Other economic and informative policy instruments (e.g. reduced VAT for mending service, information campaign for the availability of mending service and second-hand trade) can be used to encourage the prolongation of textile products' life.

1. Introduction

1.1 Background

Textile is an indispensable element of human society throughout its history. In addition to the maintenance of basic needs – protecting themselves from outside environment and maintaining necessary condition for survival –, human being have been using textile products as means of expressing their identities, wealth, power and the like and it has been an important commodity traded globally over centuries. As of 2008, the market of apparel, accessories and luxury goods generated 1,334.1 billion dollars in total worldwide (Research and Markets, 2009, as cited in Forum for the Future and Levis Strauss & Co., 2010).

Despite the significance and importance of textiles for human society, textiles also exert various environmental impacts in their life cycle. Existing studies indicate that most notable impacts occur during the use phase of textile products, as well as production process of both raw material and textile products, through the use of chemicals, water and energy (Naturvårdsverket, 1996; Chapman, 2010). The climate change impact during the use phase is equivalent to 2–3% of the total CO₂ emission in Sweden (Palm, 2011b). There are also other impacts during, for instance, the distribution phase (Olsson et al., 2009).

The consumption of textile products has been growing over time. The world, per capita, textile fibre consumption grew from 3.7 kg in 1950 to 11.1 kg in 2007 (FAO and ICAC, 2011). In recent years, per capita textile fibre consumption was increased by 35% between 2000 and 2007, from 8.8 kg to 11.1 kg (FAO and ICAC, 2011). Considering that the share of cotton have been falling while that of synthetic materials –which are lighter than cotton – have increased (FAO and ICAC, 2011), the consumption of textile per se is increasing even more. While the increase in recent years is greater in developing countries (20% between 2004 and 2007), the consumption is still increasing in developed countries as well (8% during the same period) (FAO and ICAC, 2011). In Sweden alone, the amount of clothes and home textile put on the market increased by

40% between 2000 and 2009 (Carlsson et al., 2011).¹ The increase in consumption has consequences both in terms of increased textile waste flows and in terms of the environmental impacts associated with production, use and end-of-life management of textiles.

Prevention of textile waste is one angle to address these challenges. Waste prevention refers to the reduction of both 1) quantity of waste as well as 2) the use of harmful substances in materials and products which pose qualitative problem at the end of their lives. Means to reduce the quantity of waste generation include, among others, prolongation of product's life as well as reuse.

The governments in Nordic countries have started to consider effective policy measures to address textile waste prevention. However, except for Sweden (see Carlsson et al., 2011), we do not have a good overview of the flow of textile products coming into the market of the respective countries and the subsequent fate of these products once they finish their first life under the first owner. Concerning the policy measures, many Nordic countries as well as other OECD countries have been using instruments based on the concept of extended producer responsibility (EPR) for waste prevention, increase of reuse/recycling and improved waste treatment of product groups such as packaging, cars, electrical and electronic equipment and batteries (Tojo, Lindhqvist and Davis, 2003).² The discussion on the application of EPR-based policy for textile started as early as mid 1990s (Naturvårdsverket, 1995). However, the Nordic countries have not applied EPR-based policy for textile in reality so far, and the experience elsewhere is also very limited.

1.2 Purpose and objectives of the study

The purpose of this study is to enhance the concrete knowledge related to textile waste prevention in selected Nordic countries, which could be used for the development of effective policy measures for the enhancement of textile waste prevention.

¹ The Swedish figure includes only clothes and home textile, while the global figures from the study of FAO and ICAC covers the use of all the apparel textile fibres including textiles for industrial uses and items such as furniture.

² The application of EPR concept is extended to non-OECD countries as well. See, for instance, Manomaivipool (2011).

The study is commissioned by the Waste Prevention group of the Nordic Council of Ministers. In accordance with their specification, the project team looks into the following two questions:

- What does the flow of textile products look like in three Nordic countries (Denmark, Finland and Sweden), from the time they are put on the market until their end-of-life?
- What types of government interventions may be useful for the enhancement of textile waste prevention, with a focus on the possible application of interventions based on the concept of extended producer responsibility (EPR) in particular?

1.3 Scope

Among various types of textile products, this study focuses on *clothes and home textile*. Concrete categories of products covered in this study are in line with the study of Swedish textile flow conducted by Carlsson et al. (2011).³ Items such as carpets and textiles which are integrated parts of other products, such as furniture, are not included in this study. However, some reference may be made when appropriate, especially in relation to policy discussions.

Regarding the material flow, *three Nordic countries – Denmark, Finland and Sweden* – are selected for the in-depth study. The study covers the flow of textile products from the time they are put on the market in the respective countries until their end-of-life. Material flow during the manufacturing process is beyond the scope of the study. Concerning the discussion on policy measures, examples of other countries are also included whenever relevant.

Various understandings exist for the terms reuse and recycling. Following the revised EC Waste Framework Directive (2008/98/EC), we use the following definitions for reuse and recycling.

Reuse: any operations by which products or components that are not waste are used again for the same purpose for which they were conceived (Article 3 Paragraph 13).

³ Items included are: 1) large garments, 2) trousers, 3) jackets, 4) dresses, costumes and skirts, 5) suits, 6) shirts and blouses, 7) underwear including socks and night clothes, 8) T-shirts, 9) sweaters, 10) baby clothes, 11) training and bathing suits, 12) gloves, hats, shawls, etc. 13) blankets, 14) bed sheets, 15) table clothes, curtains and bedspreads, 16) towels and 17) second-hand clothes and rags.

Recycling: any recovery operation by which waste materials are re-processed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations; (Article 3 Paragraph 17).

The analysis of the environmental impacts arising from the life cycle of textile products, as well as the comparison of environmental impacts between different measures (e.g. recycling versus incineration) is beyond the scope of this study.

1.4 Methodology

The study was primarily a desk-top study.

The study was carried out through collaboration of the following four organizations from four Nordic countries: Copenhagen Resource Institute (CRI), Denmark; National Consumer Research Centre (NCRC), Finland; Environice, Iceland and International Institute for Industrial Environmental Economics (IIIEE) at Lund University, Sweden. The duration of the study was 4.5 month (December 2011–April 2012) in which total of ca 4 and a half person-month was used.

The study of textile flow in Denmark and Finland followed the methodology used by Carlsson et al. (2011) for their study on the textile flow in Sweden. In addition to review of written sources such as statistics and existing studies, interviews to various actors such as personnel at statistical office, charity organizations, waste authorities, retailers, commercial second-hand shops, industry association and researchers were conducted to grasp the overall material flow of the two countries (see Appendix 9.1). Methodologies specific to the respective countries are found in Sections **Fejl! Henvisningskilde ikke fundet.** and **Fejl! Henvisningskilde ikke fundet.** respectively. Studies on the textile flow in Sweden have already been carried out in recent years. Thus instead of doing a new study, the knowledge in the existing studies are synthesized to describe the flow in Sweden.

Concerning government interventions, the study started with a review of existing studies on government interventions on waste prevention for textile sector, and industry's initiatives related to waste prevention in textile sector. In addition studies on the link between waste prevention and extended producer responsibility were reviewed.

In order to understand what types of policy instruments (EPR-based as well as non-EPR-based) and voluntary measures can be used to prevent the generation of textile waste, it is important to understand the views of the stakeholders who are working on/affected by such instruments/measures. We therefore conducted interviews with people from organizations such as material producers, producers of final products, charity organizations, waste management companies and policy makers such as material & garment manufacturers and retailers, second-hand dealers and waste authorities in the government regarding their view on the reuse and recycling of textile as well as qualitative waste prevention (e.g. elimination/reduction of harmful substances). Given the timeframe allocated to this study, the number of interviews was limited to 14. Except for one interview conducted in person, the rest of the interviews were conducted via telephone/Skype. Snowballing techniques were employed for the identification of interviewees. Similarly to the literature review, the study mainly covers actors in the Nordic countries. However, considering the characteristics of the industry with global supply chain, interviews were also carried out with actors outside of the Nordic countries (Japan and Canada). While the details of the questions were tailored for specific interviewees, they followed an interview guide covering three main areas: 1) content of textile waste prevention activities the organisation has been engaged in, 2) perception on textile waste prevention, 3) perception on government interventions pertaining to textile waste prevention, with specific focus on extended producer responsibility.

The study was supplemented by surveys and interviews of selected stakeholders conducted by 10 MSc students of Natural Science Department at Lund University as part of their course work on Strategic Environmental Development. The name of the students, the methods they used and stakeholder groups they covered are summarised in Appendix 9.1.

In order to ensure the incorporation of the view of stakeholders, a draft report was first sent to the Waste Prevention Group of the Nordic Council of Ministers (the commissioner of this report) for their review and comments. A more complete draft was subsequently circulated among 5 stakeholders representing waste management companies, textile industry, and academia from four Nordic countries (Denmark, Finland, Norway and Sweden, as listed in Appendix 9.3), as well as Stefán Gislason of Environice (Iceland) for their review and comments.

1.5 Structure of the report

Following this introductory chapter, Chapter 2 provides an overview of textile flow in Denmark, Finland and Sweden. Chapter 3 subsequently summarises the views of stakeholders on textile waste prevention and recycling identified and collected in this study. Chapter 4 covers a brief description of government interventions pertaining to textile waste prevention, and short discussion on extended producer responsibility (EPR) and its effectiveness in inducing upstream changes are discussed. This is followed by an analysis of potential and limitations for applying EPR-based policy measures in addressing textile waste prevention. The report ends with the synthesis of findings as well as suggestions for government officials and stakeholders.

2. Textile flow in three Nordic countries

In this chapter, the flow of clothes and home textile – from the moment they are put on the market to their end of life – in Denmark, Finland and Sweden are provided. Each section starts with a short description of the overall textile flow. It then provides synthesis of findings on the following issues: 1) quantity of textile products put on the market, 2) the collection and reuse of textile products and their destination, 3) textile waste treatment, 4) technologies used for recycling of textile waste.

2.1 Textile flow in Denmark

The flows from both households and business/public sectors are displayed in Figure 2.1 and Figure 2.2.

Households

Figure 2 1: Textile flows from Danish households

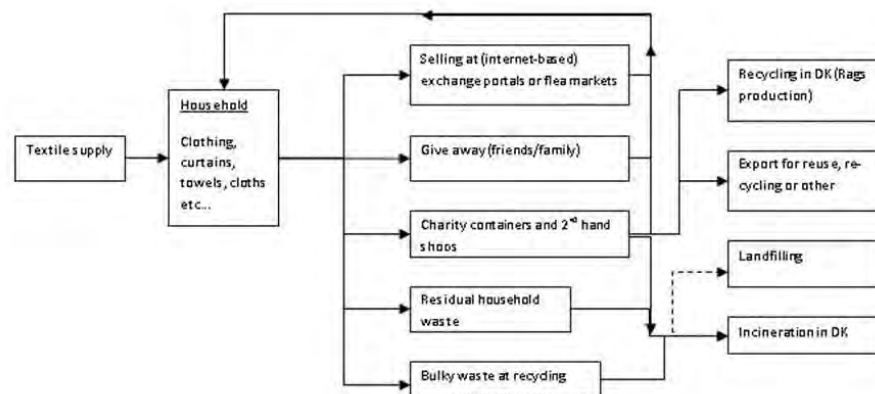
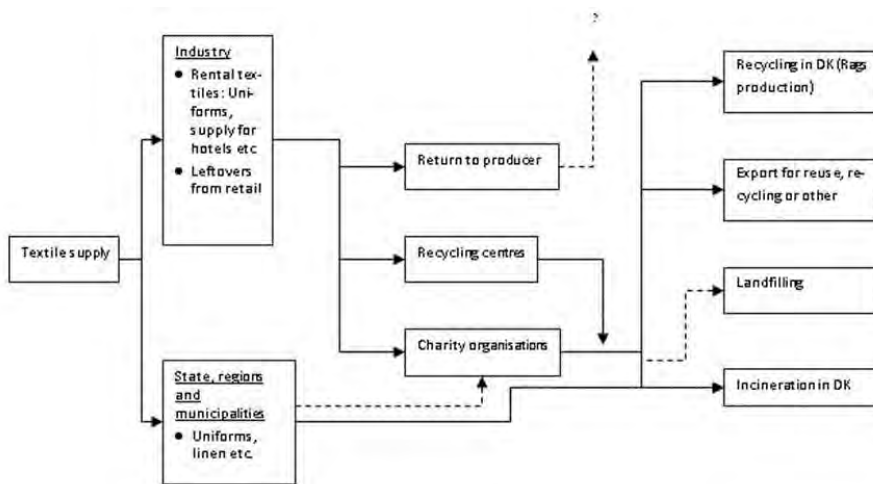


Figure 2.2 Textiles flows from the business and public sector in Denmark



2.2 Quantity of textile put on the market

The data of the Danish import, export and domestic production are derived from Danish Statistics. The overall methodology followed Carlsson et al. (2011). The numbers in Table 2.1 have been constructed by use of KN-numbers 61011010 to 63109000 with exception of a few which are out of scope for this project (like e.g. tents, airbeds, sails etc.).⁴ Some numbers are being reported in values or numbers (e.g. pairs) rather than weighs, and have therefore been converted into weighs based on Danish export numbers.

The domestic use of textiles in Denmark was circa 89,000 tonnes in 2010 or 16 kg/capita (see Table 2.1 and Table 2.2).

The group for second-hand clothes and rags shows a negative value, since the exports exceed the domestic production plus imports. A large part of the textile waste is not caught in the statistics on the supply side as part of the domestic production, since it is collected without any marketed (monetary) transaction. The flows of textile waste will be described in further detail below. Close to 14 % of all exports are used clothing.

According to estimations in a report by the Danish EPA (Miljøstyrelsen) approximately 13 kg of clothing textile per capita were supplied in 1996 (MST, 2000). This number can not be directly compared to the 16 kg per capita in 2010 which are displayed in Table 2.2, since some addi-

⁴ The KN-no. are a combined set of nomenclature which meets EU's standards for the statistics of foreign trade.

tional household textiles are included in the 16 kg. It should however be expected that the numbers from 2010 would be larger since consumer spending on fabrics and clothing, on average, have increased by close to 62 %⁵ from 2003 to 2008.

Table 2.1: The supply and use of textiles in Denmark in 2010 based on data from Statistic Denmark (in t)

Categories	Import	Domestic prod	Export	Domestic use
Large garment (gowns, coats, jackets, raingears)	16,724	291	10,755	6,260
Trousers	36,633	1,138	21,008	16,763
Jackets	1,936	100	1,225	811
Dresses, costumes and skirts	11,954	363	7,619	4,698
Suits	1,910	630	1,088	1,452
Shirts and blouses	15,664	165	9,738	6,091
Underwear including socks and night clothes	13,738	365	6,490	7,613
T-shirts	21,407	313	11,366	10,354
Sweaters	22,144	128	15,545	6,727
Baby clothes	3,375	201	1,535	2,041
Training and bathing suits	6,410	1,728	4,032	4,107
Gloves, hats, shawls, etc,	5,235	47	2,943	2,339
Blankets	2,196	94	1,149	1,141
Bed sheets	10,411	6	5,252	5,166
Table clothes, curtains, bedspreads	12,340	2,607	4,668	10,280
Towels	4,938	0	1,745	3,193
Second-hand clothes, rags	353	57	17,261	-16,851
Total (including second-hand clothes, rags)	187,367	8,235	123,420	72,182
Total (excluding second-hand clothes, rags)	187,015	8,178	106,159	89,034

Note: The domestic use is calculated as (import + domestic production – exports)

Table 2.2: Domestic use of textiles in Denmark in 2010 (kg per capita)

Categories	Domestic use
Large garment (gowns, coats, jackets, raingears)	1.1
Trousers	3.0
Jackets	0.1
Dresses, costumes and skirts	0.8
Suits	0.3
Shirts and blouses	1.1
Underwear including socks and night clothes	1.4
T-shirts	1.9
Sweaters	1.2
Baby clothes	0.4
Training and bathing suits	0.7
Gloves, hats, shawls, etc.	0.4
Blankets	0.2
Bed sheets	0.9
Table clothes, curtains, bedspreads	1.8
Towels	0.6
Second-hand clothes, rags	-3.0
Total (including second-hand clothes, rags)	13.0
Total (excluding second-hand clothes, rags)	16.0

⁵ Based on the expenditure groups (forbrugsart) 3111, 3121, 3122, 3123 and 3131 in statistikbanken.dk <http://statistikbanken.dk/FU5>

The larger proportion of the net flow of textiles in Denmark is a result of imports since domestic production is quite low. The main domestic production consists of pants, exercise- and bathing clothes as well as tablecloths, curtains and the like.

2.2.1 *The Business and Public Sectors*

A large proportion of the textiles within businesses and the public sectors are treated by business laundries. This includes towels, linen and uniforms for hotels, hospitals, care homes etc., but also uniforms from manufacturing industries are widely treated by the business laundries. In 2008 there were 77 units in the industry which consists of two market leaders, a handful of national or regional entities and a number of smaller laundries throughout the country (BVT, 2011). Half of the revenue covers public institutions and the service sectors and close to one third covers laundry from manufacturing.

However, it has not been possible to estimate the supply of textiles for the households, businesses and the public sector.

2.3 Reuse of textile and their destination

The following estimates on the quantities of collected and nationally reused textiles are partially based on personal phone interviews and e-mail correspondence. The status and activities of the used clothing sector is currently not well mapped out and information tends to be undisclosed, which is why the numbers and preliminary conclusions are to be interpreted with caution.

2.3.1 *Quantity of textile collected for reuse*

The reuse sector for textiles in Denmark is dominated by collection by NGOs and one single private actor. The main purpose for the NGOs is to provide cheap clothes for the needy and to raise funds for general NGO work. What happens to the clothing after collection is highly dependent of the overall "business idea" and on the quality of the collected clothing. A few municipalities also run kerbside collection of clothing suitable for reuse (Affaldgenbrug 2012).

In Denmark it is estimated that the total collection of used textiles is around 35,000 tonnes per year (Hove, 2011), but this estimate could be overstated (Trasborg, 2011). Up until around 2008 there have been in-

creasing amounts of clothes discarded for reuse or recycling, which might have to do with the fact that clothes have become cheaper, that the quality has lowered and that fashion changes ever faster. It is however a general impression in the sector that the total quantities have been decreasing since 2009.

The four main collectors are humanitarian organisations Røde Kors, Frelsens Hær and UFF together with private actor Trasborg. They are supplemented by a number of smaller actors, mainly NGO's. The used garments are first of all collected via publicly accessible containers and via second-hand shops.

Trasborg is the main private actor within the industry of used clothing and is considered the largest collector, in terms of having the most containers. Trasborg estimates to collect around 8,000 tonnes of used garments per year (Trasborg, 2011). Frelsens Hær estimates to collect between 7 and 8,000 tonnes of which the main part is exported (Frelsens Hær, 2012). Røde Kors estimates to collect around 6,000 tonnes per year, via their containers and second-hand shops (Hove, 2011). UFF claims to collect around 1,200 tonnes (UFF, 2010). The numbers stated above leaves close to 12,000 tonnes for the remaining actors in order to confirm the estimate of 35,000 tonnes, which should be a fair estimate.

According to Erik Hove, head of the recycling section in Røde Kors, 10 percent of their collected 6,000 tonnes is garbage (being either useless clothes or outright waste), which is discarded and sent for incineration (which means that the organisation incurs the cost of the incineration fees for this waste). This tendency is confirmed by Indre Mission and five other church organisations which all recognise the problem of receiving waste in their containers, thus resulting in having to pay incineration fees (Politiken, 2012). The problem appears to be less common for the organisations that only have collection via their second-hand shops.

Kirkens Korshær recently announced that they discard around 450 tonnes of reused clothes for incineration. They have chosen to focus on aid in Denmark and it has therefore up until now not been an option for them to sell or give away the remaining for foreign buyers or aid projects abroad, despite the fact that some of these clothes are new and well functioning (Kristeligt Dagblad, 2012).

According to Steen Trasborg approximately 65% of the collected clothes can be reused or recycling in some form, whereas the remaining 35% is disposed for incineration. Thus, there appears to be a higher reuse rate for the NGO's than for the private actor.

2.3.2 Quantity of textile reused within the country

When focusing on the national reuse it is necessary to distinguish between the various sectors, since behaviour within them are quite diverse. In the following consumers are thus separated from businesses and public sectors.

Consumers

In Denmark there is an increasing focus on reuse of clothing, interior, toys, electronics and other objects. Some amounts are being reused informally by passing on used clothes to friends and family – especially children’s clothes. There are however no data on these amounts. During the past few years Danish online-based marketplaces for used goods have experienced a boom in terms of both users and items for sale. From 2009 to 2010 the number of visitors in one of the three most popular marketplaces “Gul og Gratis” rose with 15%, corresponding to 100,000 visitors per day (Politiken, 2010). In general the online sale from one private person to the other has risen from 2008 to 2010 by 24 percent (Politiken, 2010a).

Trendsales is the single most visited online clothing marketplace in Denmark. In 2008 Trendsales facilitated sales of children’s clothes alone for 59 million kroner, and in 2010 the number exceeded 78 million kroner. In January 2012 almost 600,000 users offered for sale more than 700,000 used and unused garments (Trendsales, 2012).

“Den Blå Avis” was the first online marketplace for buying and selling private possessions in Denmark. According to head of communication in “Den Blå Avis” Simon Karsø, there were 1,072,000 trades of clothing via “Den Blå Avis” in 2011. 46% of these were women’s clothes, 43% were children’s clothes and finally 11% were men’s clothes.

Luxury second-hand shops are also becoming very popular, thus popping up all over the country, especially in the larger cities. Unused or close-to-new clothing from expensive and luxurious brands are taken in on consignment and sold at prices which are more affordable for the “average” Danes.

The same tendency appears when looking at flea markets where both clothing and other objects are sold. “Markedsbogen” which is an online directory over all flea markets in Denmark had 70-80,000 visitors per month in 2010 which is an increase by 50 % from 2009 (Politiken, 2010b).

The tendency within private reuse thus seems to be increasing but it is very difficult to estimate any specific data on the amounts hereof. In UK there have been attempts to estimate the amounts of reuse of t-shirts and woollen jumpers, and it has been estimated that 21% of total input is sent for reuse (Oakdene Hollins, 2009). It has further been estimated

which proportions are sent to charity shops, free exchange and paid exchange respectively. These data has been based on estimates from a Swedish NGO (Farrant, 2008).

On top of the private market for reuse of clothing, a smaller fraction of the clothing which is collected in containers and second-hand shops are reused nationally. According to Erik Hove, between 8 and 10 percent of the formally collected textiles are useful for this purpose, and are thus sorted out for selling in the 2nd hand shops and via NGO websites. A rough estimate is therefore that around 2,500–3,000 tonnes of all formally collected clothes is circulated back into the Danish market for reuse.

Business and Public Sector

There seems to be no direct reuse of textiles from business laundries, which serves a large proportion of the businesses and public sectors with working clothes, linen etc. (BVT, 2012). Within the clothing industry there is both waste created in the production and in the retail phase. The textiles from retailing could however be significant, but are close to impossible to determine since brands and retailers tend not to want to reveal this type of information. In Denmark retailers and producers will have to pay full VAT of all donations to charity. This has closed down the FashionAid project (P4, 2011). A Norwegian thesis has however attempted to map out some general trends, and was carried through by surveying 9 different anonymous retail chains of which 7 are internationally represented. The thesis suggests that there is only a very limited amount of clothing which is not sold since most clothing is sold if only they're priced low enough. The larger amounts of waste appear from the number of returned and faulty clothing, which appears to be a significant amount of clothing (Klavenes, 2004).

In conclusion, it has become clear that more data will be needed in order to create a proper estimate of the amounts of reuse in Denmark.

2.3.3 Quantity of textile exported for reuse

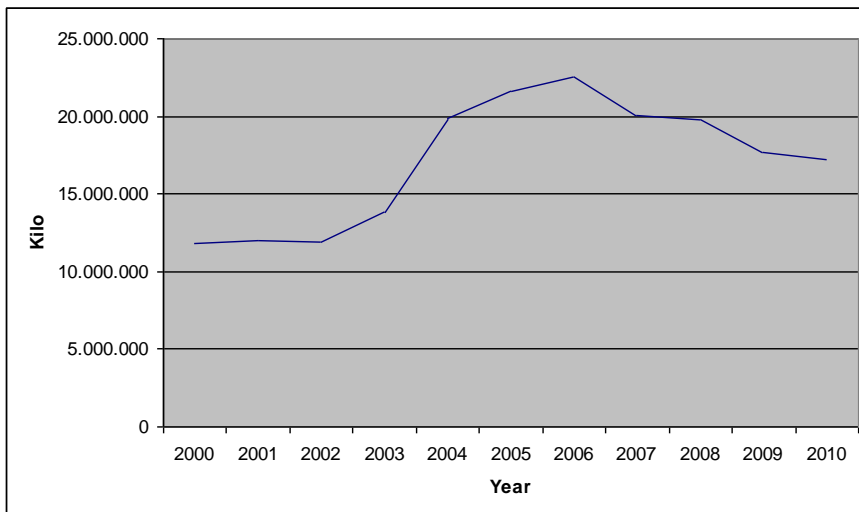
According to Danish Statistics, the export of used garments⁶ was close to 17,000 tonnes in 2010 (see Figure 2.3).⁷ The export statistics only covers "paid" flows which mean that the export performed by charity organisa-

⁶ Based on the KN-numbers 63090000, 63101010, 63101030, 63101090 and 63109000

⁷ These statistics are based on reports from Danish companies with total annual imports or exports by 3.6 mio and 4.8 mio in 2010. This threshold is set annually in order to ensure coverage of 95 and 97 percent respectively.

tions, therefore is assumed not be included in these statistics. It has however not been determined who, in addition to Trاسبorg, carries through these registered exports.

Figure 2.3: Danish export of used garments



Source: statistikbanken.dk (statistikbanken.dk/KN8Y)

The amount of exported used garments rose significantly from 2003 to 2007 but has since then been slightly decreasing. Over the full period from 2000 to 2010 the export has however risen by almost 46%.

According to the Danish export statistics the majority of exported used clothing is sent to European countries. 25% of the used clothing (KN-number 63090000) is exported for Poland, 18% goes to Germany, 16% is sent for Belgium, 13% goes to Bulgaria and 7% to Lithuania. The remaining 20% is spread throughout the rest of the world (statistikbanken.dk/KN8Y).

According to Erik Hove, 80 % of the used clothes collected by Røde Kors are exported (Hove, 2011). It varies to what extent the textiles are being reused or recycled when they reach the export market. According to Erik Hove around 50% of their exports are directly reused whereas the other half is split into recycling for cleaning cloths, new threads and yarns, synthetic felt and incineration (Hove, 2011). The collections from Trاسبorg are perceived to be exported solely for reuse. The variations should however be connected with the fact that Trاسبorg’s first sorting discards considerably larger amounts of textiles, than that of the NGO’s.

Table 2.3 summarises the numbers collected so far in this section. These numbers are backed up by the estimates provided on the website genbrugersagen.dk.

Table 2.3: Summary of estimated numbers of collection, reuse, exports and incineration that go through second-hand market actors in Denmark (in tonnes)

	Collection	Reuse (DK)	Export	Incineration
Non-market:				
Røde Kors	6,000	600	4,800	600
Frelsens Hær	8,000	800	6,400*	800
UFF	1,200	-	1,080	120
Others	12,000	1,200**	8,400***	2,400****
Consumer to consumer		?		?
Market:				
Trasborg	8,000	-	5,200	2,800
Total (rounded)	35,000	2,600	26,000	6,700

* 80% of total collections, based on Røde Kors estimate

** 10% of total collections, based on Røde Kors estimate

*** 70% of total collections, based on export estimates from other organisations

**** 20% of total collections, calculated as an residual measure

2.4 Textile waste treatment

2.4.1 Quantity of textile waste recycled

Very small amounts of textiles are recycled in Denmark. A few places are cutting textiles in pieces and sell them as industrial wipes. The municipality of Haderslev runs this activity as a social project (Haderslev kommune 2012). The amount textiles cut into industrial wipes have decreased from 300–400 tonnes per year to around 60–80 tonnes per year in the recent years mainly due to the lack of manpower (Percula 2012).

Another small fraction of the used textiles which aren't suitable for direct reuse are sorted, cut and prepared for use as cleaning cloths. In Esbjerg Frelsens Hær Genbrug has a centre for this process. Frelsens Hær has to use up to 30,000 DKK on incineration fees per month in Esbjerg alone, in order to get rid of the textiles which are not suitable for reuse. The cloth production is therefore a win-win situation in terms of both saving money for the organisation, creating jobs for people who're having difficulties filling in other positions in the job market and in terms of creating less waste. The centre in Esbjerg sells around 500 kilos of cloths per month (Jydske Vestsyksten, 2008), equalling to 6 tonnes per year. However, the cloth production was closed down in 2011 (Kjærtan 2012)

A number of designers are redesigning used clothes; however the total amounts are small. An example is using worn out textiles from indus-

trial laundries. The company *Re: something* wants to break with the current consumer culture by turning waste into high-end fashion and other cutting edge designs (Re: something, 2012, see Figure 2.4.)

Figure 2.4: Bags – recycled tea towels and table cloth (Re: Something 2012)



Source: Re: Something www.amvictoria.dk/RESO23.html

The trade organization for laundry and textile cleaning (BVT), estimate that around 80–100 tonnes of used textiles are re-sold as cloths in Denmark. These textiles mainly consist of cotton or mixed textiles like cotton/polyester (BVT, 2012).

2.4.2 Quantity of textile waste incinerated

A number of different pathways exist for textile waste for incineration.

Textile waste in residual waste from households

In a study from 2003 the sorting analyses showed that the amount of textile in the residual waste was 8.8 kg per household per year for one family houses and 3.6 kg per year per household in multi-occupancy houses. Estimation of total amounts resulted in 13,600 tonnes for one

family houses and 3,700 for multi-occupancy houses in total about 17,300 tonnes (Miljøstyrelsen, 2003).

The number of samples sorted is very few and the results have to be taken with caution. An estimate of 17,300 tonnes will be used as the best guess for textile in the residual waste. However, the amount might have increased due to the extra money spend on clothes in the last years (see section 2.2).

Textile in bulky waste from households

It is difficult to estimate the amount of textiles in the bulky waste. An older study from 2004 sorted out a few containers of combustible waste at a Danish recycling centre. The result indicated that the amount of textiles were below 1 % of the weight. (Miljøstyrelsen 2004). It was estimated that 10% of the textiles was suitable for reuse. The amount of black plastic sacks with textiles was very low in the containers.

The amount of bulky waste from households was in 2007–2009 in average 697,000 tonnes (Miljøstyrelsen 2011). If 1% of these were textiles the amount for incineration was about 6,970 tonnes.

Textile waste from sorting of clothes for reuse schemes

As found in Table 2.3 it is estimated that 6,700 tonnes of textiles from the reuse schemes are incinerated per year.

Textile waste from industrial waste

A small fraction is discarded for incineration from the laundries if it is not suitable for re-use (mainly polyester textiles which are worn out). This amount is estimated to be around 12 tonnes per year (BVT, 2012).

2.4.3 Quantity of textile waste landfilled

The quantity of textile waste land filled is very low in Denmark. Combustible waste has to be incinerated according to the regulation on waste (Statutory order on waste 2011 article 46). This regulation was implemented in 1997. The amount of textiles landfilled is not considered relevant in the estimation of waste treatments of textiles in Denmark.

2.4.4 Conclusion on the waste treatment

The main waste treatment of textiles in Denmark is incineration. Adding up the estimates from subsection on “Quality of textile waste incinerated” with the estimate of textile sent to incineration from second-hand shops (Table 2.3), it adds up to around 31,000 tonnes. Recycling is very low (below 200 tonnes) and landfilling is considered to be zero.

2.5 Technology used for recycling of textile waste

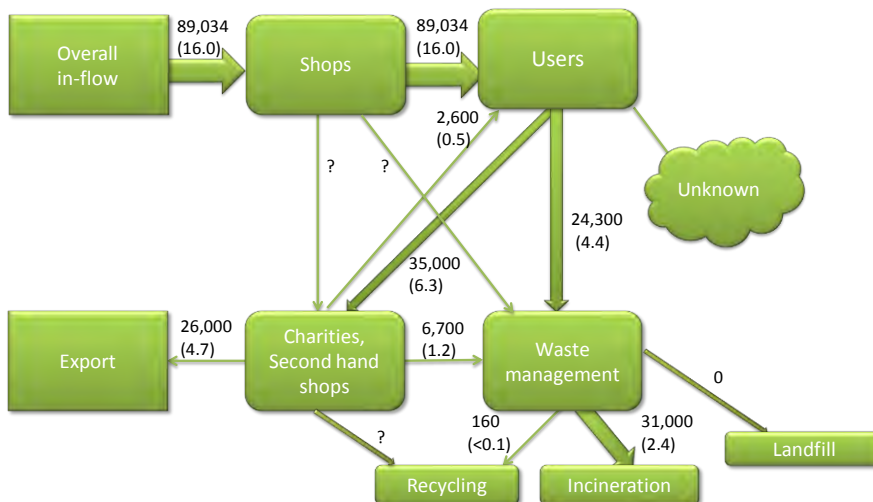
Except for the cutting of rags and a few designers selling redesigned clothes there is no recycling of textiles in Denmark. No facilities for industrial scale recycling are currently available in Denmark. However, a Danish project on technology gaps in recycling is to cover textiles in 2012 (Innovationsnetværk for miljøteknologi 2012).

2.6 Summary of the Danish textile flow in 2010

Figure 2.5 summarises the textile flow in Denmark, based on various estimated figures found in this section. The figure of total textile flow is in tonnes (the upper number) and kilograms per inhabitant are shown in parenthesis.

As has been highlighted throughout this section, there is a need for additional and more reliable data in order to draw final conclusions on the Danish textile flows. A few more assumptions could be made in analyzing the overall flow, on issues such as the increase in the textile waste in residual waste as well as a so-called hoarding effect. Although they are not included in Figure 2.5, we provide a summary of such assumptions in Appendix 9.4.

Figure 2.5: Estimated textile flow in Denmark, 2010



2.7 Textile flow in Finland

The textile flows from both households and business/public sector in Finland are very much similar to those in Denmark (see Figures in Section 2.1). The most remarkable difference is that on the contrary to Denmark most of the textiles ending up into waste are landfilled in Finland and only very little waste is incinerated.

2.8 Quantity of textile put on the market

The data of Finnish import and export is derived from statistics of National Board of Customs⁸ and domestic production data is derived from Statistics Finland.⁹ Both of the data are from 2010. The statistics of Customs include data in kilograms, whereas, the production data of clothes are in number of items. Only the household textiles are in kilograms. The number of items was converted into kilograms by multiplying the number by its average weight. The averages weights given in SMED Rapport (Carlsson et al. 2011) were used as much as possible. When there were no corresponding figures, the average weight was counted from the import-export data. The overall methodology follows Carlsson et al. (2011).

Most of the textiles is imported, because domestic production is fairly low. In Finland, there were only 1867 enterprises in the clothing sector 2010 and they employed 5865 persons. Most of the enterprises were small. According to official statistics, 91% of the enterprises have less than 5 employees and only 2% of them have more than 20 (Statistics Finland 2012).

Textile import was in total 76,500 tonnes and domestic production was close to 2,400 tonnes. The yearly export was approximately 14,150 tonnes. Second-hand clothes and rags made up to 44% of the export. The annual net inflow (domestic use) of textiles was about 64,720 tonnes; i.e. about 12 kilograms per person.¹⁰ When second-hand clothes and rags were excluded, the textile inflow per person was about 13 kilograms (see Table 2.4 and Table 2.5). A part of the textiles was used in public and private sector as uniforms, and hotels, hospitals, etc. also use a great

⁸ Foreign trade: Tullihallituksen ulkomaankauppatilastot (Ultika-tietokanta <http://uljas.tulli.fi/>)

⁹ Statistics Finland. (2010a) Domestic production, StatFin-tietokanta
h+B3http://pxweb2.stat.fi/database/StatFin/databasetree_fi.asp

¹⁰ Finnish population in 2010 was 5375276.

amount of towels and linen. The total amount of textiles used in business and public sector is not known.

Table 2.4: The supply and use of textiles in Finland in 2010 (in tonnes)

Categories	Import	Domestic production	Export	Domestic use
Large garment (gowns, coats, jackets, raingears)	8,367	14	2,142	6239
Trousers	9,492	230	890	8833
Jackets	756	131	150	737
Dresses, costumes and skirts	2,013	47	192	1867
Suits	1,107	13	162	959
Shirts and blouses	8,934	35	832	8137
Underwear including socks and night clothes	8,100	1,209	719	8590
T-shirts	6,428	51	404	6076
Sweaters	5,684	99	529	5255
Baby clothes	1,261	12	66	1207
Training and bathing suits	3,021	82	655	242
Gloves, hats, shawls, etc.	2,692	35	423	2305
Blankets	1,001	1	48	954
Bed sheets	6,632	86	175	6543
Table clothes, curtains, bedspreads	7,256	297	351	7203
Towels	3,010	39	159	2,890
Second-hand clothes, rags	737	0	6,227	-5,490
Total (including second-hand clothes, rags)	76,492	2,382	14,152	64,722
Total (excluding second-hand clothes, rags)	75,755	2,382	7,925	70,212

Note: The domestic use is calculated as: (import + domestic production – exports).

Table 2.5: Domestic use of textiles in Finland in 2010 (kg per capita)

Categories	Domestic use
Large garment (gowns, coats, jackets, raingears)	1.2
Trousers	1.6
Jackets	0.1
Dresses, costumes and skirts	0.3
Suits	0.2
Shirts and blouses	1.5
Underwear including socks and night clothes	1.6
T-shirts	1.1
Sweaters	1.0
Baby clothes	0.2
Training and bathing suits	0.5
Gloves, hats, shawls, etc.	0.4
Blankets	0.2
Bed sheets	1.2
Table clothes, curtains, bedspreads	1.3
Towels	0.5
Second-hand clothes, rags	-1.0
Total (including second-hand clothes, rags)	12.0
Total (excluding second-hand clothes, rags)	13.1

No trend data on the amount of textiles in kilograms exists. However, we can assume that the volume of textiles has increased since 2000, because the monetary value of clothing and textile import has increased, while the export has remained stable during the period. The increase in textile trade has been quite modest when the turnover and changes in the price

index are considered.¹¹ Also, consumption expenditure on clothes and household textiles had increased about 35% from 2001 to 2006 according to the latest national Household Budget Surveys compiled by Statistics Finland, which also indicates increase in textile inflow.

2.8.1 Reuse of textile and their destination

There is no nationally organized textile waste collection, nor systematic statistics about it. NGOs have containers around the country (in total more than 1700) for discarded textiles. People can also bring their discarded clothes and textiles into second-hand shops and recycling centres. NGOs and some small enterprises arrange campaigns to collect the textiles from people's homes. The textiles are usually sorted into reusable clothes, recycled material for industrial wipes, material for mechanically torn fibres for e.g. non-woven products, paper or yarn and thread. The material is very seldom used for chemical recycling.

NGOs and charity organizations (the biggest ones: UFF,¹² Red Cross, Fida International, Salvation Army) have their own containers for clothes and campaigns to collect textiles. Most of them sell reusable clothes in their second-hand shops and some clothes and household textiles are donated in Finland and some sent abroad. The rest is usually sorted into two categories: waste and material for recycling. Many local recycling centres also collect and sell the end-of-life textiles. Some of the recycling centres alter, or design and make new products of the clothes and textiles. A couple of small enterprises, handicraftsmen and artisans use the textile material in their production. Sorting the textiles into suitable sections is the biggest problem in the reuse of textiles, since the material has to be as homogenous as possible for the reclamation of end-of-life products (e.g. Hinkkala 2011; Malkki 2005; Räsänen 2007, 2011). The sorting is mostly done by volunteers or by social firms, which integrate people into working life. Besides sorting is toilsome and actors are few, effective logistic is needed to deliver reusable material to its users..

Whole sale trade and retail trade generate very little textile waste. They sell as much as possible of the clothes to consumers, first at normal price then on sale reducing the price gradually (e.g. 20%, 50%, 70% discount) and very few products are left unsold. In special cases the

¹¹ e.g. www.finatex.fi "Textile and clothing industry statistics"

¹² U-lands hjälp från folk till folk i Finland rf

clothes can even be returned to fabricants/producers. Most of the textiles left unsold are donated to charity organizations. Only rarely (e.g. musty clothes) some individual products end up into mixed waste (Räsänen 2007). The same information was given by the largest retail trade chains (Kesko and S Group), in phone interviews. They also informed that the amount of textile waste is so small that they do not have any statistics of it.

2.8.2 *Quantity of textile collected for reuse*

Hinkkala (2011) interviewed in her study many stakeholders about the discarded textiles and how those are reused and recycled. She found that the biggest textile collectors are, Red Cross (11,000 tonnes) and UFF (8,100 tonnes), and the other humanitarian organizations and private collectors collect in total about 6,000 tonnes discarded textiles. According to UFF's own statistics in their webpage, they have about 1400 containers in 109 municipalities almost all over the country, excluding the northern parts. Every inhabitant in these areas has donated on average 2.4 kg of textiles to UFF in 2010. Hinkkala (2011) estimated that the NGOs and other collectors collect yearly in total 25,000 tonnes textiles, i.e. about 4.65 kg per inhabitant. UFF has reported on its website that 13% of donated textiles are rags and waste. Using the 13% as the estimate of waste, the amount of waste of the separately collected textiles was 3,350 tonnes.

2.8.3 *Quantity of textile reused within the country*

The amount of reused and recycled textiles is very difficult to estimate, because the sorting system and criteria of the organizations varies. Hinkkala (2011) estimated that half of the discarded textiles (about 13,000 tonnes) can be reused and those are sold in organizations' own second-hand shops or exported. According to statistics, 6,227 tonnes of second-hand clothes and rags are exported. This gives a reason to estimate that 7,000 tonnes (1.4 kg per capita) is reused in Finland. When also the waste (13%) is deducted, that leaves the amount of material to recycling about 8,500 tonnes of the separately collected textiles. The division between reuse, waste and recycling is uncertain.

Worn out clothes and textiles can be recycled as raw material for cleaning rags for industries. The staff of social companies tears up the textiles mechanically (e.g. EkoCenter JykaTuote in Jyväskylä area). They do not weight the textiles they use. Local recycle centres also recycle and

alter textiles, besides, some of them design new products (e.g. Metropolitan recycle centre, EloKuopio, Ajastaikaa Kajaani, Luotsi-säätiö Hämeenlinna) (Hinkkala 2011, Räsänen 2011). A part of the recycled textiles is mechanically torn with special machines to make fibres. The only commercial firm in Finland using recycled textile material is Dafecor Oy. It gets the material from industry and from small enterprises, and also, Red Cross delivers sorted cotton to Dafecor. They produce new products of recycled material (e.g. many kinds of nonwoven products for absorbing liquids, covering blankets, industrial wipes and wadding).

The reclamation of end-of-life textile products is very rare in Finland. However, there are some handicraftsmen and artisans, who modify clothes and make new products of discarded textiles. The most famous firms whose production is based on discarded textiles are Globe Hope, Secco and Mereija (e.g. Hinkkala 2011, Räsänen 2007, 2011). All of them are small and their total production is so far low. They use both end-of-life textiles from consumers and clothes and textiles from business and public sector (e.g. uniforms, linen, and towels from textile renting companies and discarded textiles of the army). They usually need textiles of fairly good quality and homogenous material. Acquiring usable material for their production is thus a fairly toilsome task. The amount of end-of-life textiles that they use yearly is unknown.

Most consumers give their clothes after primary use to their friends or charity organizations, or sell them at flea market or via internet. Unfortunately no quantitative data exists on this. Wrangéll (1997) made a survey in her master's thesis asking consumers where they put their discarded textiles. She got replies from 112 consumers aged 12–74 (80% aged 18–50). Her survey revealed that very little textiles end up into waste after their primary use, whereas, most of those were reused. About 60% of children's wear and 15% of adults' wear was given to a friend, and comparably 10% and 20% were donated to a charity organization. About 13% of children's wear and 20% of adults' wear was sold at flea-markets. About 20% of the adults' clothes were left after primary use in one's own passive storage, and for one's own use as sportswear or casual home wear. Comparably, about 70% of worn out bed linen and towels were reused at one's own household (e.g. cleaning cloth) and most of the rest was left in one's passive storage. Half of the discarded table linen, curtains, and bed covers were left in one's own passive storage, 25% was given or sold to someone else, and 20% was recycled as raw material. The typical useful life of both adults' wear (about 50%) and household textiles (about 35%) was 5–10 years (Wrangéll 1997.)

Nowadays the quality of textiles seems worse than before, so the typical useful life has likely become shorter.

Flea markets are fairly popular in Finland. For instance, about 8 % of households sold and 24 % bought (in total 800 000 households) items at flea markets in 2006 (Nurmela, 2008). The bigger the household is, the more active the inhabitants are at flea markets (Nurmela 2008). Those figures include both clothes and all other items. Until the 1980s flea markets were usually managed by charity organizations and after that most of them are market places for private citizens who can sell their goods there. Like flea markets, second-hand shops have also been popular since the regression in the 1990s. We have not been able to find a comprehensive statistics on the second-hand sector in Finland, thus it is quite difficult to get an overview for the second-hand sector of clothing and household textiles. However, many studies, such as Jarva (2007), show that consumers are very interested in the second-hand sector.

Based on Wrangéll's study (1997) we can estimate that consumers give or sell to other consumers approximately the same amount of textiles that they donate to NGOs, i.e. about 25,000 tonnes of textiles (4.7 kg/person). Only less than 5% of clothes and less than 7% of the household textiles are thrown into waste after their primary use (Wrangéll 1997).

2.8.4 Quantity of textile sent elsewhere for reuse

Export of second-hand clothes and rags was 6,227 tonnes and import was 737 tonnes, so their net export was approximately 5,500 tonnes. In addition to that, there might be small private actors who export and donate second-hand clothes abroad.

2.9 Textile waste treatment

Official statistics about textile waste do not exist. Textile waste is a part of section *mixed waste* in official Waste Statistics and it is not reported separately. Statistics Finland estimates that the share of *household waste* is about 60% and the rest of mixed waste is generated in service sector (Environment statistics 2011). Anhava et al. (2001) estimated ten years ago the total amount of textile waste to be about 70,000 tonnes per year and the share of households to be 40,000 tonnes. The rest is generated in industry and in other sectors of the society.

Some so called "waste bag studies", that have studied the composition of unsorted waste (mixed waste), reveal the amount of textile waste gen-

erated in households. Those have been carried out in various parts of Finland (Table 2.6). The share of textile waste in those studies has in most cases been 3–5 % of households' mixed waste. Some of them have counted also the amount of textile waste by person and concluded to 8–9 kg/year. The definition of textile waste has varied between the studies. However, most of these studies include in the textile waste section clothes and household textiles (not shoes, bags and mats or rags). Unfortunately, they did not all report in detail what was included in textile waste nor did they estimate the amount per person. YTV (2008) has reported in detail the definition of textile waste and this definition was confirmed by interviewing by telephone the leading researcher (Sanna Pulkkinen, personal communication, 2012). The study sample was 15,000 people, so its representativeness is fairly large. Accordingly, the key figures of metropolitan area (YTV 2008) were used as estimates of Finnish textile waste in this study.

Table 2.6: Share and amount of textile waste generated in households in the latest "Waste bag" studies carried out in Finland

Data collection area (Researcher)	Year	Share of textiles of household waste	Textile waste per person, kg/year
Metropolitan area (YTV/Pulkkinen et al.)	2008	5.5%	8.9 kg
Kainuu (ELY-keskus, ref. Hinkkala 2011)	2010	3–5%	8 kg
Kuopio(Hynynen)	2008	3%	.*
Savonlinna (Karvonen & Voutilainen)	2007	5%	.*
Päijät-Häme (Autio & Honkanen)	2006	9%	.*
National ¹ (Myllymaa et al. SYKE)	2006	4.5%	.*

* The amount per person was not analyzed and the number of households or persons living in the study area was not reported .

¹ The data was retrieved from national waste statistics.

The estimated amount of textile waste generated by households was 48,000–50,000 tonnes in 2010. This estimation is derived using two different methods, and key figures from the YTV waste study (YTV 2008). In the first case, national statistics of the total mixed waste is used to calculate household waste (60% of mixed waste, cf. Statistics Finland 2011) and the share of textiles is estimated to be 5.5% of household waste. In the latest waste statistics households' mixed waste consists of about 911, 000 tonnes (170 kg per person) and the estimated amount of textiles is circa 50,000 tonnes (9.3 kg per person). The second way to estimate is to multiply textile amount of 8.9 kg per person by the population. In that case the estimation of total textile waste is roughly 48,000 tonnes. It is very likely that the amount of textile waste generated by households is growing, so 50,000 tonnes could be used as the estimate.

The above figure is in accordance with earlier studies which have concluded to 40,000–46,000 tonnes of households' textile waste (An-

hava ym. 2001, Talvenmaa 1998). Hinkkala (2011) estimated the total amount of textile waste to be 90,000 tonnes. That estimation was based on 16.8 kg of textiles per inhabitant discarded into waste per year (Statistics Finland 2007). The figure is very high compared to the waste studies in which only households' mixed waste was considered (e.g. Table 2.6). This may be explained by the fact that Hinkkala's figure is about municipal waste, which includes waste from both household and service sector (laundries, shops, etc.), and also industrial textile waste (Vehviläinen 2010).

In the following sections the calculations are based on assumption that textile waste is treated as mixed waste on average in 2010: 2.8% recycled, 24.6% used for energy recovery, which is mostly incineration, and 72.6% is landfilled.¹³ The textile waste in total is estimated to be about 53,350 tonnes (50,000 tonnes generated directly by households and 3,350 tonnes via NGOs, see Section 2.2).

2.9.1 Quantity of textile waste recycled

The amount of recycled textile waste is estimated to be in total 9,900 tonnes consisting of 1,490 tonnes of mixed waste (2.8% of textile waste) and about 8,500 tonnes of separately collected textiles. Anhava et al. (2001) estimated that only 1% of textile waste was recycled in 2000, so they recognized great possibilities to increase the recovery.

2.9.2 Quantity of textile waste incinerated

13,120 tonnes of textile waste (24.6% of 53,350) are estimated to be used for energy recovery including waste incineration in incineration plants. In Finland very little waste is incinerated, so until now most of the textile waste is also landfilled. The share of incinerated waste has grown rapidly in the latest years (Statistics Finland 2010). Incineration will be even more important waste handling method in the future, when new legislation decreases the amount of landfilled waste and a ban on landfill of any biodegradable waste is imposed (Tekes 2005). These new rules are not valid until 2015.

¹³ Statistics Finland (2011) Waste statistics – municipal waste 2010.

2.9.3 Quantity of textile waste landfilled

More than 38,700 tonnes (72.6% of textile waste) from households is estimated to be landfilled. In 2003 the amount of landfilled “textiles and clothes” in municipal waste was 62,300 tonnes (Myllymaa et al. 2006). Households are estimated to generate close to 60% of municipal waste on average, but the share of textiles in those figures is greater, because according to the received information, service sector does not generate much textile waste.

2.10 Technology used for recycling of textile waste

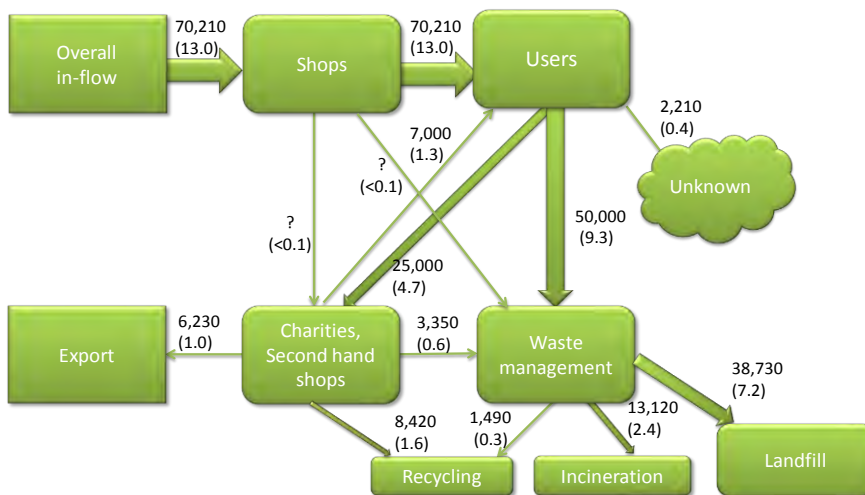
Based on several research projects about textile recycling in Finland the main problems identified have been linked to logistics and economic issues (Talvenmaa 2012). Those are also the greatest obstacles to start a successful business in the textile-recycling field. The amount of textile waste is fairly small and distances are long, which necessitate effective logistics. The economic viability is challenging as big investments and specialty machines are required for recycling waste textile to new fibres. Since textile waste is often not considered as particularly harmful and the value is currently not very high this provides rather weak incentives for businesses to enter this market. Specialized actors are also needed to sort, handle and deliver the heterogeneous material coming from consumers. All these phases need much manual work. Hence, there is neither much business dealing with textile waste in Finland nor any innovative recycling technologies. Chemical recycling is also very little used method in Finland (Nieminen & Talvenmaa 2005). Some social companies are operating in this field, processing manually e.g. industrial cloths, as described before. However, the interest is increasing and so is the demand for reused fibres, thread and yarn. So, there is a potential for better textile waste recycling. In fact, this year in Finland, some positive signals and initiatives for the better management of textile flows and waste recycling have been found on many levels, both in administrative organizations and private trading and recycling companies (Talvenmaa 2012).

2.11 Summary of the Finnish textile flow in 2010

Figure 2.6 describes the textile flow in Finland. Similarly to the Danish summary, the figure of total textile flow is in tonnes (the upper number) and kilograms per inhabitant are shown in parenthesis. It must be stressed that there is very much uncertainty in the figures especially concerning the textile waste and reuse. The net inflow is based on statistics, whereas the figures in other parts of the flow are based on existing studies and on assumptions concluded from the studies. All in all, much more data is needed to get reliable results.

There is a little gap between the inflow and outflow of households and business/public sector. The outflow makes up in total 75,000 tonnes (14 kg/inhabitant), which is 2,210 tonnes (0.4 kg/inhabitant) less than the inflow. This gap could be explained by accumulation of textiles in households (cf. Wrangéll 1997). We must also consider that there are many uncertainties about separately collected textiles, how they are divided between domestic use, waste and recycling. The flow of reused clothes and household textiles into other households is also missing in the figure. However, those do not change the total amount of inflow or outflow.

Figure 2.6: Estimated textile flow in Finland in 2010



2.12 Textile flow in Sweden

The investigation of the textile waste flow in Sweden is based primarily on the review of existing studies supplemented by interviews with stakeholders as well as surveys and interviews of selected stakeholders conducted by 10 MSc students at Lund University as part of their course work on Strategic Environmental Development (see Section 1.4).

In order to avoid repetition, the Swedish section only provides a short summary of the existing studies. For further information, please refer to, among others, Carlsson et al., (2011). Note, however, that the per inhabitant figure was re-calculated by the authors based on the population in 2008 found in the Swedish statistical office (9,256,347), to harmonise the methodology used in the three case studies.

2.13 Quantity of textile put on the market

As of 2008, approximately 132,000 tonne of textile used in the area of clothes and home textile came into Swedish society (Carlsson et. al., 2011). Based on the total population of Sweden in 2008, this is translated into the average of 14.2 kg per inhabitant. The breakdown of different types of clothes and home textile contributing to this flow is found in Table 2.7.

Table 2.7: Domestic use of textiles in Sweden in 2008 (total in tonnes and per capita in kg).

Categories	Domestic use total (tonnes)	Domestic use per capita (kg)
1 Large garment (gowns, coats, jackets, raingears)	11 700	1.3
2 Trousers	20 580	2.2
3 Jackets	1 400	0.2
4 Dresses, costumes and skirts	4 660	0.5
5 Suits	1 110	0.1
6 Shirts and blouses	7 420	0.8
7 Underwear including socks and night clothes	13 020	1.4
8 T-shirts	13 690	1.5
9 Sweaters	11 980	1.3
10 Baby clothes	2 110	0.2
11 Training and bathing suits	4 540	0.5
12 Gloves, hats, shawls, etc.	3 480	0.4
13 Blankets	2 450	0.3
14 Bed sheets	12 770	1.4
15 Table clothes, curtains, bedspreads	15 540	1.7
16 Towels	5 370	0.6
17 Second-hand clothes, rags	-11 160	-1.2
Total (including second-hand clothes, rags)	120 670	13.0
Total (excluding second-hand clothes, rags)	131 830	14.2

Source: Total in the third column, Carlsson et al. (2011), per capita is re-calculated by the authors based on the total population of 9 256 347 in 2008.

2.14 Reuse of textile and their destination

In 2008, eight large charity organisations in Sweden¹⁴ collected in total of 26,000 tonnes (i.e. circa 2.8 kg per capita) of clothes and home textile (Carlsson et al., 2011). Currently, the collection of textile waste is solely in the hands of non-governmental actors such as charity organizations and private second-hand shops, and municipalities do not have any responsibilities in terms of reuse of textiles as of yet. Textiles discarded from households are however considered a household waste legally, and therefore a municipal waste responsibility (Nilsson-Djerf, personal communication, 2012).

Besides collection at their second-hand shops, the charity organisations have collection containers in town centres and public/municipal recycling centres. Typically municipalities allow 1–2 organisations to have a few containers for textile collection, as long as the organisations meet conditions posed by municipalities such as to keep the surrounding tidy, empty the container every day on a set basis, etc. Usually there are agreements for certain period of time. Municipalities tend to choose organisations that are reliable and have good records (Nilsson-Djerf, personal communication, 2012).

According to the estimate provided by two of the eight charity organisations included in the study (see Footnote 14), approximately 11% of the 26,000 tonnes of used textile collected by the charity organisations – circa 3,000 tonnes in total, corresponding to roughly 0.3 kg per person) are sold within Sweden (Carlsson et al., 2011). Carlsson et al. (2011) indicates that the vast majority of the collected used textile – 73%, about 19,000 tonne or 2.1 kg per person – are sent abroad either sold or donated to receivers abroad. Meanwhile, interviews conducted with representatives from a total of 10 second-hand shops in Lund reveals that out of all the textiles they receive, 30–65% remain in their shops. It was also found that some of the second-hand shops interviewed do not keep records on the flow of their commodities. In addition to the charity organisations, Internet sites such as Blocket and Tradera are among the venue for for-profit exchanges. The market for second-hand and vintage has recently seen increased interest and growth in Sweden (Svensk Handel, 2010)

¹⁴ They are: Myrorna, Erikshjälpen, Röda Korset, Läkarmissionen, PMU Intertrade, Stockholms stadmission, Humana Sverige and Emmaus Björkå (Carlsson et al., 2011, p.26). According to Palm (2011), the same number is given but from 10 largest charity organisations instead of 8.

2.15 Textile waste treatment

2.15.1 Quantity of textile waste recycled

Up until 1992 there was a large-scale industrial recycling of textiles at Stena Gotthard. Since then, the recycling of textile is limited to the use of discarded rags as industrial wipes (Myrorna 2010, as cited in Palm, 2011a).

At the moment, no substantial recycling activities for textile waste take place in Sweden. According to Palm (2011a), Humana Sverige is the only charity organisation in Sweden that report that part of the second-hand textile they collect are sent for recycling, which represents approximately 4% of the products collected by the charity organisations.

Interviews with tailors in the Lund area revealed small-scale initiatives for recycle of waste textiles. One tailor mentioned giving waste fabric to a local sports store which use these rags to fill up punching bags, and another tailor mentioning giving waste fabric to a local museum who organise textile workshops for children. An interview with professional supplier of laundry service to business customers (e.g. hotels) also shows that the company systematically sells the worn-out sheets to car mechanics. If the quality of the sheets goes down to the level that cannot be sold, the company gives it to organisations such as Doctor without Borders.

A few Swedish sportswear manufacturers and fashion industry started to take part in the Eco Circle initiative organised by Teijin Fiber, a leading material manufacturer from Japan (see Section 2.16). However, according to the sportswear manufacturers who joined the initiative – Houdini and Fjällräven – they have not accumulated sufficient amount of textile that has been collected to be sent to Japan (Kupio, personal communication, 2012; Bruns, personal communication, 2012). According to Teijin, shipping of collected products from overseas usually take place in larger quantities (e.g. 1–2 tonne, one container) (Ikeda, personal communication, 2012).

With the growing interest of textile recycling, producers in Sweden started to weigh the value of (re-) establishing a recycling plant within the country. The bottleneck at the moment is the uncertainty of the amount, and guaranteed stability, of textile they would manage to collect for recycling (Nilsson-Djerf, personal communication, 2012).

2.15.2 Quantity of textile waste incinerated or landfilled

Based on the total of 57 waste analyses conducted by seven waste management companies/associations¹⁵ in 2004–10 as well as information of two charity organisations,¹⁶ it is estimated that 8 kg of clothes and home textiles come into waste stream per person per year. The vast majority (approximately 70,000 tonnes, or circa 7.6 kg per capita) are generated from household, while some 4,000 tonnes, or 0.4 kg/per capita comes from charity organisations that collect used clothes and home textile (Carlsson et al., 2011).

There is no information available regarding the ratio between incineration and landfill of textile waste per se. As of 2010, roughly 98% of municipal waste that is not recycled or composted is incinerated, while about 2% is landfilled (Avfall Sverige n.d.). However, according to a representative from Avfall Sverige, it is reasonable to assume that 100% of textiles in the household waste stream are incinerated. (Nilsson-Djerf, personal communication, 2012)

2.16 Technology used for recycling of textile waste

As mentioned above, since the closure of the recycling plant of Stena Gotthard, the recycling activities for textile have been limited to the use of discarded rags as industrial wipes (Myrorna, 2010, as cited in Palm 2011a). According to Jon Nilsson-Djerf of Avfall Sverige, it was purely an economic reason that they closed. There is also an indication that some rags were used in the pulp and paper industry in the past, but now it is taken over by wood products (Carlsson et al., 2011).

Teijin Fiber, one of the leading material producers in Japan, established a recycling system, named Eco Circle, for polyester they produced and sold. As of 2011 they have more than 150 members both within and outside of Japan, including a few member companies in Sweden. The member companies of Teijin's Eco Circle initiatives will collect the end-of-life products that include Teijin's polyester, and send the products back to Teijin. The collected products go through chemical recycling process and become the material with the same quality as virgin materials produced

¹⁵ These seven organisations are Sysav, NSR, VafabMiljo, Sörab, Region Västerbotten, Stockholm Stad and Avfall Sverige. Detailed information on the methodology is found on page 22-25 of Carlsson et al. (2011).

¹⁶ These two organisations are Humana Sverige and Ideell Second Hand. Detailed information on the methodology is found on page 25-26 of Carlsson et al. (2011).

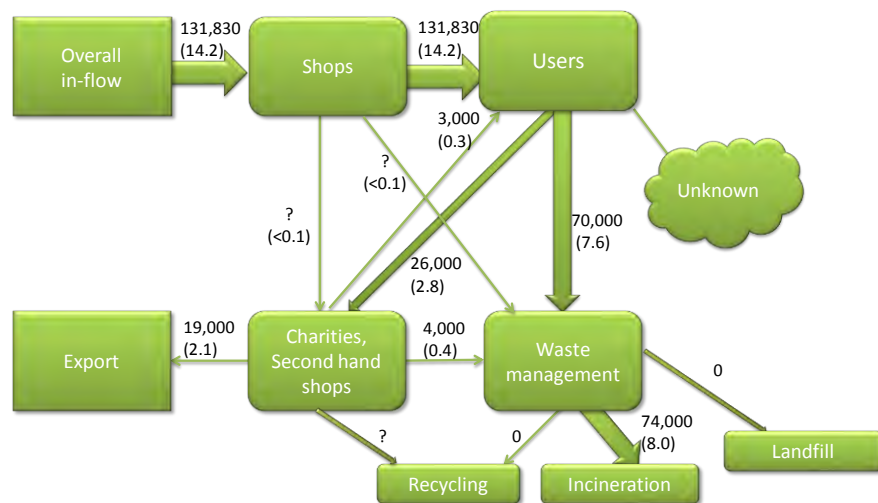
from oil, thus reducing not only waste generation but also energy consumption substantially. (Ikeda, personal communication, 2012).

There is an on-going research project at the University College of Borås, where they are investigating the possibility of recycling old clothes in the form of bio-gas production. This is not recycling according to the definition we use in this report, but one form of recovery of resources. The research group managed to produce almost 0.5 kg of ethanol or 380 litres of methane per kilo of cotton. They are currently working to solve certain challenges in the process, so that they can use other types of textile as input materials (Högskolan I Borås, 2012).

2.17 Summary of the Swedish textile flow in 2010

Figure 2.7 summarises the flow of textile in Sweden, based on the figures presented in this section.

Figure 2.7: Textile flow in Sweden in 2010 (based on Carlsson et al., with additional calculation by authors)



3. Stakeholder's initiatives and views on textile waste prevention and recycling

In this chapter we seek to present stakeholders views on textile waste prevention. The data presented here is gathered through a survey of identified literature and a number of interviews that has been performed in connection with the development of this report. It should be noted that we are only able to present samples from different actor categories, not a comprehensive analysis of the views of all relevant actors within each category.

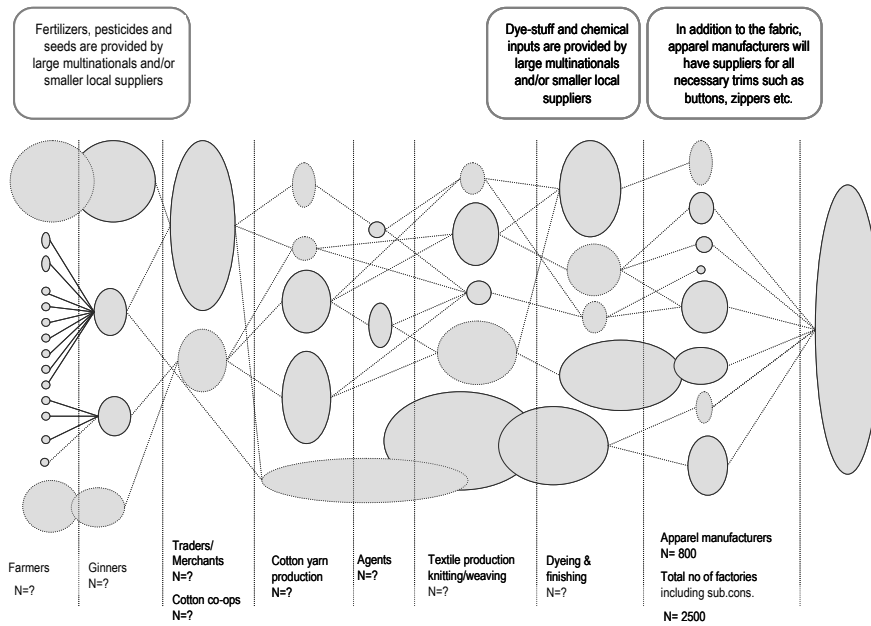
Due to the request of anonymity from some interviewees, the name of the interviewees is not referred to in this chapter. Information found in this chapter is based on the interviews and the student work (See Section 1.4), unless otherwise mentioned.

3.1 Production and distribution phase

Before we move on to discuss the views of actors in the production and distribution phase it may be relevant to illustrate the complex nature of textile supply chains. Figure 3.1 gives a very rough illustration of a textile supply chain. The figure is simplified on many levels, it only includes cotton fibre at the raw material side (in reality the focal company buys fabrics made from a range of man made and natural fibres), it does not illustrate the heterogeneity of the nature of dyadic relationships that exists between buyers and sellers throughout the chain, and it does not illustrate the passing of national boundaries that takes place many times on the path from raw material to finished products at the point of sale. It does, however, serve to illustrate that textile/fabric and fibre producers are often one, or several, tiers removed from the retailers and brand owners that are responsible for most of the import of textiles to the Nordic countries. It also worth noting that in many cases one retailer will be engaged with a large number of first tier suppliers which would often also reflect a large number of actors being involved further upstream. Closing the loop

back to the stage of fabric or fibre production would consequently involve bridging tiers that many times do not normally interact through direct, contractually regulated, transactions (Kogg, 2009).

Figure 3.1: A rough illustration of the complexity of the H&M supply chain. (Kogg, 2009, p. 153)



(Please note that this image only includes the cotton alternative in the fibre producing stages of the supply chain)

In addition to upstream measures designed to address environmental and social aspects upstream in the supply chain, and the use of restricted substance lists and other initiatives designed to ensure that hazardous chemicals are not present in the final product, a growing number of garment producers and retailers started to use recycled materials. A study on Swedish situation found examples of such companies from both fashionbrands such as Boomerang, H&M,¹⁷ Lindex and Gina Tricot, as

¹⁷ In 2010 H&M used 1,600 tonnes of recycled cotton, wool and polyester in their garment collections. (H&M, 2012). However it should be noted that with respect to polyester the material for the fibre does not come from textiles but from PET bottles and for cotton and wool the materials that are recycled are pre-consumer waste. (Lampa, 2012)

well as outdoor and sportswear companies such as Fjällräven, Haglöfs, Houdini and Klättermusen (Sundin, 2011).

There are also a number of examples of retailers that through different schemes encourage and enable collection for re-use e.g. through the establishment of their own second-hand shops. Examples of such shops include Filippa K (Fillipa K, 2008) and Boomerang (Boomerang, n.d.). In the case of Boomerang, the clothes returned from the customers are washed and sorted, and those in good condition are resold again (Sundin, 2011). A similar initiative was mentioned by Houdini who sells products with small faults at reduced prices in their outlet. H&M is currently running a scheme in Switzerland where consumers are encouraged to bring back discarded garments to selected H&M's stores. The customers get a gift voucher in return for each bag of discarded clothes they bring to the store. The company is currently planning to expand this scheme in Switzerland and is evaluating the possibilities to extend the program to other countries. For this project H&M is collaborating with the company I:CO (short for I collect) who is responsible for managing and finding the best possible uses for the collected material. Currently part of the materials that are collected in Switzerland are recycled into isolation for cars. Internationally different types of schemes to collect reusable and/or recyclable materials are also launched by actors such as Levis, Puma, Patagonia and Marks & Spencer (Hvass, personal communication, 2012).

In addition, there appears to be some initiatives that have been taken by material producers of synthetic fibres to close their material loop. One example is Teijin Fiber, a leading material producer from Japan, which started recycling of polyester based on the notion of extended producer responsibility. In the beginning they recycled the collected PET bottles to products such as films, PET bottles and textile made of polyester. Developed from this material recycling system, they further established chemical recycling system for polyester products called Eco Circle in 2002. Materials collected from old products are broken down to polymer level and are used again in new products with the same quality as virgin materials.

In the beginning, the types of products they handled in Eco Circle were mostly uniforms and school gym clothes generated within Japan. In terms of participation of oversea members, a big turning point was when Patagonia, one of the large outdoor apparel industries joined the initiatives in 2005. The initiative now enjoys memberships of 150 of apparel industries and general trading companies, and collaborates with them in areas such as new product development, sales, collection and reuse. The

types of products they work with are not limited to clothes, but extended also to seats and cushions in cars and trains, furniture and other miscellaneous products.

Physically speaking, all polyester products can be chemically recycled in the Teijin system. At the moment, however, Teijin is handling only the products they themselves produced. It is mainly to do with the difficulties of handling mixed materials. Their member such as Houdini (see below) have expressed a wish that Teijin Fiber should take back not only their own products but others that are also 100% polyester, or alternatively that they would have the possibility to recycle polyester in Europe. With the European producers having limited period of participation, Teijin has not received the materials back from their European members of the Eco Circle Initiative. However, they do sell high-end polyester made of recycled polyester to these members.

Teijin Fiber being a material producer, their main focus is to improve the material – polyester thread and fabric – they produce. For them the first measures to take for waste prevention is to provide high-quality products that last long, while they also seek to close their material loop once they become waste through recycling.

Houdini was the first European company to become a partner in Teijin's closed-loop polyester recycling system, in 2006. Today the company uses recycled polyester more than 60% of their styles. Houdini seeks to use homogeneous materials to ease recycling, and considered themselves that they are very ready for government interventions to take back and recycle their products. Fjällräven, another European company that became a partner in Teijin's Eco Circle Initiative, started to use a type of polyester produced by Teijin free of fluorocarbons and is waterproof.

Houdini has also styles that are biodegradable and state that they practice a zero tolerance for waste (Houdini Sportswear 2012). A development in this area is the use of wool-silk.¹⁸ They are seeking for technical studies to establish the compostability of the material. Interviewees from both Houdini and Fjällräven mentioned that their priority in their waste prevention activity is to improve the durability of their products.

There is an on-going initiative to facilitate discussions regarding textile waste prevention and management among different stakeholder

¹⁸ Wool-silk combines the two raw materials in one. The use of silk helps strengthen the durability of the fabric used at the bottom layer without including the synthetic materials.

groups currently taking place in Sweden. In this initiative several large garment and household textile retailers/brand owners are participating, along with representatives from the second-hand sector, waste management organizations, academia and government authorities.¹⁹ Current reports from these discussions indicate that participating brand owners/retailers are willing to work on closing the material loop and in light of the lack of industry-scale textile recycling facility in Sweden (see Section 3.3.2), the producers and retailers started to weigh the value of (re-) establishing a recycling plant within the country. One of the concerns currently brought up is the uncertainty regarding the amount of textile they would manage to collect for recycling.

There are some textile waste recycling facilities both in the Baltic states, Germany and the Netherlands, and some of these facilities (e.g. the one in the Netherlands) have the possibility to recycle various types of textile, such as cotton, wool, synthetics. A representative from Avfall Sverige (the association for Swedish waste management companies) noted that if the amount of waste collected is not big enough, it may be better to send the collected waste. A representative of the Swedish industry association for textile and fashion producers TEKÖ, have also expressed some hesitancy with regards to the viability of establishing textile recycling in Sweden, arguing that it will be difficult to make it financially viable and to find a market to offset the recycled material.

Another key issue discussed among the stakeholders is the interpretation of the “ownership of waste”. Namely, if textiles are classified as municipal waste the textile waste is collected as household waste. The handling of textile waste is then interpreted to be under responsibility of the municipalities, who in turn would also claim the ownership to textile waste. In order to allow the producers or retailers to take the textile waste in their hands for recycling, a clarification of ownership needs to be clear.

Some retailers/brand owners have expressed concerns with respect to how ownership of household waste is interpreted. This is based on experiences in some EPR systems, for other waste streams, where the household waste stream has been classified as municipal waste (e.g. plastics, newsprint). In these cases some municipalities interpret the law to grant them ownership of all municipal waste despite the waste stream being under EPR programme. This is perceived as problematic by producers (for

¹⁹ It is interesting to note that the two Swedish companies who are participating in the Teijin Eco-cycle scheme (interviewed for this study) have not been engaged in the on-going initiative. At least one of them have expressed an interest in participating in such discussions.

several reasons but in part): if the municipalities claim ownership, producers can't control that collected waste is actually handed over to their assigned recycling and/or production facilities. In some cases (e.g. newsprint) a portion of waste papers collected by municipalities are sold abroad, while in others (e.g. plastics) a portion is incinerated.

3.2 Consumption phase

3.2.1 *Private consumers*

As noted in Chapter 2 of this report, imports and consumption of new textiles is on the increase in all three countries included in the analysis. At the same time it is noted that the market for second-hand and vintage has recently seen increased interest and growth in Sweden (Svensk Handel, 2010) and Denmark (Politiken, 2010a & b), and in Finland, flea markets and the second-hand market has also become increasingly popular since the regression in the 1990s (See, for instance, Jarva 2007). A survey of Swedish consumers (Fues and Norberg, 2011) indicates that people buy second-hand garment because it offers an opportunity to find unique items, but also because price is low and the advantage of a reduced environmental impact.

A survey among 1000 Swedish consumers (Ungerth, 2011) looked at consumer attitudes to extended producer responsibility. They found that 70% of respondents were positive to a more regulated system for collection of used garments. They also asked about preferences with regards to the type of system and found that 27% preferred a system with collection points where as 28% preferred a deposit refund system, while 15% indicated that both systems would appear to be good.

At the same time as consumer propensity to collect and buy used garments appears to be on the increase, it appears that consumers are less prone to take action to prolong the use of garments already in their possession. A very small open survey reaching primarily young consumers indicate that over 60% had never been to a tailor shop to mend or adjust clothes and 90% do not think that a tailor shop is an obvious alternative when clothes break. There was also an indication that the propensity to get garments fixed is correlated to the purchase or affectionate value of the item. The higher the value, the higher the propensity to

mend an item when it is broken.²⁰ The NICE Consumer project (Danish Fashion Institute, BSR. 2012) identifies cost of repairs in conjunction with low prices of new fashion products as one barrier for sustainable fashion consumption. Laitala and Klepp (2012) lists value of garment, type of clothing (e.g. sportswear or formal clothing), visibility of mending as well as the level of difficulty for mending as factors influencing whether a Norwegian consumer repair their clothes or not.

3.2.2 Organizational consumers

A potentially important sector in this context are the commercial laundries which to a large extent are also becoming the actors that buy and own the items renting them out to users rather than selling them. While the interviewed laundry service providers have many measures in place to reduce the environmental impact of their laundry operations and logistics (the laundry facility is labeled by the Nordic Swan), and can offer ecological textiles to customers that are asking for this, they did not express having undertaking any explicit measures for waste prevention and the promotion of long use of their textiles. Apparently some textiles do go to waste unnecessarily as a result of moulding when wet towels are stored improperly and in particular when wet dirty laundry is mixed with dry dirty laundry. However rather than discarding textiles that can no longer be used, the company sells worn out textiles to car mechanics that use these textiles as rags. They also donate discarded textiles to charities such as Doctors without borders/Medecins sans frontiers.

3.3 Post (first) consumption phase

3.3.1 Representatives of the second-hand market

The story of second-hand can be assumed to be as long as the manufacture of clothing. While the original purpose was to provide cheaper clothing to the underprivileged, more recently we have seen second-hand and, in particular, high quality/high fashion vintage become a trend in western society. (Palmer and Clark, 2005)

²⁰ It should be noted, however, that it was an open survey administered by students who posted it on Facebook, which generated in total 31 responses where a majority were students between the age of 20-25.

In addition to non-commercial exchange of used clothes between individuals there are three main categories of actors that facilitate such exchange commercially; for-profit second-hand stores, charity second-hand stores and Internet sites (such as Blocket and Tradera in Sweden and Den Blå Avis in Denmark) that facilitate commercial exchange between private sellers and buyers. In all three countries, the charity organizations are the biggest facilitator of second-hand clothes trade. While the interest in second-hand clothing appears to be on the rise in the Nordic countries, it is clear that the volume of donated used garments each year vastly exceeds the demand for such clothes on the internal market. As indicated in Chapter 2, a large fraction of collected used clothes are exported rather than resold on the domestic market. There appears to be several companies in Europe that specialize in buying and sorting second-hand garments for further export to commercial buyers in developing countries.²¹ For both Denmark and Sweden, Eastern European countries have been the prominent first stop of the used clothes. Some clothes received there have been sold locally, while others may have been repackaged and sold to other parts of the world such as Africa.

It is argued that many poor countries benefit a great deal from the import of second-hand textiles, as it do not only provide clothing for people, but also creates employment in the receiving country due to transporting, cleaning and repair work etc. (Baden and Barber, 2005) However, there are also concerns that this influx of second-hand clothing may be undermining the local industries and livelihood in these countries (Baden and Barber, 2005; Myrorna, 2012B)

Morley et al. (2006) raise concerns that the drop in prices of new clothing will have a number of negative impacts on the second-hand sector. One concern is that the price difference between new and used clothes will be lower leaving the consumer with less of an incentive to buy second-hand clothes. Another concern is that the lower price of new clothes is also an indication of lower quality, which may mean that they will have a reduced value as a second-hand item, which can in turn reduce the life span of the garment and increase the volumes of textiles going directly to recycling or waste disposal. (Morley et al 2006)

²¹ One such example is Fratelli Esposito in Italy which employs over 80 workers that to sort and pack second-hand clothing for resale. The company lists Eastern Europe, Northern and Central Africa and Asia as its key export markets and states that "The foreign expansion proceed at the same rate as the growth of the internal markets so that to promote the opening through the different customer needs." (Fratelli Esposito,2012).

As indicated in the overview of waste flows in the three different countries approximately 10–15% of the garments collected for reuse are considered unfit for reuse and sent to recycling or disposal. The amount of waste is generally not significant in smaller for-profit second-hand stores as they generally do not use collection boxes but receive the garments directly from the seller and discard clothes that are not fit for resale before they enter the store. The criteria for discarding textiles as waste were generally if they are very broken, very dirty, or even mouldy and in general poor quality. Some of the interviewed stores indicated that they are able to do some mending or washing to salvage an item for re-sale. One of the surveyed second-hand stores mentioned selling discarded garments as lump, but otherwise it appears that textiles that are sorted as waste generally goes directly to final waste disposal.

Supply today outweighs the demand for used textiles and it appears that actors on the second-hand market have few incentives to spend resources on mending and fixing clothes that could be salvaged for further use. In addition, among the stores surveyed in Lund, there were very few indications of these actors actively looking for recycling or down cycling options as an alternative to final waste disposal for the items they discard.

During the course of this project we have interviewed the CSR manager of one of the major charity actors on the Swedish market. Clearly their whole operation is designed to facilitate the prolonged use of textile product (and other types of products), and as such they play an important role in diverting textile products from the waste stream when these items are discarded by their first users. However, the collection of garments is only financially viable in certain areas. An important factor here is the density of population, but also other factors such as proximity to the stores and sorting centres of the charity organization. This means that when collection is left to voluntary actors accessibility to collections points will most likely be dependent on where you live and not equal across the country. It is also relevant to note that like many actors on the second-hand market, this organization is clearly stating that they are only looking for donations of textile products that are reusable, that is, garments that are whole and clean. Meaning that for the consumer who wishes to separate waste textile from the municipal waste stream there are currently very few collection options available.

For the interviewed second-hand actor, the sorting process is vitally important as it enables the organization to bring clothes to their stores that will be sellable on their market. Consequently a familiarity with the market is relevant in the sorting process.

The company has tried different measures to increase recycling rates both in terms of the collection points and in terms of information campaigns directed at potential donors. They notice that both information and improved accessibility to collection points generally results in increased collection volumes.

With regards to EPR the organization is positive to such an initiative as they point out that it is not financially viable for them to provide collection points in all parts of the country. They note however that unless they are included in such schemes alternative means of collection may actually compete with their collection efforts. The actor is positive to discuss different potential roles it may play under an EPR scheme.

To further the rate of collection of reusable garments, this actor would like to see support in terms of information measures to inform consumers about the potential for donating garments for reuse and the benefits of this action. In addition they note that different municipalities differ in terms of how forthcoming and supportive they are towards charity collectors, and therefore think it would be beneficial if the role of municipalities would be made clearer and that municipalities should be encouraged to collaborate with these collectors. Finally they see the need to share the economic burden of collection, in particular in areas where they cannot financially sustain collection efforts.

As mentioned the interviewed actor is placing high emphasis on making the stores attractive by working with selection and display in the stores as well as with marketing. Some argue that there is a general need for second-hand retailers to place more emphasis on issues such as display and targeted selection of clothes to fit the demands of different target customers (Hvass, personal communication, 2012). By making the stores more attractive and easier to navigate for the customers, the second-hand market could potentially attract more customers.

3.3.2 Recyclers

Recycling of textiles can be made through mechanical or chemical processes. This means that textiles that are unfit for reuse can be recycled in a range of different ways. Crude ways involve cutting fabrics into rags for use as e.g. wipes. However, textile material can also be shredded for use in other types of products such as bedding flock, insulation or paper, or go through further processing be recycled into new fibres.

The Japanese company Teijin Fiber has a process where they claim the ability to recycle polyester into virgin quality (see section 3.1). Both Teijin, and other actors (see e.g. Textiles4Textiles, 2012) note that it is important

to know the content of the material going into the recycling process, and the streams are as pure as possible in order to be able to generate high quality recycled fibres. Teijin is solving this through establishing their own closed loop recycling system where they bring back garments originally made from Teijin fabrics. However, an EU funded project, Textiles4Textiles has been launched to develop and test a machine that can sort textile waste automatically (using Near Infra-Red Spectroscopy) into fractions based on fibre composition and colour. When compared to manual sorting, such a system can potentially increase both the financial viability of the sorting process as well as the number and homogeneity of the sorted fractions. (Textiles4Textiles, 2011)

In addition to testing the machine for automatic sorting the Textiles4Textiles project are also testing the ability to make garments out of recycled fractions. (Davies, 2011) Other research projects that currently look at developing new technologies for recycling of textiles, include the "Reuse, recycling and end-of-life issues" project within the MISTRA Future Fashion Programme (Mistra Future Fashion, n.d)

It is difficult to assess the current market for waste textile. In a report from 1996 the Swedish EPA indicated that one company in Sweden had been engaged in textile waste recycling (Naturvårdsverket, 1996). In the same report it is indicated that while there was technology available for textile recycling, the demand for waste textile and recycled products remained a problem (Naturvårdsverket, 1996). Today, more than 15 years later information from actors in the recycling sector in Sweden indicates that there are currently no industrial scale recycling of textile waste in Sweden. Stena Recycling, one of the leading recycling companies in Sweden, did run a recycling facility in Älmhult engaged in the sorting of textiles made from natural fibres (cotton and wool) which, at its peak time, employed 200 people. The company sold both the yarn made from recycled fibres, as well as fabrics as insulation materials, etc. Due to the high quality of sorting based on materials and colours, they could resell the yarn without re-dyeing them most of the time. However, due to declining input material and less demand for the output materials, they closed the facility in 1998. The interviewee from Stena Recycling was cautious regarding the re-introduction of a recycling facility in Sweden, arguing that (considering the importance of prolongation of the life of textile products via reuse) it would make more sense to conduct recycling at places where textile products really finish their first life. Another argument raised was that at this moment, the amount of collected textile that becomes waste is too small for recycling to be viable.

A Finnish expert also lists logistical and economic issues as key barriers for national recycling initiatives in Finland, but notes that recently some positive signals and initiatives for improved management of textile waste flows and recycling can be seen in the country. (Talvenmaa, personal communication, 2012)

The interviewee from Stena Recycling pointed to two hurdles in the enhancement of the collection of textile. One is to secure space for collection containers in areas close to the residence of consumers (similarly to, for instance, packaging waste). In addition to the challenges of including (an) additional container(s) together with other waste fractions, actors who are engaged in the management of such place (e.g. municipalities or producer responsibility organisation for packaging) have different views as to who should pay for the clean up of the location and the like. Another hurdle is that incineration is currently portrayed positively as energy recovery operation.

While we have not found any ongoing large-scale recycling initiatives, in the Nordic countries, it should be stated that we have encountered a number of small-scale initiatives for recycling. From the interviews with a local laundry in Skåne we found that they sell used sheets to local mechanics, where they are used as rags. Local tailors in Lund indicated different options for their waste textiles, with one giving it to the local sporting goods store who use textile to fill punching bags and another donating waste textile to a local museum where it is used in arts and crafts workshops for children. Linked most likely to the revival of the arts and crafts movement, there is also an increasing range of small companies, and individuals, who make new garments or other textile items out of used textiles. Such companies include Re: Something in Denmark (Section 2.1.4) and Globe Hope, Secco and Mereija in Finland (Section 0).

It is interesting to note that organizations and individuals who are making new garments out of used textiles (as a business or for personal use) often look for materials at flea markets and charity shops such as Myrorna. However, it appears as if charity organizations do not currently cater specifically to this market, i.e. buyers which would potentially accept to buy garments with a few stains or garments that are torn or broken in a few places, if they were sold at a cheaper price than items which can be reused as they are without any alterations or mending. Potentially there could be a market for slightly broken or stained garments where the defects are of such a minor scale that most of the fabric could be reused for new items. It should be stated though that we do not have an estimate of the potential size of this market.

3.3.3 Waste managing companies/authorities

As of now, in both Denmark and Sweden, separate collection of textile waste is solely in the hands of charity organisations, and municipalities do not have any responsibilities. Besides collection at their second-hand shops, they have collection containers in town centres and public/municipal recycling centres. In Sweden, in cases where collection containers are placed in municipal recycling centres, charity organisations get time-limited permission from the municipalities to set up the containers under certain conditions (e.g. frequency of containers to be emptied). In Finland some municipalities set up collection containers for textiles, but the main entity engaged in collection is charity organisations. All in all, as of now the current solution is inexpensive and convenient for municipalities, as – especially in Denmark and Sweden – all they need to do is to allow charity organisations to set up containers.

According to one interviewee, there exist different views on the introduction of separate collection of textile waste among 258 municipalities in Sweden. Some may be in favour of such movement, while others do not care. Meanwhile, other interviewees commented on the unwillingness of some municipalities in introducing source separation of textile waste, as it would mean decline of the amount of dry waste they can send to incineration.

4. Government interventions

This chapter starts by providing a brief review of policy measures in relation to textile waste prevention which have been either implemented or discussed. It subsequently discusses the potential of interventions based on extended producer responsibility (EPR) in promoting waste prevention. Finally, we analyse the potential and limitations for using EPR-based policy in the area of textile waste.

While it is not within the scope of this report to assess the environmental benefits of reuse and recycling, nor the financial and technical viability of such initiatives, we find it relevant before proceeding with the discussion regarding interventions, however, to acknowledge that conclusive answers to these highly relevant questions are still not readily available.

A recent review of live cycle assessments of clothing (Chapman, 2010) notes that many of the existing LCAs of textiles follow a cradle-to-gate methodology. Thus for clothing, the impacts of the initial stages of manufacture are relatively well established (at least for common types of textiles) but comparatively less data is available for impacts associated with use, and end-of-life management of textiles. Based on the available data Chapman (2010) does however draw the conclusion that it is in the textile use phase that the main contribution to most environmental indicators are made, followed by the production phase.²² With regards to impacts in the end-of-life phase, Chapman notes a large variance in the identified impacts although most identified studies list these impacts as comparatively insignificant. He further notes that while energy recovery from incineration can lower total energy use, none of the reviewed LCAs had included potential reduction of impacts from reuse and recycling scenarios (Chapman, 2010).²³

²² It is worth noting that different impact categories are prominent in different life cycle phases, while energy consumption, and emissions from energy use may (depending on the type of material) be highest in the use phase (from washing and drying), toxicity impacts are some times higher in the production phase.

²³ It should be acknowledged, however, that there are general limitations among LCA studies regarding among, others, the setting of system boundary, arbitrary nature of valuation and the like. For a critical review of LCA studies for textiles and alternative methodologies for comparing textiles and fibres, see Kviseth and Tobiasson (2011).

Still other studies have shown that reuse and recycling of textiles have the potential to reduce the impact of clothing. Morely et al. (2009) concludes that reuse and recycling perform best in energy and waste /resource terms compared to other options such as e.g. energy from waste. McGill (2009) focuses on analyzing the carbon footprint of different End-of-life management options for textiles and concludes that “This carbon footprint analysis has shown that exporting for textile sorting, reuse and recycling will not affect the carbon footprint substantially. If anything, it improves the performance of the system because of the higher reuse rates that can be achieved in the export regions compared to the UK. The analysis also shows that reusing textiles results in greater benefit than recycling.” (McGill, 2009, p. i) McGills concludes that “ideally, the system would be optimised by reusing the textiles as long as possible, and then recycling them. (McGill, 2009, p. 76) In a similar vein a Swedish study (Zamani, 2011) compared the carbon footprint and energy use of different methods of textile recycling against a baseline of incineration. While being cautious about the limitations of the study Zamani (2011) finds that remanufacturing provides a higher saving (in Global warming potential) than recycling, but that all investigated remanufacturing and recycling scenarios are beneficial since avoided CO₂ emissions are higher than the emissions caused by the process of manufacture/recycling.

As noted by many contributors in these studies more data is still needed. But current evidence seems to indicate that in a life cycle perspective it is actually the use phase that is the major source of many key impacts. Still it is clear that prolonged use and re-use has the potential to reduce important impacts generated in the production phase, at least if this prolonged use/re-use is associated with so-called displacement of the purchase of new products. (Fisher et al. 2011) In addition, evaluations with respect to carbon footprint and global warming potential of recycling indicate a potential for reducing these types of impacts. Furthermore, Fisher et al. (2011) argues that increased collection and reuse can generate positive financial impacts both for the individual consumer who can save money on buying new items and for society e.g. through job creation.

4.1 Government interventions pertaining to waste prevention for textiles

Geographical coverage of government interventions pertaining to waste prevention for textiles varies. In this section we start with the provision of a brief description of regional and international policy measures, followed by measures taken at the national level.

4.1.1 *Regional and international policy measures*

EU Waste Framework Directive

In the EU, no legislative measures have been taken to address textile waste prevention. Meanwhile, the strengthening of waste prevention under the revised Waste Framework Directive 2008/98/EC²⁴ may have indirect influence on textile. The Directive, in setting the scene under its recital, stress the importance of prioritising waste prevention (recital 7 and 8) and the need to strengthen measures for waste prevention (recital 40). Article 4 of the Directive clearly indicates the waste hierarchy, and as a means of ensuring that measures are taken, Member States are required to develop waste prevention programmes (Article 29).

EU Waste Shipment Regulation

The EU Waste Shipment Regulation²⁵ regulates the procedure surrounding the movement of waste both within the European Community and between European Community and countries outside of the European Community. Under this legislation, waste is categorized depending on their hazardousness, whether it is going to be disposed or recovered, its destination and the like. Concerning textile waste, it is subject to requirements related to general information provision including, in essence, various actors involved in the handling and transport of waste and the content of waste (Article 3 Paragraph 2, Article 18, Annex V), but nothing more. However, if it is mixed with hazardous substances, it will face more stringent procedural requirements or ultimate prohibition if sent to non-OECD countries. Again the Regulation most likely does not

²⁴ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

²⁵ Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste

provide direct influence, but it may give disincentives to the waste handlers from mixing textile waste with other waste. Those that are traded as second-hand products are not waste and thus won't be subject to this legislation.

EU REACH Regulation

The EU REACH Regulation²⁶ that came into force in 2006 regulates the chemicals put on the European market through their registration, evaluation, authorization and restriction, depending on the risks the chemical in question may have for human health and the environment. The regulation is of relevance in this context as it, in addition to chemical substances and chemical preparations, also applies to substances in articles (which includes textiles). In terms of the environmental impact of textile flows through our society, the current provisions for substances in products in the REACH Regulation²⁷ will probably primarily have the effect that many textile importers most likely will take measures to ensure that imported products do not contain candidate substances listed as Substances of Very High Concern (SVHC) (for instance, by adding these substances to their own Restricted Substances Lists). Such measures would, among others, help them avoid the obligation to communicate that their products contain SVHC substances (along with guidelines for safe use) to downstream customers and consumers.

The REACH Regulation does not specifically address the end-of-life phase of products, but the chemical content in products will of course affect the environmental impacts throughout the product life cycle, including the end-of-life phase. As such the REACH Regulation can serve to improve the quality of the textile waste stream.

While there are provisions within REACH to ensure that information regarding the content of SVHCs in products will be communicated to downstream users (including consumers upon request), there is no mechanism in place to ensure that information regarding chemical content in textiles will follow the product past the consumption stage.

²⁶ Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

²⁷ For a brief summary of the relevant provisions in REACH, please see Appendix 9.5.

Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention on Persistent Organic Pollutants seeks to reduce the negative effects of persistent organic pollutants (POPs) by requiring the Parties of the Convention to take specific measures upon POPs listed in the Convention. POPs are divided into three different annexes. The use and production of POPs under Annex A should be eliminated, and that of under Annex B should be restricted. Annex C deals with substances that are unintentionally produced. The Convention also regulates the handling of stockpiles, as well as products and articles in use and wastes consisting of, containing, or contaminated with, one or more of the POPs covered under the Convention.

When coming into force in 2004, the Stockholm Convention covered 12 POPs. In May 2009, the Conference of the Parties to the Convention adopted the decision of adding nine new POPs. Included in the new nine POPs are commercial PentaBDE (Penta brominated flame retardants: tetra- and penta bromodiphenyl ether) and commercial OctaBDE (Hexa- and hepta-bromodiphenyl ether). These two substances are reported to be in use in many products. The Convention was therefore amended so that there is a possibility for a country to be exempt from banning the use of the substances. In this case, the country may allow the recycling of articles that (may) contain Penta BDE or Octa BDE, as well as the use and final disposal of articles manufactured from recycled materials that (may) contain Penta BDE or Octa BDE, provided that “the recycling and final disposal is carried out in an environmentally sound manner and does not lead to recovery of” Penta BDE and Octa BDE “for the purpose of their reuse (Part IV and V of Annex A, Stockholm Convention).

One of the products in which Penta BDE or OctaBDE has been widely used is textiles. Canada is among the countries that opted for exemption. In answering the questionnaire issued by the Stockholm Convention secretariat, the Canadian government indicates lack of data regarding, among others, in which products these substances are used (Canadian Government, n.d.). It was observed that the situation surrounding the Stockholm Convention raised high interest in the EPR legislation for textiles among the policy makers in Canada (Lindhqvist, personal communication, 2012). In the case of EU, the use and placing on the market of these brominated flame retardants, as well as products that contain

them, have been prohibited since 2003 via Directive 2003/11/EC.²⁸ This on the one hand would reduce the existence of these substances in the EU. On the other hand, as Brunn Paulsen et al. (2011) indicates, brominated flame retardants are still found in textiles in society. Although the magnitude of the problem might be lower, there could still be uncertainties regarding the whereabouts of these substances in Europe.

Labelling schemes²⁹

There exist a number of eco-labelling schemes that set criteria for the textile sector (UNEP DTIE/Chemical Branch 2011; Brunn Paulsen et al., 2011). Among them we looked into the criteria set in the schemes that are geographically most relevant for the Nordic countries (the EU eco-labelling scheme,³⁰ the Nordic Swan label and the Swedish Good Environmental Choice label), as well as a few other labelling schemes (the Global Organic Textile Standard (GOTS), OEKO_TEX® Standard 100 and the Global Recycle Standard).

The EU eco-labelling scheme for textile products addresses, in principle, water pollution during the manufacturing process, which includes fibre production, spinning, weaving, knitting, bleaching, dyeing and finishing. The scheme sets the criteria for 1) manufacturing of textile fibre, 2) manufacturing of textile products and 3) fitness for use. The scheme covers both natural and synthetic fibres. The criteria include restriction in the use of various chemicals and heavy metals (Annex, Commission Decision (2009/567/EC)).

The Nordic Swan label for textiles first requires the compliance to the criteria found in the EU eco-labelling scheme, and adds a number of supplementary criteria specific to the Nordic Swan. The additional issues covered in relation to the environment include the provision of information about the product, organic production of natural fibres, energy

²⁸ Directive 2003/11/EC of the European Parliament and of the Council of 6 February 2003 amending for the 24th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodiphenyl ether)

²⁹ Among the labelling schemes discussed, the Swedish Good Environmental Choice label is a national label. However, as the content of the programme is closely related to other labelling schemes of wider geographical coverage, we include the description of the Swedish eco-labelling scheme here instead of having a separate section under the national policy measures. Similarly, some of the labelling schemes discussed in this section, such as Global Organic Textile Standards, OEKO_TEX® Standard 100 and the Global Recycle Standard, have been developed/organised without direct government interventions. However, a brief description of these schemes are included here for the ease of organisation of the report.

³⁰ The criteria currently valid is set in Commission Decision of 9 July 2009 establishing the ecological criteria for the award of the Community Ecolabel for textile products (2009/567/EC). The previous version was established in 2002.

and water consumption, ethics and recycling systems. Concerning recycling system, the criteria stipulates the conformity with national laws and agreements among the business actors in relation to recycling of products and packaging (Nordic Ecolabelling, 2011).

Both the EU and the Nordic labelling scheme include specific provisions for the use of recycled fibres. Namely, when using the recycled fibre – the fibre originated from cuttings from textile and clothing manufacturer or from post-consumer waste – requirements given to specific types of fibre manufacturing does not have to be met. However, in order to be considered equivalent to meet the criteria for fibre manufacturing, at least 85% by weight of all fibre in the product must be of recycled origin (Annex, Commission Decision (2009/567/EC); Nordic Ecolabelling, 2011).

Similarly to the EU eco-labelling scheme, the Swedish Good Environmental Choice label for textile, since 1996, sets standards for both fibre production and the production of textile products. Up until 1 April 2012, there were possibilities for producers to apply only for the production process, or both production process and fibre production (Naturskyddsföreningen, 1996). Similarly to the EU and the Nordic eco-labelling schemes, recycled fibre is considered to meet the criteria for fibre production (Naturskyddsföreningen, 1996). In addition, specific criteria for second-hand products have also been established and such products have been eco-labelled,³¹ and as of 2012, 30 out of 79 licenses are awarded to second-hand products between 2008 and 2011 (Naturskyddsföreningen, 2012b).

The latest criteria document for the Swedish Good Environmental Choice label valid from 1 April 2012 requires all the licensees to meet criteria set both for fibre production and production process of textile products. Meanwhile, depending on the level of the achievement, producers can choose to go for Class I (most stringent) or Class II. The latest Good Environmental Choice label set specific criteria for 1) second-hand – reused textile – and 2) re-design – reused and altered textile. The second-hand for textile is defined as a textile product that has been collected after it is used by a consumer or another user. So long as they do not contain polyvinylchloride (PVC), the second-hand textile products

³¹ Interview with Ms. Weronika Rehnby who is in charge of Good Environmental Choice eco-label for textile indicated that criteria for second-hand products have been incorporated into the criteria document from 1996 in recent years. However, we could not find the inclusion of such criteria in the English translation of the old criteria found on the website of the Good Environmental Choice labelling board at the time of this report writing in 2012.

that are sold without remaking are qualified for Class I products. Re-design for textile is defined as new design made of reused material or production spills. The re-designed textile product must not include PVC, and the accessories (e.g. buttons, buckles) need to meet the requirement set for new textile products unless also coming from second-hand materials. When alternation such as printing and dyeing takes place, requirements relevant to the specific production processes need to be met, and based on the level of compliance to the requirement, the re-designed products can be classified as either Class I or Class II products (Naturskyddsforeningen, 2012a).

As illustrated above, existing eco-labelling schemes can encourage the use of recycled materials and or reuse of second-hand products. There is also a standard called Global Recycle Standard, which allows producers to state the content of the recycled products in their products. Producers that use the Standard must include in their label the percentage of pre-consumer recycled materials (production waste) and post-consumer recycled materials. Global Recycle Standard has been used by, among others, members of Textile Exchange, a non-profit membership-based organization that is committed to “the responsible expansion of textile sustainability across the global textile value chain”, with their stated specific focus being on organic cotton (Textile Exchange, n.d.). As of 26 March 2012, members of Textile Exchange from Nordic countries include Dibb International, H&M, KnowledgeCottonApparel, Lindex, MQ, Novozymes and Nudie Jeans (Textile Exchange, 2012).

In addition to these labels, the Global Organic Textile Standard (GOTS) set standards for production process as well as packaging, labeling, trading and distribution for textile products made at least of 70% organic natural fibres certified by globally recognized organic farming standard (International Working Group on Global Organic Textile Standard, 2011). The Swedish Good Environmental Choice eco-label recognises certification by GOTS products for the fulfilment of part of their criteria (Naturskyddsforeningen, 2012a).

Unlike the four eco-labelling schemes mentioned above, the OEKO-TEX® Standard 100 focuses on the effects of chemicals in the products on the users of the products and set standard accordingly. The organization running OEKO-TEX® Standard 100 introduced OEKO-TEX® Standard 1000 for the certification of production process as well (OEKO-TEX® Institutes n.d.).

4.1.2 National policy measures

There could be a number of policy measures that are potentially applicable for textile waste prevention at the national level.³² The description in this section is limited to measures whose (consideration on) introduction and/or implementation can be confirmed through written sources. In addition to the measures found in this section, we will discuss the potential application of a handful of policy instruments under Section 4.3: many of these instruments can be introduced either within or outside of an EPR programme.

Extended producer responsibility (EPR) for textiles

As mentioned earlier, the application of EPR on textiles has been limited. It was discussed as potential policy measure as early as mid 1990s in Sweden (Naturvårdsverket, 1995), but no concrete policy measures was actually introduced since then.

One of the exceptions is France, where producers, distributors and importers of clothes, linen and foot wears became responsible by law since June 2008 for providing or managing the recycling of their products once the products come to their end-of-life. They can fulfil the responsibility either on their own, or by joining a scheme accredited by the French public authority. EcoTLC is the only organization in France so far that received the accreditation by the French public authority and has been running the collection, sorting and recycling system on behalf of their members. The member companies pay fees based on the volume of products put on the market the previous year (EcoTLC, n.d.).

Another development is found in the State of California, where a mandatory EPR program was introduced for carpets under California Assembly Bill 2398 (AB2398). The law came into force in September 2010, with the main policy driver being increased landfill diversion and recycling. Under the bill, manufacturers, wholesalers and importers are considered as producers. They need to submit a so-called stewardship plan which includes the goals for increase in recycling, diversion from landfills, recyclability and the like. Similarly to the French system, they

³² See, for instance, a study on product-oriented policy instruments and their potential mixture by Tojo and Lindqvist (2010), which includes a number of policy measures that directly or indirectly address waste prevention. A study by Nordic Council of Ministers, Danish Ministry of the Environment and Copenhagen Resource Institute (n.d.) also discusses various potential policy measures to promote sustainable consumption and production via food retail sector. Although neither of the studies address textile sectors specifically, a portfolio of policy measures pertaining to waste prevention can be found.

have the choice of fulfilling their responsibility on their own, or join an organisation which fulfills their responsibility on their behalf.

The Canadian government, through its action plan for extended producer responsibility, list textile and carpets to be one of the targeted products for the next round of EPR legislation (Canadian Council of Ministers for the Environment).

Green public procurement

Another policy measure that can be applied to textile is green public procurement. One concrete example is the criteria set for textile products such as uniforms, hats and curtains in the Green Public Procurement Law in Japan. Coming into force in 2001, the Green Public Procurement Law in Japan obliges all the public entities in Japan to include environmental criteria for their procurement, and set criteria for some 60 plus product categories commonly used in these organizations. For textile products mentioned above, when made of synthetic materials, one criteria concerns the percentage of the recycled materials used in the products. The existence of collection and recycling infrastructure was also included as criteria for consideration (thus not mandatory). In the most updated criteria that came into force in February 2012, the latter is included as mandatory criteria for at least hats.

4.2 Extended Producer Responsibility and waste prevention

Before discussing issues around extended producer responsibility (EPR) and waste prevention, we provide a concise overview of EPR-based policies, which would serve as the building blocks for the analysis in the next section (4.3). It subsequently discusses some of the key implementation issues related to EPR and waste prevention. It further highlights a few other issues that have been considered important for effective implementation of EPR-based policies.

4.2.1 *Basic characteristics of extended Producer Responsibility*

What is extended producer responsibility?

Extended Producer Responsibility (EPR) can be defined as a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the

product to various parts of the product's life cycle, and especially to the take-back, recovery and final disposal of the product (Lindhqvist, 2000).

To date, the application of EPR is pre-dominantly related to the reduction of environmental impacts arising from the end-of-life phase of products. Through the provision of responsibility to manufacturers of the products for end-of-life management of their products – the weakest link in the product chain – EPR-based policies seeks to provide incentives to the manufacturers to consider, already at the *design phase* of the product/system surrounding the products, how they could reduce environmental impacts arising from the end-of-life phase of their products. What distinguishes EPR from other policies addressing end-of-life/waste phase of products, including a mere take-back scheme, is this creation of feedback mechanism between the downstream and the upstream of products – and thus *waste prevention*.

Two main policy goals

The goals of these policies based on extended producer responsibility can be divided into two categories based on the stages of life cycle the actual measures take place. One is the improvement of system and product design, and the other is the high utilization of products and material quality through effective collection, reuse and recycling (Lindhqvist and van Rossem, 2005). The former – the *upstream improvements* – refers to the *preventative actions* mentioned above. This can be done, among others, through the selection of environmentally superior materials, design that allows easy-repair/reuse, design for longevity, to name but a few. The latter – *downstream improvements* – consists of three sub-components: effective collection, enhanced reuse and recycling and environmentally sound treatment.

EPR-based policy instruments

As of now, EPR-based policy has been most commonly used for products such as packaging, electrical and electronic equipment, cars and batteries. These products possess different characteristics concerning, for instance, the number of materials used within a product, complexity, inclusion of toxic substances, durability/longevity, size and weight, the structure of the industry, and the like. They have been introduced to countries with various demographical, socio-economic and cultural settings. Reflecting these differences, the concrete design of EPR programmes as well as the means of implementation differs from one programme to another. One way of analyzing an EPR programme is to look at the types of policy instruments used. Table 4.1 provides examples of EPR-based policy instruments found in existing EPR programmes.

Table 4.1: Examples of EPR-based policy instruments

Administrative instruments	Obligation to collect and/or take-back discarded products, substance and landfill restrictions,* achievement of collection, reuse (refill) and recycling targets, fulfilment of environmentally sound treatment standards, fulfilment of minimum recycled material content standards, product standard, utilisation mandates**
Economic instruments	Material/product taxes, subsidies, advance disposal fee systems, deposit-refund systems, upstream combined tax/subsidies, tradable recycling credits
Informative instruments	Reporting to authorities, marking/labelling of products and components, consultation with local governments about the collection network, information provision to consumers about producer responsibility/source separation, information provision to recyclers about the structure and substances used in products

* Some exclude substance and landfill bans from EPR-based policy instruments.** Utilisation mandates refer to the situation where producers should achieve certain reuse and /or recycling targets, but do not have to use them within their own activities.

Source: Tojo (2004) adopted from Lifset (1992), OECD (2001), Stevens (2004), Walls (2004).

Each of the instruments has different goals to achieve, and it would be important to consider their use in light of the specific policy goals.

It should be stressed here that *many of the policy instruments listed above can be implemented independently, without being part of an EPR programme.*

Typologies of responsibility

A programme could also be assessed based on the type of responsibilities provided to different actors. The responsibility can be categorized into physical responsibility, financial responsibility, informative responsibility, liability and ownership (Lindhqvist, 1992).

4.2.2 EPR and waste prevention

Individual vs. collective responsibility

Concerning responsibility, another important distinction can be made especially in relation to upstream changes/waste prevention. That is, in essence, “if a producer takes responsibility for the end-of-life management of their own products (*individual responsibility*) or producers in the same product group together fulfil their responsibility for the end-of-life management of their products regardless of the brand (*collective responsibility*)” (Tojo, 2004). It has been argued that implementation of individual responsibility is crucial in order to induce upstream changes – that is, the reduction of environmental impacts downstream by changing the design of products/systems surrounding the products. If, for instance, producers pay the same fee for the end-of-life management of their products regardless of the level of design-for-end-of-life, producers

that provide products with higher design-for-end-of-life ends up subsidizing those who do not. This would not provide incentives for producers to further their design-for-end-of-life.

The question in this regard is, how we can differentiate the responsibility of producers so that EPR programme indeed provides incentives for upstream changes. Implementation of individual responsibility is relatively straight forward when an individual producer has his/her own collection and recycling infrastructure (a pure form of individual physical responsibility). A notable example of companies that carry out individual responsibility in this way is copying machine manufacturers, such as Fuji-Xerox and Ricoh. In the textile sector, companies participating in Teijin Fiber's Eco Circle initiative also carry out individual physical responsibility for the collection of their products. In these cases, the company would pay for the management of infrastructure they themselves manage.

However, when a large number of manufacturers as well as importers (who are considered as producers in virtually all the existing EPR programmes) exist in one geographical area, it may not be very practical for all producers to have their own individual infrastructure. In order to implement individual producer responsibility, it then becomes necessary to find a way where producers pays for the end-of-life management of his/her own products, while sharing (a) common physical infrastructure(s) for end-of-life management with other producers. This requires, in essence, for producers sharing the same physical infrastructure to agree upon the basis on which the differentiation of the size of end-of-life fee is made. This is not so difficult when the variables is limited in numbers (e.g. mercury free vs mercury containing batteries, the materials used in the packaging, the number of components in one packaging). However, it becomes very difficult in the case of more complex products, such as electrical and electronic equipment, where there could be a number of variables relevant for differentiation (e.g. type of materials, size of the product, ease of disassembly, toxicity of the products, etc). It becomes even more difficult when the life-time of the products is long, as various factors that determine the recycling cost, such as available recycling technology, requirement in legislation, the price of recycled materials, etc. may change during the life time of the products.

Tojo (2004) sought to define individual producer responsibility through the examination of implementation of a number of EPR legislation in different countries. She found that there existed a number of EPR programmes that contains/contained elements of/potential for individual producer responsibility. She also systematically investigated the factors

influencing the design strategies of the producers and found that anticipation of EPR legislation was a tangible promoting factor for manufacturers to strive for design improvement related to end-of-life. During the anticipation phase, producers tend to consider that they would take back their own products (individual producer responsibility). She documented various measures taken by manufacturers of cars and electrical and electronic equipment to enhance the closure of material loop. Such measures include both change in the type of materials used, as well as those that enhance ease for dismantlement, recyclability, and the like.

Another example is from the EPR programme for packaging in Germany. The record of changes since the early 1990s indicate a clear decoupling of the change in overall amount of packaging material put on the market and that in GDP (DSD, as cited in Tojo et al., 2006). However, systematic studies of EPR and design change are limited, and among the existing studies some are quite negative on the effect of EPR programmes on waste prevention (van Rossem, 2008). In addition, regarding the so-called WEEE Directive,³³ despite being the first Directive that clearly allocates individual financial responsibility for future WEEE³⁴ (Article 8 Paragraph 2), many of the EU member states have not transposed the Directive that way (Sander et al., 2008). This limits the possibility of evaluating the waste prevention effect of EPR programme implemented based on individual producer responsibility.

It should be worthwhile noting, however, that a handful of EEE producers, together with NGOs, an insurance company and researchers, have been advocating individual producer responsibility. Not satisfied with the current transposition and implementation of the WEEE Directive, they have been searching for concrete alternative mechanisms to implement individual financial responsibility in physically collective schemes.

Historical and orphaned products

Another challenge pertaining to individual producer responsibility is the handling of so-called historical waste and orphaned waste. Historical waste referred to the waste generated from products put on the market prior to the coming into force of an EPR program. Orphaned waste is the

³³ Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on the waste electrical and electronic equipment (WEEE).

³⁴ Waste electrical and electronic equipment (EEE) that arise from EEE put on the market after the Directive came into force.

waste generated from a product whose producer has disappeared from the market when the product becomes waste. For the former, the design change incentive does not exist for producers. For the latter, some resources need to be set aside so that there is sufficient resource for recycling despite the disappearance of producers. In the case of the WEEE Directive, producers need to set aside some form of financial guarantee (Article 8 Paragraph 2). However, many Member States set the requirement in such a way that favour producers that join a collective scheme over those who have alternative systems (Sander et al., 2008). This has created another hindrance for implementing individual responsibility.

Municipality as the collection entity

In many countries that have functioning waste management systems, municipalities have often been the entities that organize local waste management systems. Thus even when an EPR programme comes into being, municipalities often continue to collect the waste stream covered by the EPR programme. In addition to the challenge related to the “ownership of waste” (see Section 3.1), this turns out to create another hindrance to the implementation of individual producer responsibility. When municipalities manage the physical collection, the cost of the collection is often – unless otherwise agreed upon – borne by municipalities as well. If a producer established a separate collection infrastructure, such support from the public money does not exist, giving a default disadvantage to those who would opt for alternative systems. Moreover, municipality would not want to sort/distinguish products based on brands/properties, which makes the practical implementation of individual producer responsibility quite difficult.

4.2.3 Other issues relevant for EPR implementation

Achievement of downstream improvement

In order for the feedback mechanism to work, the establishment of downstream infrastructure is equally important. For downstream improvements, the use of various policy instruments – collection targets, recycling targets, requirement to include certain amount of recycled materials, standard for treatment facilities, to name but a few – needs to be carefully considered. Of importance in relation to collection is the convenience, financial incentives and information given to actors (often consumers).

Who are the producers?

Another important aspect to consider is the definition of producers. In the existing EPR legislation for electrical and electronic equipment as well as cars, it is the manufacturer of the final products as well as the actor who put the product on the market in question (importers and in some cases distributors) who have responsibility. This is practical from policy implementation point of view i.e. it would be very difficult to identify various actors in the supply chain, not to mention to require specific measures to be taken by these actors. The producers of the final products are also good entities to address for inducing upstream changes, as they make ultimate choices as to which materials they use in their products. However, the question arises when components of the product starts to be replaced by other components, without the control of the original producers. The replacement of various components typically happens in the reuse market. Who should be the producer in this case, and how should the financing be managed?

EPR across the border?

Finally, an EPR system is typically financed by having a pool of fees gathered from producers in a country where the EPR system is operated. The money collected essentially covers the cost of end-of-life operation within the country. A challenge in this regard is how to financially support the end-of-life management of the products that leave the country. From the perspective of a country receiving such products, unless there is a system to have one entity (e.g. importer of reused products) that can be considered as producers, the problem of orphaned products occur. In addition, the products tend to move from an economically wealthier country to a less wealthy country. The availability of financial resources would be even more important for the recipient country. As of now, we have not seen any example where financial resources pooled in one country is transferred and used in the end-of-life management in another country. The issue is highly relevant for textiles as currently the majority of post-first-consumer textile products collected in the country where the first consumer resides, are sent outside of the national border for further reuse. Another important consideration in this regard is the distinction between the reuse textile products versus textile waste.

4.3 Potential and limitations for applying the concept of extended producer responsibility for textile

In light of the various aspects of EPR programme mentioned in Section 4.2 as well as the situation of the waste flows (Chapter 2) and the view of stakeholders (Chapter 3), we can consider what an EPR programme for textile in the Nordic countries may look like. As discussed in Section 4.2.1, the goals of EPR policies can be categorised into two – *upstream improvements* and *downstream improvements* – the latter is further divided into *effective collection, enhanced reuse and recycling, and environmentally sound treatment*. In order to clearly indicate which specific measures might be useful for specific policy goals, the analysis of the policy instruments/measures are conducted in four separate sections divided in accordance with these policy goals. A number of these instruments have *potential to address more than one policy goals*. For instance, take-back obligation have potential to address all four policy goals: it could provide incentives to producers to consider end-of-life feature of their products (upstream improvements) and to ensure the quality of the recycling activities (environmentally sound treatment, and could facilitate the development of infrastructure for collection (effective collection) and for recycling (enhanced reuse and recycling). Therefore, *the same policy instrument may appear in more than one section*.

To ease the organisation, the analysis is put together in the form of tables. For each policy instrument suggested, the typology of the instrument, the rationale for suggestion (including potential success factor) as well as issues that require careful consideration, are indicated. In addition, other policy measures that would facilitate the respective improvements are discussed.

As noted earlier, it should be emphasized that *many of the instruments listed below can be used independent of it being part of an EPR programme*.

4.3.1 *Upstream improvements to reduce end-of-life impacts of textile products*

Instrument (type)*	Rationale	Issues to be considered	Note
Restriction of the use of certain chemicals (A)	Straight forward design requirement. Experience suggests that it is one of the most effective policy measures in EPR programmes.	Resistance of the industry, may require regional (i.e. EU-wide) legislation due to internal-market harmonization requirement.	A proposal for EU-wide standards is currently developed by the Swedish Chemical Inspectorate (KEMI, 2012)
Achievement of recycling targets (A)	Provision of incentives to producers to consider recyclability of products/materials at the design phase	To reward proactive producers an individual producer responsibility would be needed, but it may face implementation challenge	
Take-back obligation (A)	Provision of incentives to producers to consider the end-of-life feature of their products in general, encourage producers to work on design for longevity	To reward proactive producers an individual producer responsibility would be needed, but it may face implementation challenge	
Recycled material content requirement (A)	Straight forward design requirement	May hamper innovation To apply across the different materials would impact design and function Potential trade barrier	Have been used as eco-labelling criteria or green procurement criteria for specific materials
Labelling requirement on chemicals (I)	Enhance communication among upstream actors as well as other actors in the products' life cycle, the system already exists for materials, which might ease the inclusion of additional information	Information overload Challenge of creating chemical in product systems that are practically and financially feasible.	Currently discussed internationally under the UNEP led CiP (Chemicals in Products) project, which is mandated under the SAICM (Strategic Approach to International Chemical Management) process.

* A stands for Administrative instrument, E stands for economic instrument and I stands for informative instrument.

In addressing the issue of prolongation of product life that can be taken upstream, one could consider measures such as R&D grant for the development of durable and functional materials, as well as award for the development of such materials/products.

From the consumer's side, another interesting factor for the prolongation is the initial price of the products as well as the availability of tailors/mending service that is affordable for consumers. Concerning the former, the production of quality products most likely leads to higher initial price. A possibility could be to provide information to consumers regarding the initial cost and the durability. Unlike, for instance, EEE, the

cost during the use phase may not be that different between products (except for maintenance cost in some cases, such as impregnation for sportswear). Thus the use of total life cost concept may not apply for most of the textile products. It would then be the quality and the durability that are the likely selling points. Meanwhile, the rise of the initial price may create undesirable social consequence – putting more burden on people with lower incomes than those with higher incomes.

Concerning the tailors/mending service, similarly to the demand for recycled materials and their market, it is a chicken-and-egg situation. An information campaign for the availability of such service could be one idea to make people realise that there is such possibility. Prolongation of the guarantee period for some clothes (e.g. sportswear) and make it possible to have producers/retailers fix the products may also have potential. Another possibility includes the waiver of VAT for mending services.

4.3.2 *Downstream improvements to reduce end-of-life impacts of textile products*

The policy goals for downstream improvements in EPR programmes can be further divided into three elements – effective collection, enhanced reuse and recycling and environmentally sound treatment.

Effective collection

Instrument (type)*	Rationale	Issues to be considered
Collection targets mandated to producers (A)	Provision of incentives to producers to development good infrastructure for collection, measurability of the target, enhance collection	Concrete ways of setting the target (weight? %? If %, what should be the denominator?), potential acceleration of consumption, hindrance for existing collection conducted by e.g. charity organisation and risk of hampering reuse
Take-back obligation (A)	Enhance the development of infrastructure for collection	Balancing the interest of existing actors in the market (e.g. charity organisation) and risk of hampering reuse
Recycled material content requirement (A)	Encourage collection of recyclable materials	
Requirement to ensure convenience to consumers (A)	Secure good infrastructure for collection	Resistance of the producers due to higher cost, hindrance for existing collection conducted by e.g. charity organisation and hamper reuse
Buy-back system/provision of some bonus point (E)	Encourage consumers to bring back clothes that they do not need any more	High administrative burden, may lead to increase consumption, if organised centrally, may hinder the continuation of already existing initiatives.

Instrument (type)*	Rationale	Issues to be considered
Labelling requirement for materials (I)	Ease sorting	
Information requirement for consumers regarding the collection system (I)	Enhance collection	

* A stands for Administrative instrument, E stands for economic instrument and I stands for informative instrument.

In promoting effective collection that leads to reuse and recycling, as stressed by interviewees (Section 3.1), a clarification regarding who legally owns the waste needs to be made. As found in Finland (Waste Act), it could be stated in the legislation. On the one hand, some municipalities may concern loss of input into waste incineration. On the other hand, unlike other waste streams that became subject to EPR legislation such as WEEE and batteries, none of the three case countries have been allocating responsibility for separate collection to municipalities. Thus the resistance from municipalities might be smaller.

In the case of textile, it is the charity organizations who have been the primary actor in charge of collection of textile waste in all the case countries. They are also the main actor who facilitates reuse. Careful consideration needs to be made so that the collection at sites other than organised by charity organizations do not hamper reuse and the activities of existing legitimate actors on the second-hand market. A possibility could be collaboration between second-hand shops and producers: the collected textile could be reviewed and sorted by second-hand shops, while the producers may provide financial resource for this. Instead of the collection target, a possibility is to set diversion target from municipal solid waste stream. A foreseeable challenge in this case is the actual measurement.

A care should be also made so that the initiatives organised by individual producers should not be hampered by the introduction of nationwide EPR system. If a collection target is introduced, there should be a mechanism to account for the collection organised by individual producers. Here something similar to the clearing house in the case of electrical and electronic equipment may become necessary.³⁵ The introduction of diversion target helps avoid the problem. Nevertheless, as discussed by some producers already, perhaps some type of financial incentives may

³⁵ For more information on the clearing house, see, for instance, van Rossem (2008).

become necessary for individual producers to collect their own products back in places such as retail shops.

Enhanced reuse and recycling

Instrument (type)*	Rationale	Issues to be considered	Note
Quality standards for recycled materials (A)	To enhance the development of relatively clean stream of recycled materials, which would in turn create demand for such materials, enhancement of sorting which may lead to job creation	Current lack of manpower for sorting	Development of automated sorting technology in progress
Achievement of recycling targets (A)	Measurability of the target, enhance recycling, provision of incentives to various actors to invest in recycling technologies, creation of relatively clean stream of recycled materials, which would in turn create demand for such materials, enhancement of sorting which may lead to job creation	Current lack of manpower for sorting, lack of domestic recycling potential, more effective recycling abroad?	Development of automated sorting technology in progress
Take-back obligation (A)	Enhance the development of infrastructure for recycling	Domestic take-back obligation do not capture products going outside of the national boarder as second-hand products	
Recycled material content requirement (A)	Enhance the market for recycled materials	To apply across the different materials would impact design and function	
Incineration/landfill tax (E)	Encourage actors who collected used textile to find ways to reuse or recycle them		Already used in some Nordic countries
Tax on the use of virgin products (E)	Provision of incentive to producers to use recycled products	Resistance of material producers, lack of strong political will, potential political issues between nations	
Labelling requirement for materials (I)	Enhance the sorting for recycling		

* A stands for Administrative instrument, E stands for economic instrument and I stands for informative instrument.

Conventional EPR-based policy does not contain many measures for the enhancement of reuse. Some of the issues that need to be addressed include:

- Increase in the domestic sales of second-hand clothes
- Wider utilization of tailor/mending service
- Increase in the man power for sorting for reuse based on the characteristics of the specific markets

The current increase of various initiatives to enhance the clothes exchange may solve part of the first problem. Second-hand shops could become more attractive by becoming specialized in certain items. In addition to vintage boutiques that already exist, second shops could sell specific items such as coats, skirts, pants and the like. This would provide more certainties to consumers that they may be able to find items that they are looking for without visiting many second-hand shops. Similarly to the second-hand book shop, the trade/exchange between different second shops could enhance such specialization. Roles of the government in these regards may be quite limited, but they could promote such practice by making information available. They could also engage tailors/mending shops when discussing possible system for reuse/recycling.

Regarding sorting, as has been conducted in Finland (Section 2.10), it could create employment opportunity for socially disadvantaged people (see, for instance, Fisher et al., 2011). Sorting is also essential for the enhancement of the use of fabrics for purposes different from the original purpose. As discussed in Section 3.3.2, development of sorting technology for textile recycling may reduce/eliminate the need of human labour. However, the sorting of textile products for reuse still require man power.

Environmentally sound treatment

Instrument (type)*	Rationale	Issues to be considered
Restriction of the use of certain chemicals (A)	Ensure that chemicals in the products do not cause harm to workers or the environment in the end-of-life phase, enhance recycling	
Operational standards for treatment plants (A)	Ensure environmentally sound treatment	Challenges in imposing standards outside of the national border
Take-back obligation (A)	Provision of incentives to producers to ensure the quality of the recycling activities	Depending on how the system is organised, it may create oligopoly and hinder new entrants to the market
Labelling requirement for materials (I)	Enhance sorting for recycling	

* A stands for Administrative instrument, E stands for economic instrument and I stands for informative instrument.

4.3.3 *Other issues*

Similarly to the electronic sector, textile industry is known to have very long and complex supply chain (Kogg, 2009). In an EPR system for textile, it would be most practical to define manufacturers and importers of final products as the producer.

5. Synthesis and proposal for government officials and stakeholders

In this concluding chapter, a summary of, as well as our reflection on the findings from the study are provided.

5.1 Summary of the textile flow in three Nordic countries

Table 5.1 provides a summary of the flow of textile products in the three countries examined in this study. The table consists of six parts: *Use* (A: the sum of in-flow of new products and domestic purchase of second-hand products); *Collection* (B: the sum of collection by second-hand actors and collection of textile waste in mixed waste); *Treatment* (C: the sum of textile waste recycled, incinerated and landfilled); *Export of second-hand products* (D); *Total out-flow* (E: the sum of Treatment (C) and Export of second-hand products (D)), and the *Gap* between total use (A) and total out-flow (E). To ease comparison, in all parts, we provide the figure of 1) weight of *textile flow per capita* in three countries as well as the average of the three countries, 2) *proportion of the respective flow* in comparison to the total use of textile, in three countries as well as the average of the three countries, and 3) the *total quantity* of the respective flow in three countries.

Table 5.1: Proportion and amount of textile products and waste in various stages of use, collection and end-of-life treatment, in Denmark (2010), Finland (2010) and Sweden (2008)

	Denmark		Finland		Sweden		Total, three countries (tonne)	Per capita average (kg)	Average proportion to total use (%)
	Per capita (kg)	Proportion to total use (%)	Per capita (kg)	Proportion to total use (%)	Per capita (kg)	Proportion to total use (%)			
Use (A)									
Overall in-flow of textile products (A1)	16.0	97	13.1	91	14.2	98	290174	14.4	96
Domestic purchase of second-hand textile products (A2)	0.5	3	1.3	9	0.3	2	12600	0.6	4
Total use of textile products (A1+A2=A3)	16.5	100	14.4	100	14.6	100	303674	15.0	100
Collection (B)									
Used textile products collected by second-hand actors (B1)	6.3	38	4.7	32	2.8	19	86000	4.3	28
Used textile mixed in municipal waste (B2)	4.4	27	9.3	65	7.6	52	144300	7.1	48
Total collection of used textiles (B1+B2= B3)	10.7	65	14.0	97	10.4	71	230300	11.4	76
Treatment (C)									
Textile waste recycled (C1)	Negligible		1.9	13	Negligible		10070	0.5	3
Textile waste incinerated (C2)	5.6	34	2.4	17	8.0	55	116640	5.8	39
Textile waste landfilled (C3)	0	0	7.2	50	0	0	40210	1.9	13
Total textile waste (C1+C2+C3=C4)	5.6	34	11.5	80	8.0	55	166920	8.3	55
Export of used textile products (D)	4.7	28	1.2	8	2.1	14	51230	2.5	17
Total out flow (C4+D=E)	10.3	62	12.6	88	10.1	69	218150	10.8	72
Gap between use and out-flow (A3-E)	6.2	38	1.7	12	4.5	31	85524	4.2	28

Source: summary of the findings presented in Chapter 2 of this report

The numbers summarised above as well as review of the situation in the three countries reveal that the three countries share similar characteristics, although there are differences in details.

- *Half of the textile products obtained by consumers are discarded as waste:* in all the three countries, significant amount of textile ends up in the waste management facility. It is especially significant in Finland and Sweden where more than half of the amount of textile products obtained by consumers are discarded as waste in the municipal waste stream. The total amount in the three countries

becomes close to 145,000 tonnes (B2 in Table 5.1). As it stands now, the vast majority of those discarded textiles are incinerated or landfilled (C2, C3). According to KEMI (Swedish Chemicals Inspectorate) (2012), every kg of prevented textile waste saves 15 kg of carbondioxide-equivalents. In comparison with other waste streams, it is considered that textile waste prevention generates the most significant climate impact per ton of prevented waste (KEMI 2012). The potential environmental benefits by avoidance of the textile waste might be very big.

- *Textile consumption has been increasing:* all the three countries experienced increase in the consumption of textile products. Meanwhile, the degree of increase is somewhat different. Denmark experienced an increase in expenditure on fabrics and clothing by 62% from 2003 to 2008, while the increase is considered modest in Finland. In Sweden, the quantity of products put on the market increased by 40% from 2000 to 2009. It should be noted that the increase in the expenditure may not correspond to the rate of increase in the quantity of textile products consumed. If the unit price of the individual clothes goes down, the increase rate of the latter could be higher than the former, and visa versa.
- *Charity organizations are the main entity in charge of collection:* in all three countries, there is a strong reliance on the charity organisations regarding the collection of used textile products. Denmark has experienced an increase interest among private consumers to reuse clothes – most notably the web-based private sales of used clothes. Similar initiatives in this regard are also found in Sweden. In Finland, flea market plays an important role in the commerce of used textile products. However, there is no data regarding the magnitude of the exchange
- *The quantity of second-hand products is based on many assumptions:* despite the apparent activities carried out by charity activities, the information on the quantity of second-hand textile products is somewhat unclear. As data is lacking, the estimation of the overall quantity need to be based on various assumptions. The uncertainty is accelerated with the lack of information on the quantity of private exchange via, for instance, Internet and flea market. It may explain the difference among the three Nordic countries in, among others, the domestic purchase of second-hand products (A2 in Table 5.1), the collection of used textile products by second-hand actors (B2) and export of second-hand products (D)

- *There are gaps between the total amount of textile used and those going discarded and exported:* in all three countries, there are some discrepancies in the amount of textile products put on the market and out-flow of the products (F in Table 5.1). In addition to a number of assumptions mentioned above, it may also have to do with the *hoarding effects*
- *The flow at the user phase (institutional vs. private users) is not well known:* in all three countries there are institutional users as well as private users, although the amount of textile products going to the respective group of users is unclear
- *Very limited recycling of fabric for other purposes takes place:* in all three countries, the recycling of textile for purposes different from the original ones – such as industrial wipe, use in special machines and car mechanics – takes place, although to a rather limited degree. This is estimated to be 13% of the amount of textile products obtained by the users in Finland, and the amount in Denmark and Sweden is negligible. Different entities are involved in this: some municipalities in Denmark, social firms, volunteers and municipalities in Finland, and in the case of Sweden, it is directly organised between the user (e.g. car mechanics, charity organizations) and the provider (institutional workers). Findings from the three case countries elucidates that the high labour cost and lack of man power for sorting have been the main bottlenecks to enhance this activity
- *Textile recycling industry has faded away:* in both Denmark and Sweden, some recycling facilities for textile waste used to exist, but they have faded away over the years
- *The flow of exported second-hand textile products is not well known:* More than half of the textile products collected by second-hand actors are exported. Meanwhile, what happens to these products after its first destination is not well known

5.2 Pathways for prevention of textile waste

As mentioned in the introduction the environmental impacts associated with textile waste can be reduced both through the reduction of the *quantity* of waste and through the improvement of the *environmental quality* of textile products (e.g. through a reduction of harmful substances in materials and products which reduce impacts throughout the life cycle including the end-of-life phase, or improved design that facilitate

reuse and recycling). Table 5.2 summarises existing and/or discussed policy actions pertaining to textile waste prevention as well as actions by private actors that have been taking place, identified in the course of this study. It also provides issues that require consideration when contemplating on further actions to be taken.

Table 5.2: Existing/discussed policy actions and existing private actions related to textile waste prevention identified in this study, and issues to consider

Areas	Existing/discussed policy actions	Existing private actions	Issues to consider
Reduction of Chemicals/hazardous substances	REACH (A, I), Stockholm, EU, national (FI, NO) on specific substances (A) various Type I labelling schemes (EU, Nordic, SW) (I), proposal of SW Chemical Inspectorate to the EU SAICM/CIP (A, I)	Sportswear manufacturer' initiatives to use alternative materials OEKO TEX label Manufacturers' measures in the upstream with the push of Greenpeace	Measures exist, but scattered: it may be advantageous to streamline and harmonise
Prolongation of products' life	SW Type I labelling scheme (I) (second-hand, redesign)	Sportswear manufacturer' initiatives of using durable materials More private initiatives started to appear (e.g. clothes exchange, internet second-hand shops etc.) Sales of second-hand products by fashion brands Charity organisations Collaboration between service providers of textile materials (e.g. sheets) and charity organisations/other users	Co-existence with existing measures
Collection of used clothes	Criteria in JP green public procurement (E), but in Nordic countries, as of now, no direct intervention EPR legislation (FR)	Charity organisations Sportswear brands (e.g. Teijin's Eco Circle) Stakeholder discussions Buy back systems, gift vouchers, bonus points and other financial incentives provided by manufacturers to consumers for collection	Co-existence with existing measures Environmental gains of the collection of waste textile Ownership of waste Destination of second-hand clothes
Recycling/use of recycled materials	various Type I labelling schemes (EU, Nordic, SW) considers use of recycled fibres as equivalent to complying with the requirements set upon respective virgin fibres (I) EPR legislation (FR)	Global Recycle Standard/brands' own initiatives Initiatives of tailors/mending companies for recycling	Lack of recycling facilities in Nordic Countries Current lack of input materials High personnel cost for sorting Destination of second-hand clothes Mandatory requirement in green public procurement
Environmentally sound treatment of textile waste	Stockholm Convention (A)		Destination of second-hand clothes

* A stands for Administrative instrument, E stands for economic instrument and I stands for informative instrument. Interventions include ISO Type I eco-labels.

Reduction of hazardous substances

With respect to the qualitative waste prevention there are several measures already in place. Eco-labels for textiles address chemical content, as do some national regulations and the EU wide REACH regulation.³⁶ Currently the Swedish Chemicals Inspectorate is proposing that restrictions regarding chemicals in textiles should be harmonized internationally, and at least in the first phase on an EU level (The Swedish Chemicals Inspectorate, 2012).

In this area, instead of reinventing the wheel, harmonisation of the standards found in existing policy instruments may be the way to go.

Reduced consumption of new textiles

With regards to reducing the quantity of textiles that goes to final waste disposal, there are three key pathways: i) reduced consumption of new textiles, ii) prolonged life span of textile products iii) the reuse/recycling of textiles that are no longer fit for their first intended use.

Partly this is a life style issue and one that may be difficult to address through single specific policy measures. Still it is worthwhile to further explore and analyze potential measures designed to encourage and facilitate more responsible consumption patterns in this context. Here information measures such as e.g. guidelines for responsible consumption and general information regarding the negative environmental impacts associated with textile production can be considered. One relevant measure that is already in place is the Good Environmental Choice eco-labelling programme which has special provisions in the criteria allowing second-hand garments to be labelled with the eco-label (Section 4.1.1).

There are also alternative business models that, while still rare and small in scale, potentially could play a role here. Such business models explore new models of ownership for garments and include initiatives such as e.g. rental firms for clothes worn at specific occasions (e.g. wedding) and clothing libraries.

Prolongation of life span of products (within national boundaries and beyond)

In this area, producers can play a crucial role by designing products that can last long. As highlighted in Chapter 3, some manufacturers interviewed during the course of this study have been already working on

³⁶ For a more comprehensive overview of relevant regulations related to health and environmental impacts from chemicals in products please see KEMI (Kemikalieninspektionen) (2012).

this via selection of functional materials. Such initiatives can be pursued further. Similarly to the development in, for instance, electronic industry, a design guideline that includes consideration on various environmental aspects, including longevity, can be developed in this area. In addition, penalty for manufacturing practices that deliberately shorten the products' life (e.g. sand blasting) can be also considered.

The life span of textile products can be prolonged by the encouragement of mending as well. For simple mending such as putting back a button that fell off, continued inclusion of sewing class in the primary school educational curricula may be sufficient. For more complicated mending such as fixing a broken zipper in a multi-layered garment, wider availability as well as higher visibility of mending service may play an important role. Reduction or removal of VAT from mending service could help enhance the availability of the service. In addition, municipalities can actively provide information about the mending service by, for instance, listing the service providers on the community website. Extension of guarantee period/service by brands is another possible measure to prolong the life span of textile products.

In all three countries studied, the primary entity that collect second-hand garments are charity organisations. Meanwhile, charity organisations have experienced difficulties in establishing a nation-wide collection network – it is financially challenging to set up collection points especially in remote areas. This is where other entities with more financial resources – public and/or private – could play an important role in filling in the gap.

Recognising second-hand garments as equivalent to meeting the criteria set on the new textile products in eco-labelling scheme would enhance the involvement of various actors in the second-hand sales. This is evident from the fact that 30 out of 79 licenses are awarded to second-hand products, including some high-end fashion brands, in the Swedish Good Environmental Choice label.

In all three countries studied, entrepreneurial designers who make the use of old textiles in the new products started to appear. The development of such business models could be explored by looking into, for instance, the success factors as well as hindrances in pursuing their business. Moreover, new business models that change the ownership structure of clothes, as found in initiatives such as clothing libraries, as well as rental firms for clothes worn at specific occasions (e.g. wedding), may also contribute in the prolongation of the life span of products.

Prolongation of the life span of products could be achieved also by pursuing the use of second-hand clothes beyond the national border.

This is already happening as found especially in the case of Denmark and Sweden. While this is positive from environmental point of view, careful consideration should be made in regard to the potential social and economic impacts that the large flow of second-hand textile products may induce to the recipient countries.

Recycling of textiles that are no longer fit for their first intended use

No matter how high the quality of the original materials might be, there comes the time where textile products cannot be used any more for its original purpose. However, there are various uncertainties regarding the non-reusable textile products. For instance, despite that many second-hand clothes collected in the three Nordic countries examined in this study are exported, we do not have a clear picture as to the final location where textile clothes becomes non-reusable anymore. Nor do we know the quality of textiles that are currently discarded as waste by consumers. What is the proportion of current textile waste that could have been reused, and what is the proportion of the non-reusable but recyclable textiles? Once such information becomes available, it would be useful to conduct cost benefit analysis of separating non reusable garments from the household waste stream. LCA studies that compare various options at the Nordic level to compare various options in terms of location of the recycling facility(ies), including the scenario where we conduct recycling outside of the Nordic countries, should be considered.

Interviews of the second-hand sector reveal that they generally do not cut out reusable fabrics or parts from used textile products which are not reusable as such but may contain reusable fabrics/parts. This could be a new business for second-hand sector, especially there is a small but growing interest among the entrepreneurs to use fabrics from old garments. The sorted fabrics could be also sold to hobby shops. Fabrics and accessories from non-reusable garments can be used as recreational activities for children where they can learn how to sew, which would help people feeling comfortable in mending their clothes later on.

5.3 Points and means for government interventions

As discussed earlier, there are a number of areas where *further studies are needed* to fine-tune policy actions, such as:

- Quality and type of textiles currently discarded as waste in the Nordic countries: what are the proportion between reusable versus non-reusable textile products? Among the non-reusable yet recyclable

textile products, what type of materials are there? What are the technological feasibility of sorting these materials?

- Cost benefit analysis of recycling the recyclables versus other means of treatment
- Paths and destinations for second-hand products that are exported
- Cost benefit analysis and life cycle analysis for various scenarios including the options of recycling outside of the Nordic countries: in analysing such scenarios, the potential social and economic impact on the recipient countries of second-hand products should be also considered

If the further research indicated above suggests that source separation and recycling in Nordic countries is environmentally beneficial, assigning responsibility for collection and recycling of textile waste to producers can be a policy option. In this case, in addition to the consideration that should be made with regard to existing initiatives (charity organisations and other legitimate actors on the second-hand market, individual producers who have established/will establish their own/alternative collection and recycling infrastructure), careful consideration should be made to ensure that producers receive some form of *incentives in making upstream changes (i.e. taking preventative measures)*. In addition, in case the responsibility for recycling is allocated to producers, means should be established so that municipalities do not hinder recycling of textile waste carried out by producers.

Namely, producers that opt for organising the physical infrastructure collectively should consider cost differentiation based on the recyclability of the materials used. Learning from the EPR system for packaging found in, for instance, Germany, the differentiation can be based on the type of materials (e.g; cotton, wool, synthetics, or mixture of various), the number of components (e.g. inclusion of buttons, zippers and others), ease of separation and the like. The concrete means of differentiation would depend, among others, on the available sorting recycling technology and can be left in the hands of producers. In setting up the financial mechanism, care should be also made on the differences between products that tend to end up in the waste stream (e.g. underwear) versus those that have higher potential to be brought in for reuse (e.g. coats, high-end sports wear).

In terms of qualitative prevention, there exist a number of measures that have been in place or discussed. In case some qualitative standards are to be included in a prospective EPR program, synergy can be made with existing/discussed measures – such as harmonised EU legislation

as proposed by Swedish Chemicals Agency or eco-labelling standards – by making reference to these measures. The Nordic countries can join forces in proposing such policy measures to the EU or in the international community.

In promoting second-hand products as well as enhancing recycling of textiles, the inclusion of second-hand products or recycled materials in the criteria for green public procurement can be considered. Setting up specific criteria for second-hand products and re-designed products, as found in the Swedish Good Environmental Choice label, can be further adopted in other eco-labelling schemes. Other economic and informative policy instruments (e.g. reduced VAT for mending service, information campaign for the availability of mending service and second-hand trade) can be used to encourage the prolongation of textile products' life.

6. References

- Affaldgenbrug. (2012). Tøj og sko. [On Line]. Available: www.affaldgenbrug.vejle.dk/page42831.aspx [23 February 2012]
- Anhava, J., Ekholm, E., Ikäheimo, E., Koskela, K., Kurvi, M., & Walavaara, M. (2001). *Jätehuollon ja materiaali- ja tekstiiliteknologian kehittäminen ja niiden kehittämissuunnitelmat*. Teknologiatyöryhmän raportti 102/2001 TEKES. Helsinki.
- Avfall Sverige. (n.d.). Svensk Avfallshantering 2011. [Swedish Waste Management 2011, in Swedish]. Malmö: Avfall Sverige AB.
- Baden, S., and Barber. C. (2005). *The impact of the second-hand clothing trade on developing countries*. [On Line]. Oxfam Available: http://www.maketradeair.com/en/assets/english/shc_0905.pdf [26 February 2012]
- Boomerang. (n.d.). Boomerang Vintage. [On Line]. Available: www.boomerang.se/sv/boomerang-effekt-vintage [23 March 2012]
- Brunn Paulsen, P., Schmidt, A. and Dammand Nielsen, K. (2011). *Kortlægning af kemiske stoffer i Tekstiler [Mapping of Chemical Substances in Textiles, in Danish]* [On line]. Available. www2.mst.dk/udgiv/publikationer/2011/09/978-87-92779-37-3.pdf [22 March 2012]
- BVT. (2011). Brancherapport 2011, BVT – Danske Vaskerier, Brancheorganisationen for vask og tekstiludlejning, Dec. 2011 [On Line]. Available: danskevaskerier.di.dk/sitecollectiondocuments/brancherapport%202011%20bvt.pdf [23 February 2012]
- Canadian Council of Ministers of the Environment. (2009). *Canada-wide Action Plan for Extended Producer Responsibility*. [On line]. Available. www.ccme.ca/assets/pdf/epr_cap.pdf [9 March 2012]
- Canadian Government. (n.d.). *Questionnaire for submission of information on New POPs in accordance with SC-4/19*. [On line]. Available. chm.pops.int/Implementation/Exemptions/RegisterofSpecificExemptions/tabid/1133/Default.aspx [20 March 2012]
- Carlsson, A. , Hemström, K., Edborg, P., Stenmarck, Å. and Sörme, L. (2011). *Kartläggning av mängder och flöden av textilavfall [Mapping of Quantity and Flow of Textile Waste, in Swedish]*. SMED Rapport Nr 46 2011. Norrköping: Sveriges Meteorologiska och Hydrologiska Institut.
- CBI Ministry of Foreign Affairs in the Netherlands. (2011). The Netherlands legislation: Formaldehyde in textiles (additional requirements). [On line]. Available. www.cbi.nl/marketinfo/cbi/docs/the_netherlands_legislation_formaldehyde_in_textiles_additional_requirements [2 April 2012]
- Chapman, A. (2010). *Mistra Future Fashion – Review of Life Cycle Assessments of Clothing*. Stockholm. MISTRA The Foundation for Strategic Environmental Research.
- Commission Decision of 15 May 2002 establishing the ecological criteria for the award of the Community Ecolabel for textile products and amending Decisions 1999/178/EC (2002/371/EC).
- Commission Decision of 9 July 2009 establishing the ecological criteria for the award of the Community Ecolabel for textile products (2009/567/EC).

- Danish Fashion institute & BSR. (2012). The NICE Consumer. Research summary and discussion paper: Toward a framework for sustainable fashion consumption in the EU. Copenhagen Danish Fashion Institute.
- Danmarks Statistikbank. (2012). FU5: Husstandenes årlige forbrug efter forbrugsart, husstandsgrupper og prisenhed. [On Line]. Available: <http://statistikbanken.dk/FU5>. [23 February 2012]
- EcoTLC. (n.d.). French ERP for Clothing, Linen and Footwear. [On Line]. Available: www.ecotlc.fr/ressources/Documents_site/plaq-Anglais_ECOTLC_BD.pdf [20 March 2012]
- Environmental Statistics. (2011). Yearbook. Environment and Natural resources. Helsinki: Statistics Finland.
- Farrant, L. (2008) Environmental benefits from reusing clothes. Master Thesis at the Technical University of Denmark
- Fillipa K. (2008). Sustainable Design. The story behind opening a second hand store. [On Line]. Available: www.filippa-k.com/news/brand-new-shirt.html [23 March 2012]
- Fisher, K., James, K. and Maddox, P. (2011). *Benefit of Reuse. Case Study: Clothing*. [On Line]. Available: www.wrap.org.uk/downloads/Clothing_reuse_final1.060f3863.11447.pdf [23 March 2012]
- Food and Agricultural Organisation of the United Nations and International Cotton Advisory Committee (FAO and ICAC). (2011). *A Summary of the World Apparel Fiber Consumption Survey 2005-2008*. [On Line]. Available: http://www.fao.org/fileadmin/templates/est/COMM_MARKETS_MONITORING/Cotton/Documents/World_Apparel_Fiber_Consumption_Survey_2011_-_Summary_English.pdf [18 March 2012]
- Forum for the Future and Levis Strauss & Co. (2010). *Fashion Futures 2025. Global scenarios for a sustainable fashion industry*. [On Line]. Available: www.forumforthefuture.org/sites/default/files/images/Forum/Projects/Fashion-Futures/FashionFutures_2025_FINAL_SML.pdf [20 March 2012]
- Fratelli Esposito. (2012). Fratelli Esposito SRL. [On Line]. Available: www.fratelliespositosrl.com/eng/index.html, [27 February 2012]
- Frelsens Hær. (2012). Genbrug med hjertet. [On Line]. Available: www.frelsenshaer.dk/index.php?page=genbrug [23 February 2012]
- Fues, E. and Norberg, E. (2011). Vad styr ett second hand köp? En undersökning om hur de fyra P:na påverkar butikerna Myrorna och Beyond Retro. Borås. Textilhögskolan i Borås.
- Haderslev kommune. (2012). Værkstederne i Vojens. [On Line]. Available: www.haderslev.dk/borger/job-og-uddannelse/aktivering/kompetencecenter-haderslev/v%C3%A6rksteder/v%C3%A6rkstederne-i-vojen [23 February 2012]
- H&M. (2012) Recycled fabrics. [On Line]. Available: about.hm.com/content/hm/AboutSection/en/About/Sustainability/Commitments/Reduce-Reuse-Recycle/Recycled-Fabrics.html [30 March 2012]
- Hinkkala H. (2011). Tekstiili kierrätyksen esiselvitys – Poistotekstiilimassojen hyödyntämistöjen edistäminen jätehierarkian mukaisesti. [Prestudy about textile recycling and reuse] Hämeen ammattikorkeakoulu. Forssa. [On Line]. Available: portal.hamk.fi/portal/page/portal/HAMKJulkisetDokumentit/Tutkimus_ja_kehitys/HAMK_in%20hankkeet/velog/VALMIS_Helenan%20selvitys180511.pdf [23 February 2012]
- Houdini Sportswear. (2012). Facts and philosophy behind Houdini's sustainability work. [On Line]. Available: www.houdinisportswear.com/en/news/8526 [5 March 2012]

- Hynynen, J. (2008). Jätehuollon palvelutason vaikutukset kotitaloudessa syntyvän sekajätteen koostumukseen. Insinööriyö. Ympäristötekniikan koulutusohjelma. Savonia-ammattikorkeakoulu, Kuopio. [On Line]. Available: www.jatekukko.fi/www/fi/liitetiedostot/ohjeet_esitteet/raportit/JohannaHynynen_insicrity_lajittelu_tutkimuspdf.pdf [10 February 2012]
- Högskolan i Borås. (2012). Etanol/biogas av textila avfall- IH [Ethanol/biogas from textile waste – IH, in Swedish]. [On line]. Available. www.hb.se/wps/portal/!ut/p/c0/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hXX49QSydDRwN_9zALAyPjUH_XY09AbxNPM_2CbEdFAPi-BgU! [2 March 2012]
- Innovationsnetværk for miljøteknologi. (2012). [On Line]. Available: Technology gaps i genanvendelsesprocesser [On Line]. Available: inno-mt.dk/dk/projekter/technology-outlooks/technology-gaps-i-genanvendelsesprocesser.aspx [23 February 2012]
- International Working Group on Global Organic Textile Standard. (2011). *Global Organic Textile Standard (GOTS) Version 3.0*. [On line]. Available. http://www.global-standard.org/images/stories/gots-version3_01march2011.pdf [28 March 2012]
- Jarva, A. (2007). LEONARDO DA VINCI –program of European Commission: Second Hand Sector Analyses in Finland. Tervatulli Oy. [On Line]. Available: www.kotu.oulu.fi/sytrim/raportti_jarva.pdf [15 March 2012]
- Jydske Vestkysten. (2008). Genbrug til sidste trevl. [On Line]. Available: www.jv.dk/artikel/353944:Dagens-succes--Genbrug-til-sidste-tre-avl [23 February 2012]
- Karvonen, T. and Voutilainen, M. (2007) Yhdyskuntajätteen lajittelututkimus Noulialan jäteasemalla -raportti. [On Line]. Available: www.savonlinna.fi/teknisetpalvelut/lajittelukokeen_raportti.pdf [10 February 2012]
- KEMI (Kemikalieinspektionen). (2012). Bättre EU-regler för en giftfri miljö – rapport från ett regeringsuppdrag. [Better EU law for a toxic-free environment – report from a government commission, in Swedish]. Sundbyberg: Kemikalieninspektionen.
- Klavnes, M. (2004). En studie av kleskjedenes behandling av “overskuddsvarer” sett i et miljøperspektiv, Hovedfagsoppgave i Geografi Norges Teknisk- Naturvitenskapelige Universitet Geografisk Institutt.
- Kogg, B. (2009). Responsibility in the Supply Chain: Interorganisational management of environmental and social aspects in the supply chain – Case studies from the textile sector. IIIIEE Dissertation 2009: 2. Lund: IIIIEE, Lund University.
- Kristeligt Dagblad. (2012). [On Line]. Available: www.kristeligt-dagblad.dk/artikel/449608:Kirke---tro--Flere-hundrede-ton-genbrugstoej-ender-paa-forbraendingen?all=1 [23 February 2012]
- Kviseth, K. and Tobiasson, T., S. (2011). *Pulling Wool over our Eyes: The Dirty Business of LCAs*. [On Line]. Available: www.nicefashion.org/files/KEA_paper.pdf [24 March 2012]
- Laitala, K. and Klepp, I., G. (2012). Presentation material dated 27 March 2012.
- Lindhqvist, T. (1992). Extended Producer Responsibility. In T. Lindhqvist, *Extended Producer Responsibility as a Strategy to Promote Cleaner Products*. (1-5). Lund: Department of Industrial Environmental Economics, Lund University.
- Lindhqvist, T. and van Rossem, C. (2005). *Evaluation Tool for EPR Programs*. Lund: IIIIEE, Lund University. [On line]. Available. www.solidwastemag.com/postedddocuments/PDFs/2005/AugSep/CanadaEPRevaluation.pdf [2 March 2012]

- Malkki, H. (2005). Materiaalin hankinta Globe-Hopen tuotantoa varten. Tekstiili- ja vaatetustekniikka. Tampereen AMK. [On Line]. Available: <https://publications.theseus.fi/bitstream/handle/10024/9964/TMP.objres.135.pdf> [10 February 2012]
- Manomaivipool, P. (2011). Advancing the Frontier of Extended Producer Responsibility: The management of waste electrical and electronic equipment in non-OECD countries. IIIIEE Dissertation: 2011:1. Lund: IIIIEE, Lund University.
- Miljøministriet and Miljøstyrelsen. (2011). Affaldsstatistik 2009 og Fremskrivning af affaldsmængder. 2011-2050. Orientering fra Miljøstyrelsen nr. 4. [On Line]. Available: www2.mst.dk/udgiv/publikationer/2011/10/978-87-92779-44-1/978-87-92779-44-1.pdf [23 February 2012]
- Miljøstyrelsen. (2000). Kemikalier i Tekstiler. Miljøprojekt nr. 534. [On Line]. Available: www.statensnet.dk/pligtarkiv/fremvis.pl?vaerkid=6585&reprid=0&filid=26&iarkiv=1 [23 February 2012]
- Miljøstyrelsen. (2003). Sammensætning af dagrenovation og ordninger for hjemmekompostering. Miljøprojekt nr.868
- Miljøstyrelsen. (2004). Storskraldsordninger – øget genbrug og genanvendelse. Miljøprojekt nr. 894. [On Line]. Available: www2.mst.dk/udgiv/publikationer/2004/87-7614-134-9/pdf/87-7614-135-7.pdf [23 February 2012]
- Miljøstyrelsen. (2011). Affaldsstatistik 2009 og Fremskrivning af affaldsmængder. Copenhagen: Miljøstyrelsen.
- Morely, N., Slater, S., Russel, S., Tipper, M. Ward, G.D., (2006). *Recycling of low grade clothing waste*.
- Myllymaa, T.; Tohka, A.; Dahlbo H. & Tenhunen, J. (2006). *Ympäristönäkökulmat jätteen hyödyntämisessä energiana ja materiaalina*. Valtakunnallinen jätesuunitelma vuoteen 2016, Taustaselvitys Osa III. [Environmental aspects of energy and material recovery of wastes Finnish national waste plan 2016, Background document Part III] Reports of Finnish Environment Institute 12/2006.
- Myrorna. (2012). *Frågor & Svar*. [On Line.] Available: www.myrorna.se [22 February 2012]
- National Board of Customs. (2010). *Tullihallituksen ulkomaankauppatilastot* [Statistics of foreign trade] Ultika-tietokanta. [On Line]. Available: uljas.tulli.fi/ [10 February 2012]
- Naturskyddsföreningen. (1996). *Environmental Criteria for Textiles. 1996*. Göteborg: Naturskyddsföreningen.
- Naturskyddsföreningen. (2012a). *Textil. Kriterier 2012:1. Bra Miljöval*. [Textile. Criteria. 2012:11. Good Environmental Choice, in Swedish]. [On Line]. Available: www.naturskyddsforeningen.se/upload/Foreningsdokument/Foreningsdokument/Kriterier-Textil-120401.pdf [30 March 2012]
- Naturskyddsföreningen. (2012b). *Textilprodukter märkta med Bra Miljöval* [Textile product marked with Good Environmental Choice, in Swedish]. [On Line]. Available: sn.snf.se/bmv/bmv-register/textil.cfm [30 March 2012]
- Naturvårdsverket. (1995). *Textiler. Materialflöden i samhället. Rdovisning till regeringen del 2*. [Textile. Material flow in society. Report to the government part 2, in Swedish]. Rapport 4507. Stockholm: Naturvårdsverket.
- Naturvårdsverket. (1996). *Textil och miljö. Rdovisning till Kretsloppsdelegationen*. [Textile and Environment. Report to Ecocycle Commission, in Swedish]. Rapport 4668. Stockholm: Naturvårdsverket.
- Nurmela, J. (2008). *Kierrätys kotitalouksissa vuoden 2006 Kulutustutkimuksen mukaan* [Recycling in Households according to Household Budget Survey in 2006].

- In Kirsti Ahlqvist, Anu Raijas, Adriaan Perrels, Jussi Simpura & Liisa Uusitalo (eds.) Kulutuksen pitkä kaari – Niukkuudesta yksilöllisiin valintoihin. Palmenia. Helsinki University Press 2008, 281-304.
- Nieminen, E. and Talvenmaa, P. (2005). Preventing waste related to textile products in the producer, trade and consumer chain and developing recycling and waste recovery systems for this waste. In *Streams – Recycling Technologies and Waste Management* (79–80). Tekes. Teknologiaohjelmaraportti 5/2005. (in Finnish)
- Nordic Council of Ministers, Danish Ministry of the Environment and Copenhagen Resource Institute. (n.d.). *Potential policies to promote SCP via the food retailer sector in Nordic Countries*.
- Nordic Ecolabelling. (2011). *Nordic Ecolabelling of Textiles, skins and leathers. Version 3.6. 18 March 2004- 31 December 2013*. [On Line]. Available: www.nordic-ecolabel.org/Templates/Pages/CriteriaPages/CriteriaGetFile.aspx?fileID=135902001 [25 March 2012]
- Oakdene Hollins, (2009). Maximising Reuse and Recycling of UK Clothing and Textiles EV0421, Technical Report Appendix I. [On Line]. Available: www.nicefashion.org/files/Maximising_the_Reuse_and_Recycling_of_Clothes_and_Textiles.pdf [25 March 2012]
- Oeko-TEX® Institutes. (n.d.). Concept. [On Line]. Available: www.oeko-tex.com/OekoTex100_PUBLIC/content.asp?area=hauptmenue&site=grtextiloekologie&cls=02 [28 March 2012]
- Olsson, E., Posner, S., Roos, S. and Wilson, K. (2009). Kartläggning av kemikalieanvändning i kläder [Mapping of the Use of Chemicals in Textile. Report to Ecocycle Commission, in Swedish]. Mölndal: Swerea IVF AB. (Swerea IVF Uppdragsrapport 09/52).
- Palm, D. (2011a). *Improved waste management of textiles. Project 9 Environmentally improved recycling*. IVL Report B1976. Göteborg: IVL Swedish Environmental Research Institute Ltd.
- Palm, D. (2011b). *Varför återanvända textil? Europa minskar avfallet 2011 [Why reuse textile? Europe reduce waste 2011. in Swedish]*. Presentation material. [On Line]. Available: www.naturvardsverket.se/upload/Kalendarium/Dokumentation/Gardagens-textil-morgondagens-mode/Varfor-ska-vi-ateranvanda-textil.pdf [23 March 2012]
- Politiken. (2010). Vi har fået lopper på hjernen. [On Line]. Available: politiken.dk/tjek/sundhedogmotion/familieliv/ECE933452/vi-har-faaet-lopper-paa-hjernen/ [23 February 2012]
- Politiken. (2010a). Forældre går efter brugt børnetøj. [On Line]. Available: politiken.dk/tjek/ECE1110196/foraeldre-gaar-efter-brugt-boernetoej/ [23 February 2012]
- Politiken. (2010b). Genbrug er for alle [On Line]. Available: politiken.dk/tjek/sundhedogmotion/familieliv/ECE933466/genbrug-er-for-alle/ [23 February 2012]
- Politiken. (2012). 2000 ton ubrugeligt tøj: Danskere bruger genbrugsbutikker som skraldespand [On Line]. Available: politiken.dk/tjek/ECE1526354/2000-ton-ubrugeligt-toej-danskere-bruger-genbrugsbutikker-som-skraldespand/ [23 February 2012]
- Päijät-Hämeen Jätehuolto Oy. (2006). Päijät-Hämeen Jätehuolto Oy:n kaatopaikkatutkimus 2006. [On Line]. Available: www.phj.fi/downloadable_material/Kaatopaikkajatetutkimus_2006.pdf [10 February 2012]
- Re: something. (2012). Re:something [On Line]. Available: www.amvictoria.dk/REAB01.HTML [23 February 2012]

- Räsänen, J. (2007). Lappilaisten poistotekstiilien potentiaali uudessa tuotannossa. In M. Pursianen (Ed.) *Haastetta kerrakseen! erityistarpeet & kierrätysmateriaalin hyödyntäminen tekstiili- ja vaatesuunnittelussa*. (43–55). University of Lapland. Rovaniemi.
- Räsänen, J. (2011). *Tekstiilijätteen katoamistemppu*. [The disappearing trick of textile waste: The possibilities for design for end-of-life in Finnish textiles and clothing production] Pro gradu thesis. Textile design. University of Lapland, Faculty of Art and Design.
- Sander, K., Schilling, S., Tojo, N., van Rossem, C., Vernon, J. and George, C. (2007). *The Producer Responsibility Principle of the WEEE Directive. Final Report*. Study Commissioned by the European Commission, DG Environment.
- Statistics Finland. (2010a). Domestic production. StatFin-tietokanta. [On Line]. Available: http://pxweb2.stat.fi/database/StatFin/databasetree_fi.asp [10 February 2012]
- Statistics Finland. (2010b). Treatment of waste 2009. OSF: Statistics Finland, Waste statistics.
- Statistics Finland. (2011) Waste statistics – municipal waste 2010. [On Line]. Available: tilastokeskus.fi/til/jate/2010/jate_2010_2011-11-18_tau_001_fi.html [10 February 2012]
- Sundin, K. (2011). *An evaluation of clothes recycling in Sweden*. C-uppsats i Textilevetenskap. Uppsala: nstitutionen för Konstvetenskap. Uppsala Universitet.
- Talvenmaa, P. (1998). *Tekstiilit ja ympäristö*. Tekstiili- ja vaatealusteollisuus ry. Tampere.
- Tekes. (2005). *Streams – Recycling Technologies and Waste Management*. Teknologiahjelmaraportti 5/2005. (in Finnish)
- Textile Exchange. (n.d.). About us. [On Line]. Available: textileexchange.org/about-us [2 April 2012]
- Textile Exchange. (2012). All Member Companies. [On Line]. Available: textileexchange.org/companies [2 April 2012]
- Textile Exchange. (2012). *Global Recycle Standard, Version 2.1. (March 2012)*. [On Line]. Available: textileexchange.org/sites/default/files/te_pdfs/integrity/Global%20Recycle%20Standard%20V2.1.pdf [2 April 2012]
- Tojo, N. (2004). Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality? IIIIEE Dissertations 2004:2. Lund: IIIIEE, Lund University.
- Tojo, N., Lindhqvist, T. and Dalhammar, C. (2006). Extended Producer Responsibility as a driver for product chain improvement. In D. Scheer & F. Rubik (eds). *Governance of Integrated Product Policy*. (224-242). Sheffield: Greenleaf Publishing Ltd.
- Tojo, N., Lindhqvist, T. and Davis, G. (2003). EPR Programme Implementation: Institutional and Structural Factors. In OECD, Proceedings of OECD Seminar on Extended Producer Responsibility: EPR Programme Implementation and Assessment. Part II: Assessing EPR Policies and Programmes, 13-14 December 2001, OECD (226-275). Paris: OECD (ENV/EPOC/WPNEP(2003)10/PART2/FINAL)
- Tojo, N. and Lindhqvist, T. (2010). *Product-oriented Environmental Interventions. Bundling of Policy Instruments*. IIIIEE Reports 2010:1. Lund: IIIIEE. Lund University.
- Trendsales. (2012). [On Line]. Available: www.trendsales.dk [23 February 2012]
- United Nations Environmental Program DTIE/Chemicals Branch. (2011). *The Chemicals in Products Project: Case Study of the Textiles Sector*. [On Line]. Available: www.chem.unep.ch/unepsaicm/cip/Documents/CaseStudies/CiP%20textile%20case%20study%20report_21Feb2011.pdf [21 March 2012]

- UFF 2010: <http://www.uff.dk/TextPage.asp?MenuItemID=41&SubMenuItemID=94> [23 February 2012]
- Van Rossem, C. (2008). Individual Producer Responsibility in the WEEE Directive – From Theory to Practice? IIIIEE Dissertation 2008:3. Lund: IIIIEE, Lund Univesity.
- Wrangéll, A. (1997). *Tekstiilien elinkaaren pidentäminen – kotitalouspoistot ja niiden taustalla olevia asenteita*. [Renewal of textile product life cycle – Disposal of household textiles and personal attitudes behind] Pro gradu thesis. Handicraft sciences. Faculty of education. University of Helsinki.
- YTV. (2008). *Pääkaupunkiseudun kotitalouksien sekajätteen määrä ja laatu 2007*. [The amount and quality of mixed household waste in the Helsinki metropolitan area in 2007] YTV Helsinki Metropolitan Area Council 15/2008. [On Line]. Available: www.hsy.fi/jatehuolto/Documents/Julkaisut/sekajatatutkimus_2007.pdf [13 February 2012]
- Zamani, B. (2011). *Carbon footprint and energy use of textile recycling techniques. Case study: Sweden. Master of Science Thesis*. Gothenburg. Department of Chemical and Biological Engineering, Chalmers university of technology

Legislation

- Statutory order on waste 2011: BEK nr 1415 af 12/12/2011 [On Line]. Available: www.retsinformation.dk/forms/r0710.aspx?id=139654#Kap7
- Stockholm Convention on Persistent Organic Pollutants
- Directive 2003/11/EC of the European Parliament and of the Council of 6 February 2003 amending for the 24th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodiphenyl ether)
- Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on the waste electrical and electronic equipment (WEEE). OJ L37 13/02/2003 p.24 –39.
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
- Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste
- Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

7. Sammanfattning

Textilier har varit ett oundgängligt inslag i det mänskliga samhället under alla tider och en viktig global handelsvara under århundraden. Men de ger också upphov till en rad olika typer av negativ miljöpåverkan under sin livscykel. De negativa miljökonsekvenserna som kan associeras med textilier påverkas också av att konsumtionen av textilvaror ökat över tiden, i Norden såväl som globalt. Denna ökande konsumtion har konsekvenser när det gäller miljöpåverkan i samband med produktion, användning och omhändertagande av ökande flöden av textilavfall. Att verka för att förebygga textilavfall är en möjlig väg för att möta dessa utmaningar.

Denna studie, beställd av den nordiska Avfallsförebyggande gruppen i Nordiska ministerrådet, har till syfte *att ta fram förbättrad konkret kunskap relaterad till förebyggande av textilavfall i utvalda nordiska länder. Denna kunskap ska kunna användas för att utveckla effektiva politiska åtgärder för att stärka arbetet med att förebygga textilavfall.*

Studien undersöker följande två frågor:

1. Hur ser flödet av textila produkter ut i tre nordiska länder (Danmark, Finland och Sverige) från den tidpunkt då de introduceras på marknaden tills deras slutliga omhändertagande?
2. Vilka typer av statliga ingripanden kan vara användbara för att förbättra förebyggandet av textilavfall, med fokus på en eventuell tillämpning av producentansvar (EPR)?

Bland olika typer av textilvaror fokuserar denna studie på kläder och hemtextil.

Studien har genomförts genom ett samarbete mellan följande fyra organisationer från fyra nordiska länder: Copenhagen Resource Institute (CRI), Danmark; Konsumentforskningscentralen (NCRC), Finland; Environice, Island och Internationella Institutet för Industriell Miljöekonomi (IIIEE) vid Lunds universitet, Sverige. Studien baseras främst på en genomgång av olika skriftliga källor, men utöver detta har empirisk data samlats in genom totalt 26 intervjuer i Danmark, Finland, Sverige och Japan.

Genomgången av textilproduktflödet i Danmark, Finland och Sverige visar att även om det finns skillnader i detaljer uppvisar de tre länderna en liknande situation, som sammanfattas nedan:

- Hälften av de textilprodukter som används av konsumenter (nya kläder såväl som secondhand) kastas som avfall. Den totala mängden i de tre länderna blir närmare 145 000 ton, och det allra mesta av dessa kasserade textilier går till förbränning eller deponi.
- Textilkonsumtionen har ökat, men det är bara för Sverige som vi har jämförbar information angående mängderna. I Sverige ökade mängden produkter som släpps ut på marknaden med 40% från 2000 till 2009
- Vålgörenhetsorganisationer är den viktigaste aktören när det kommer till insamling av textilier som kan återanvändas. I alla tre länderna har man också funnit ett växande intresse hos privatpersoner för att köpa och sälja begagnade kläder. Dessa privata transaktioner sker t.ex. via forum för handel av begagnade produkter på Internet och på loppmarknader. Det finns emellertid inga uppgifter om hur stora volymer av begagnade kläder handlas på detta vis
- Den uppskattade totala mängden av begagnade produkter på marknaden i de olika länderna bygger på många antaganden. Trots att man vet att vålgörenhetsorganisationers verksamhet spelar en viktig roll här, så är tillgänglig information om mängden av begagnade textilprodukter (t.ex. inhemska köp av begagnade produkter, insamling av använda textilprodukter från secondhandaktörer och export av begagnade produkter) något oklar
- Det finns diskrepanser mellan den totala mängden som introduceras på marknaden och den totala mängden textilier som blir avfall eller exporteras. Denna diskrepans kan i enlighet med ovan förklaras med att flera siffror baseras på antaganden, men det kan också vara en effekt av hamstring i hemmen
- I alla tre länder finns institutionella användare såväl som privata användare av textilier, men mängden av textilprodukter som respektive grupp använder är oklar
- I alla tre länder förekommer återvinning av textil för andra syften än de ursprungliga – t.ex. framställning av industriella trasor som används i mekaniska verkstäder – om än i relativt begränsad omfattning (försumbar i Danmark och Sverige och beräknad vara 13% av mängden textilprodukter som används i Finland). De höga

lönekostnaderna för sortering har varit en viktig barriär för att öka denna typ av verksamhet

- I både Danmark och Sverige har det funnits återvinningsanläggningar för textilavfall, men denna typ av verksamhet har gradvis försvunnit under senare år
- Mer än hälften av de textilprodukter som samlats in av secondhandaktörer exporteras, men flödet av exporterade begagnade textilprodukter är dåligt känt

Befintliga statliga initiativ med potentiell påverkan på kvantitet och/eller kvalitet av de textila avfallsströmmarna i de nordiska länderna inkluderar reglerna om kemikalier i produkter inom EU:s REACH-förordning, Stockholmskonventionen om långlivade organiska föroreningar (POPs) och olika typer av märknings- och certifieringssystem. EU:s ramdirektiv om avfall och EU:s avfallstransportförordning kan också indirekt påverka förebyggande av textilt avfall. Nationella politiska åtgärder som identifierats utanför Norden är producentansvar (EPR) för textilier i Frankrike och i Japan grön offentlig upphandling med kriterier som bland annat innefattar användning av återvunna material och inrättande av återtagningssystem.

Studier av befintliga producentansvarsprogram för olika produktgrupper visar att det finns ett antal administrativa, ekonomiska och informativa styrmedel som kan användas under ett producentansvarsprogram. Med utgångspunkt i granskningen av textilflödet i de tre nordiska länderna samt input från olika intressentgrupper, analyseras 15 styrmedel mot bakgrund av de mål som normalt förknippas med EPR. Dessa mål kan delas in i två grupper: förbättringar uppströms respektive nedströms. De senare – förbättringar nedströms – delas vidare in i effektiv insamling, ökad återanvändning och återvinning samt miljövänlig hantering. Varje förslaget styrmedel definieras, grunden för förslaget diskuteras (inklusive potentiella framgångsfaktorer) och frågor som kräver noggrant övervägande i relation till förslaget framhålls. Dessutom diskuteras andra politiska åtgärder som skulle understödja att respektive politiska mål uppnås.

Det finns ett antal områden där ytterligare studier behövs för att ge viktig input till den politiska beslutsprocessen, t.ex.:

- Kvalitet och typ av textilier som för närvarande kasseras som avfall i de nordiska länderna: Hur stor andel av det som kasseras kan egentligen återanvändas? Vilka typer av material finns det bland de icke-återanvändningsbara, men återvinningsbara textilprodukterna?

Vad finns det för tekniska förutsättningar att sortera dessa material för vidare återvinning?

- Samhällsekonomisk konsekvensanalys för utökad återvinning av kasserade textila produkter kontra andra former av omhändertagande
- Spridningsvägar och destinationer för begagnade produkter som exporteras
- Samhällsekonomisk konsekvensanalys och livscykelanalys för olika scenarier, inklusive alternativ för återvinning utanför de nordiska länderna. I analysen av sådana scenarier bör potentiella sociala och ekonomiska konsekvenser för länder som mottar begagnade textilier också beaktas

Om sådan forskning som föreslås ovan indikerar att ökad källsortering och återvinning i de nordiska länderna är miljömässigt fördelaktigt kan lagstiftning om producentansvar för insamling och återvinning av textilavfall vara ett alternativ. I detta fall är det viktigt att hänsyn tas till de aktörer som redan spelar en viktig roll för att samla in och ta hand om avlagda textilier (t.ex. välgörenhetsorganisationer och andra legitima aktörer på andrahandsmarknaden, samt enskilda producenter som har initierat egna initiativ/system för insamling och återvinning). Därutöver bör noggrant övervägande göras för att säkerställa att producenterna får någon form av incitament att göra förändringar uppströms (= vidta förebyggande åtgärder). Dessutom bör åtgärder vidtas så att kommuner inte försvårar återvinning av textilavfall om ansvaret för sådan återvinning tilldelas producenter.

När det gäller kvalitativt förebyggande har ett antal åtgärder genomförts eller diskuterats. Om kvalitetsnormer ska ingå i producentansvarsprogram kan man finna synergier med befintliga åtgärder och/eller åtgärder som redan finns på förslagsstadiet – t.ex. harmoniserad EU-lagstiftning som föreslagits av den svenska Kemikalieinspektionen eller miljömärkningsstandarder. De nordiska länderna kan förena sina krafter genom att föreslå sådana åtgärder inom EU eller det internationella samfundet.

I syfte att främja ökad användning av begagnade produkter och ökad textilåtervinning, kan man överväga att införa referenser till begagnade produkter eller återvunna material i kriterier för grön offentlig upphandling. Miljömärkning av begagnade produkter och produkter som görs av återvunnet material tillämpas av den svenska miljömärkningen Bra Miljöval och borde kunna inkluderas även i andra miljömärkningsprogram. Vidare kan både ekonomiska och informativa styrmedel användas för att främja användningen av tjänster som hjälper till att för-

länga livslängden på textila produkter, t.ex. avskaffad moms för skrädderitjänster för lagning samt informationskampanjer för att främja lagning och återförsäljning av secondhand produkter.

8. Tiivistelmä

Tekstiilit ovat välttämätön osa inhimillisen yhteiskunnan historiaa ja ne ovat olleet merkittäviä kaupallisia tuotteita maailman markkinoilla jo vuosisatojen ajan. Tekstiileistä aiheutuu monenlaista ympäristökuormitusta niiden elinkaaren aikana. Lisäksi tekstiilien kulutus on kasvanut jatkuvasti niin Pohjoismaissa kuin maailman laajuisestikin. Kulutuksen kasvun myötä lisääntyvät sekä jätemäärät että ympäristökuormitus tekstiilien kaikissa elinkaaren vaiheissa. Ehkäisemällä tekstiilijätteiden syntymistä voisi merkittävästi pienentää haitallisia ympäristövaikutuksia.

Pohjoismaiden ministerineuvoston jätteiden ehkäisytyöryhmä tilasi tutkimuksen, joka tehtävänä on lisätä tekstiilijätteen ehkäisyyn liittyvää konkreettista tietoa Pohjoismaissa. Tavoitteena on, että tietoa voisi käyttää tehokkaiden politiikkatoimenpiteiden kehittämisessä tekstiilijätteen ehkäisemiseksi.

Hankkeessa tarkasteltiin erityisesti seuraavia kysymyksiä:

1. Millaisia tekstiilivirtoja kolmessa Pohjoismaassa (Tanska, Suomi ja Ruotsi) on tekstiilien markkinoille tulosta niiden hylkäämiseen?
2. Millaiset yhteiskunnalliset toimenpiteet voisivat olla menestyksellisiä tekstiilijätteen ehkäisemisessä, kun tarkastellaan erityisesti tuottajavastuun soveltamista?

Tämä tutkimus tarkastelee tekstiilituoteryhmistä vaatteita ja kodin tekstiilejä.

Tutkimus on tehty neljän pohjoismaisen organisaation yhteistyönä: Copenhagen Resource Institute (CRI), Tanska; Kuluttajatutkimuskeskus (NCRC), Suomi; Environice, Islanti ja Lundin yliopiston International Institute for Industrial Environmental Economics (IIIEE), Ruotsi. Työ on tehty pääosin hyödyntäen aiempia tutkimuksia ja selvityksiä. Lisäksi tehtiin yhteensä 26 haastattelua Tanskassa, Suomessa, Ruotsissa ja Japanissa.

Tanskan, Suomen ja Ruotsin tekstiilituotevirroissa on paljon yhteisiä piirteitä, joskin myös joitain eroja kuten seuraava yhteenveto osoittaa:

- Lähes puolet siitä tekstiilimäärästä, jonka kuluttajat hankkivat uutena tai käytettynä, hylätään jätteeksi. Kolmen maan yhteenlaskettu tekstiilijättemäärä on noin 145 miljoonaa kiloa vuodessa. Ruotsissa ja Tanskassa tekstiilijäte pääosin poltetaan ja Suomessa se joutuu kaatopaikalle
- Tekstiilien kulutus on kasvanut kaikissa Pohjoismaissa. Joskin ainoastaan Ruotsissa on vertailutietoja tekstiilimäärästä, joka on kasvanut vuosien 2000 ja 2009 välillä noin 40 %. Kulutusmenot tekstiileihin ovat kasvaneet erityisesti Tanskassa, mutta myös Suomessa
- Käytettyjen tekstiilien keräämisestä huolehtivat pääasiassa hyväntekeväisyysjärjestöt. Lisäksi yhä useammat yksittäiset kuluttajat ovat innostuneet tekstiilinsä omatoimisesta välittämisestä uudelleenkäyttöön niin internetin välityksellä kuin kirpputoreillakin. Tilastotietoja käytettyjen tuotteiden myyntimäärästä ei kuitenkaan ole
- Uudelleenkäytettävien ja kierrätettyjen tekstiilituotteiden määrät perustuvat pitkälti arvioihin ja oletuksiin. Aktiivisesta hyväntekeväisyystoiminnasta huolimatta edes koko maan kattavia tilastotietoja kerättyjen tekstiilien määrästä ei juuri ole, koska eri toimijat tilastoivat niitä hyvin eri tavoin
- Tekstiilivirtoja kuvaavissa tilastoissa on runsaasti puutteita, joten tässä tutkimuksessa jouduttiin käyttämään arvioiteja seurattaessa hankittujen tekstiilien päätymistä kierrätykseen, hylkäykseen ja vientiin. Lisäksi osa aktiivikäytöstä poistetuista vaatteista jää todennäköisesti kuluttajien omaan varastoon odottamaan mahdollista käyttöä tai niistä ei tunnesyistä haluta luopua
- Kaikissa kolmessa maassa tekstiilituotteilla on yksittäisten kuluttajien lisäksi myös yhteis- ja ammattikäyttöä (esim. työasut ja hotellien tekstiilit), mutta tekstiilien jakautumisesta eri sektoreille ei ole yksityiskohtaisia tietoja
- Kaikissa kolmessa maassa on myös tekstiilituotteiden kierrätystä. Kierrätyksessä tuotteen käyttö poikkeaa alkuperäisestä, kuten uusiokäyttö teollisuuspyyhkeinä esim. teollisuudessa ja autokorjaamoissa tai valmistus imeytysmatoiksi (Ruotsissa ja Tanskassa kierrätettyjen tekstiilien määrä on todennäköisesti pieni, Suomessa arviolta noin 13 % hankituista tekstiileistä). Suurimpina esteinä käytöstä poistettujen tekstiilien hyödyntämisen laajentamiselle ovat korkeat työvoimakustannukset lajittelussa ja toiminnan hajanaisuus
- Käytettyjen tekstiilituotteiden kerääjät vievät ulkomaille yli puolet kierrätettävistä tekstiilituotteista, mutta vientimäärästä ei ole tietoa

Hallitusten ohjauskeinoina tekstiilijätteen ehkäisyssä ovat lähinnä EU REACH -kemikaalimääräyksiin perustuvat toimenpiteet sekä sertifiointi- ja merkintäjärjestelmät. Euroopan Unionin jätemääräykset ja direktiivit (The EU Waste Framework Directive ja the EU Waste Shipment Regulation) saattavat niin ikään epäsuorasti vähentää tekstiilijätettä. Pohjoismaiden ulkopuolella, esim. Ranskassa, käytetään laajennettua tuottajavastuuta (EPR) myös tekstiilituotteissa. Japanissa puolestaan lainsäädäntö tukee kestäviä julkisia hankintoja mm. siten, että hankintaohjeisiin sisältyy määräyksiä kierrätysmateriaalien käytöstä ja takaisinottovelvollisuudesta.

Tutkimukset erilaisten tuotteiden tuottajavastuusta osoittavat, että tuottajavastuuohjelmassa on mahdollista käyttää monia hallinnollisia, taloudellisia ja informatiivisia ohjauskeinoja. Kolmen Pohjoismaan tekstiilivirtaselvitykseen ja eri osapuolten haastatteluihin perustuen arvioitiin 15 poliittisen ohjauskeinon mahdollisuuksia tuottajavastuun näkökulmasta ja keinot luokiteltiin vastavirta parannuksiksi (jätteiden ehkäisy) ja myötävirta parannuksiksi. Myötävirtaparannukset on edelleen jaoteltu tehokkaaseen keräilyyn, tehostettuun uudelleenkäyttöön ja kierrätykseen sekä ympäristön kannalta puhtaaseen käsittelyyn. Jokaisesta ehdotetusta ohjauskeinosta kuvataan raportissa ohjauskeinon tyyppi, ehdotuksen perusteet ja vahvuudet mahdollisine menestystekijöineen sekä tekijät, jotka ovat kriittisiä ja edellyttävät erityistä seuranta. Lisäksi tuodaan esille, mitkä muut toimenpiteet tukisivat ja edistäisivät tavoiteltuja parannuksia.

Monilla alueilla tarvittaisiin lisää tutkimusta, jotta toimenpiteitä voisi edelleen kehittää ja tarkentaa:

- Käytöstä poistettujen tekstiilien laadusta ja tyypistä tarvitaan lisää tietoa Pohjoismaissa. Kuinka paljon käytöstä poistetaan käyttökelpoisia ja toisaalta käyttökelvottomia tuotteita? Millaisia ja mitä materiaalia ovat käyttökelvottomat, mutta materiaaliltaan hyödynnettävät tuotteet? Millaisia tekniikoita näiden materiaalien lajitteluun on olemassa?
- Kierrätettävien tuotteiden kierrätyksen kannattavuudesta tarvitaan kustannus-hyötyanalyysjä ja vertailuja muihin käsittelytapoihin
- Ulkomaille vietyjen kierrätystuotteiden reittien ja päätepisteiden selvittäminen olisi niin ikään tarpeen
- Kustannus-hyöty- ja elinkaarianalyysjä eri skenaarioista tarvitaan myös Pohjoismaiden ulkopuolelta. Skenaarioita analysoitaessa tulisi arvioida myös toiminnan mahdolliset sosiaaliset ja taloudelliset vaikutukset vastaanottajamaissa

Mikäli aiemmin ehdotetut jatkotutkimukset päätyvät siihen, että tekstiilien käyttöpaikkalajittelu ja kierrätys Pohjoismaissa olisi ympäristön kannalta hyödyllistä, vastuun siirtäminen tekstiilijätteen keräyksestä ja kierrätyksestä tuottajille voisi olla varteenotettava vaihtoehto. Siinä tapauksessa tulisi ottaa huomioon myös nykyiset toimijat (hyväntekeväisyysjärjestöt ja muut toimijat käytettyjen tuotteiden markkinoilla sekä yksittäiset tuottajat, jotka ovat kehittäneet omia keräys- ja kierrätysjärjestelmiään), ja varmistaa, että he saavat kohtuullisen korvauksen toimintamuutoksista, joita heiltä edellytetään asian edistämiseksi. Lisäksi, mikäli kierrätysvastuu siirretään tuottajille, tulee varmistaa, ettei kunnallinen kierrätystoiminta haittaa tai estä tuottajien ylläpitämää tekstiilien kierrätystä.

Jätteiden ehkäisyyn on olemassa useita laadullisia mittareita. Mikäli laadullisia standardeja sisällytetään mahdolliseen EPR ohjelmaan, on syytä hyödyntää jo olemassa olevia mittareita (harmonisoitu EU-lainsäädäntö kuten on ehdotettu Ruotsin Kemikaalivalvonnassa tai ympäristömerkintästandardeissa). Pohjoismaat voisivat yhdistää voimansa ehdottamalla em. poliittisia keinoja EU:lle tai kansainväliselle yhteisölle.

Edistettäessä uudelleenkäyttöä ja tekstiilien kierrätystä, tulee myös julkisiin hankintakriteereihin sisällyttää uudelleen käytettävät tuotteet ja kierrätysmateriaalit. Uudelleen käytettävien ja uusiotuotteiden suosiminen ruotsalaisen ympäristömerkin tapaan (Bra miljöval) voitaisiin sisällyttää kriteerinä myös muihin ympäristömerkintäjärjestelmiin. Myös muita taloudellisia ja informatiivisia ohjauskeinoja voisi käyttää pidentämään tekstiilien käyttöikää (esim. tekstiilien korjauspalveluille alempi arvonlisävero sekä tiedon levittäminen korjauspalveluista ja käytettyjen tuotteiden liikkeistä).

9. Appendix

9.1 List of interviewees

List of interviewees contacted by the authors of the report

Country	Type of the organisation	Name of the Organisation	Timing / mode	Name & position of the interviewees
Denmark	Online marketplace for private selling and buying	Den Blå Avis	17.01.2012 via telephone and e-mail	Simon Karsøe, Kommunikationsansvarlig
	Charity Organisation	Dansk Røde Kors	17.01.2012 via telephone	Erik Hove, Sektionschef
	Exporter of used clothes	Trasborg	18.01.2012 via telephone	Steen Trasborg, Manager
	Trade organization	Brancheforeningen for vask og tekstiludlejning	07.02.2012 via telephone	Søren Gram, Deputy Chairman
	Charity organization	Frelsens hær, Esbjerg	13.02.2012	Kjærtan, Manager
	Municipal waste company	Dansk Affald,	29.02.2012	Orla Percula, Manager
	Trading company used textiles	Re-tex	29.02.2012	Piet Nielsen, Manager
Finland	Supermarket chain	Kesko	13.02.2012, via telephone	Satu Nissi-Rantakömi, Research Engineer Harri Ajomaa
	Supermarket chain	S-Group	13.02.2012, via telephone	Satu Fält-Itkonen, Research Engineer
	Waste management consult	Ramboll Finland	15.02.2012, via telephone	Sanna Pulökkinen, researcher, consult
	Government official	Statistics Finland	16.02.2012, via telephone	Simo Vehviläinen, expert in waste statistics
	University, research	Technical university of Tampere /Department of Material Science	23.02.2012, via telephone	Päivi Talvenmaa, researcher, e.g. textile materials and textile waste

Country	Type of the organisation	Name of the Organisation	Timing / mode	Name & position of the interviewees
Sweden	University	IIIEE	15.02.2012, in person	Thomas Lindhqvist, Researcher, Director of PhD Education
	Waste management association	Avfall Sverige	16.03.2012, via telephone	Jon Nilsson- Djerf, Adviser for Material recycling, collection, transport
	Final-product manufacturer	Houdini	16.03.2012, via telephone	Mia Tapio, Product Manager
	Final-product manufacturer	IKEA of Sweden	19.03.2012, via telephone	Lena Pripp-Kovac, Sustainability
	Government official	Naturvårdsverket	21.03.2012, via telephone	Sanna Due, Section on Waste and Chemicals
	Recycler	Stena Recycling	27.03.2012, via telephone	Mats Tarring, Manager Business Area Services
	Second-hand shop	Myrorna	27.03.2012, via telephone	Emma Enebog, CSR Manager
	Final-product manufacturer	Fjällräven International	02.04.2012, via telephone	Donna Bruns, Global Product Manager
	Government official	Kemikalierinstitutionen	02.04.2012, via telephone	Ann-Marie Johansson, xxx
	Industry association	TEKO	02.04.2012, via telephone	Henrik Willers, Expert on Environment
	Environmental Organisation	Naturskyddsforeningen	02.04.2012, via telephone	Weronika Rehnby, in charge of Bra Miljöval eco-label for textile
	Government Official	Swedish Ministry of the Environment	11.04.2012, via telephone	Lars Ekecrantz, Special investigator, waste investigation
	Retailer	H&M	16.04.2012, via telephone	Henrik Lampa, Head of product sustainability
Japan	Material manufacturer	Teijin Fiber Ltd.	05.01.2012, in person	Mr. Yuuichiro Ikeda, Management Strategy Team

Overview of four studies on the view of stakeholders Interviewees

The studies were conducted by 10 MSc students of Natural Science Department at Lund University as part of their course work on Strategic Environmental Development.

Stakeholders	Geographical boundary	Type of the study	Number of stakeholders interviewed/surveyed	Name of the students conducted the study
Tailors, consumers	Lund	Interview, survey	3 tailors, 31 consumers	Espen Christiansen, Carl Runsbek
Second-hand shops	Lund, Malmö	Interview	10 second-hand shops	Sara Andersson, Malin Assargård, Jonna Ganslandt
Institutional users	Lund	Interview	1 service provider, 6 institutional users	Therese Svensson, Niklas Bruce
Consumers	Lund	Survey	55 consumers	Christian Nilsson, Ted Martinsson, Erik Norlander

9.2 Interview guide

1. A brief intro of the project (1. Mapping of the flow, 2. Government intervention, with focus on applicability of extended producer responsibility)
2. Activities related to textile waste prevention
 - Have you/your organisation been engaged in activities related to prevent textile waste prevention (if the interviewee does not know what we mean by textile waste prevention, we can give examples...e.g. reduction of the use of hazardous chemicals, change of material for prolongation of use, change of design to make the repair easy, collaboration with material producers on these upstream changes, engage in collection, recycling) – when we know that the actor has been doing something, we can start with the next question and come back by asking if there is anything more e have been doing
 - If yes, please let us know what you have done (examples of breakdown below)
 - Which part of the life cycle (raw material production, production of garment/final product, sales, use, second-hand, end-of-life)
 - If end-of-life, which stage? (collection, sorting, reuse, recycling, other treatment)

- Concrete description of the activities (who is doing what? What is happening at different parts of the product chain? Who is paying what, on what basis?... for end-of-life, try to fill in the “who, where, how” of the squares in the table below)

Activities	Type of responsibility		
	Physical management	Financial mechanism	Information management/provision
Collection			
Sorting			
Recycling/treatment			

- How long have you been doing this?
 - Achievement so far (e.g. change in the type of chemicals used, change in the type of textile used, collaboration with material producers regarding improved function such as durability, impregnation, etc., amount of used products collected, collaboration with specific actors regarding reuse/recycling...)
 - Key promoting/success factors (e.g. government intervention, collaboration with specific actors, provision of convenience for actor XX, support from XXX..., change in the perception of XXX, etc. etc.)
 - Challenges
 - What you have done/your suggestions for overcoming the challenges
- If no,:
 - Has anyone approached you on this issue?, if yes, who? Why did you decide not to be part of whatever others would like you to participate?
 - Any obstacles to carry out waste prevention related activities?
 - (For the upstream interviewees, in case the interviewee did not mention about initiatives related to end-of-life management, we can double check by asking what happen to the clothes the organisation produces/sells).
3. Perception on textile waste prevention today
- In your view, what are the main obstacles around textile waste prevention today? (we are looking for answers such as consumer’s attitude towards clothes, price of new clothes, price/convenience of fixing old clothes, lack of market for recycled products, lack of demand for second-hand clothes, cost for sorting, cost for recycling)

4. Perceptions on government interventions (can skip if the interviewee talk about it already when asking about promoting factors/challenges/obstacles)
 - In your view, what type of government interventions could be useful in the promotion of textile waste prevention?
5. Perception on extended producer responsibility
 - Do you know the concept of extended producer responsibility (producentansvar)?
 - If yes:
 - In general, how would you consider the applicability of EPR in the area of textile?
 - (depending on the knowledge level/type of the interviewees we can have some follow up questions such as...)
 - What could be the role(s) of your organisation in the system?
 - How should collection be carried out? In addition to charity organisations, who should carry out collection? What do you think of the potential of individual producer responsibility?
 - Who should finance the sorting?
 - Where should recycling take place? What are the potential for having domestic recycling?

If no, explain a bit about EPR, then ask about the applicability.

9.3 List of individuals in the reference group

Stakeholder group	Name, position and organisation	Country
Waste authorities/ companies	Jon Nilsson Djerf, Adviser for Material Recycling, Avfall Sverige	Sweden
Textile industry	Tone Skårdal Tobiasson, Editor-in-Chief, NICE (Nordic Initiative, Clean and Ethical)	Norway
	Lena Pripp-Kovac, Sustainability, IKEA of Sweden	Sweden
Academia	Kerli Kant Hvass, PhD fellow, Copenhagen Business School, Department of Intercultural Communication and Management	Denmark
	Päivi Talvenmaa, Research Scientist, Tampere University of Technology, Department of Materials Science, Fibre Materials	Finland

9.4 Summary of additional assumptions for the Danish case

As has been highlighted throughout Section 2.1 there is a need for additional and more reliable data in order to draw final conclusions on the Danish textile flows. However, a preliminary statement can be drawn up if a few additional assumptions (all highlighted in italic in Table in this Section) are made.

The data and the estimated data in this section are summarised in **Fejl! Henvisningskilde ikke fundet.**Table in this section. The non-market exports are the total exports from NGOs and other organizations which are assumed to be practicing non-paid export, according to the comments in Section 2.3. Further, with respect to the residual waste and bulky waste from households, a 50 % increase in the numbers from 2003 has been assumed, which is based on the fact that consumption has risen by 62 %. Finally, in this study, a small accumulation (in e.g. closets, addicts and basements) has been estimated to 3 %. In some assessments it has been suggested that there might be an accumulation effect, meaning that the clothes will accumulate in e.g. addicts, basements or closets in private homes. Given that the consumer spending on fabrics and clothing on average have increased by close to 62 %³⁷ from 2003 to 2008, this could be a fair assumption.

³⁷ Based on the expenditure groups (forbrugsart) 3111, 3121, 3122, 3123 and 3131 in statistikbanken.dk http://statistikbanken.dk/FU5_.

Table summary of Danish textile supply and use with some assumptions

	Tonnes	
Import	187,367	*
Domestic production	8,235	*
Total supply	195,602	
Exports, incl. market waste textiles (market)	123,420	*
<i>Non-market waste exports</i>	20,800	**
Incineration	31,000	***
<i>- 50% addition to incineration from households</i>	12,135	****
Landfills	0	
Recycling	160	
<i>Accumulation</i>	1,545	*****
Total use	190,060	
Supply – use	6,542	

* Table 2 1

** Table 2 3

*** Data from Section 2.1.4

**** 50 % extra waste in residual and bulky wastes

***** Domestic supply (total supply – market and non-market exports) incl. a 3 % accumulation effect

These numbers leaves us with a “gap” of 6,542 tonnes which is a relatively small number considering the uncertainties in the numbers

9.5 A summary of REACH regulation relevant to textiles

The REACH regulation applies to chemical substances as such, chemical preparations and to articles. Textiles and apparel products are considered to be articles under REACH and here the specific requirements for substances in articles become relevant. For substances in articles there are three key requirements or relevance, related to registration, notification and the provision of information for downstream users.

Requirements regarding registration of substances in articles – REACH Article 7(1) and 7(5))

Producers and importers of products must submit a registration regarding the chemical substances found in the products, provided that (a) chemicals present in those product exceeds one tonne per producer or importer per year, AND (b) the chemical “is intended to be released under normal or reasonably foreseeable conditions of use” (Article 7 Paragraph 1). It is worth noting here that very few textile products are be-

lieved to meet the second condition, that the chemical must be *intended* to be released from the product. Exceptions may include scented textiles, and textiles made out of *synthetic fibres* with antibacterial properties. (It is important to note the distinction of *synthetic fibres with antibacterial properties*, fabrics (synthetic or others) with antibacterial finish does not contain substances with an intended release, nor does natural fibres with antibacterial properties).

Requirements regarding notification of substances in articles – REACH Article 7(2)

Producers and importers of textile products need to notify the European Chemical Agency when their products contain hazardous substances³⁸ that are included in the REACH candidate list for authorisation when both of the following conditions are met: (a) chemicals present in all products produced by the same producer or importer exceeds one tonne per year, (b) the chemical is present in products above a concentration of 0.1 % weight by weight. (Article 7 Paragraph 2, Article 57). (The requirements do not apply if the producer or importer can ensure that humans or the environment will not be exposed during foreseeable conditions of use and disposal, or if the substance has already been registered for that specific use.) The duty to notify applies 6 months after the substance has been included on the candidate list.

Article 33: Duty to communicate information on substances in articles

Producers, importers and other suppliers of articles containing substances listed on the Substances of Very High Concern candidate list (in concentrations above 0,1%) are obliged to forward information available to them down the supply chain (Article 33(1) and to consumers upon request (Article 33(2)).

Two recent studies on chemicals in textile products (the Danish and Swedish studies on chemicals found in textiles pointed to various chemicals found in clothes (Brunn Paulsen et al., 2011) and those used in the different parts of textile life (Olsson et al., 2009). A handful of substances found in the studies (e.g. organostannic compounds, cadmium, nonylphenol, nonylphenol ethoxylates) are found in the list of restricted substances (Annex XVII of the REACH Regulation). In addition, although

³⁸ The properties of these hazardous chemicals include carcinogenic, mutagenic, reproductive toxic, persistent, bioaccumulative and toxic and very persistent and very bioaccumulative (Article 57). Detail criteria of these chemicals are listed in Annex XIII of the REACH Regulation.

not in REACH legislation, a few European countries, including Finland and Norway, restrict the use of formaldehyde in textile products (CBI Ministry of Foreign Affairs of the Netherlands, 2011). the substance also found in the studies. Especially the Danish study (Brunn Paulsen et al., 2011) indicates that products with some of these substances manage to slip into the market.



Prevention of Textile Waste

Material flows of textiles in three Nordic countries and suggestions on policy instruments

Textile exerts various environmental impacts throughout its life cycle. Prevention of textile waste is one means to reduce these impacts. This study seeks to map-out the flow of textile products in the three Nordic Countries – Denmark, Finland and Sweden – from the time they are put on the market until they are discarded. Based on the findings on the flows as well as on the perception of stakeholders, the study reviews and discusses government interventions that may be useful for the enhancement of textile waste prevention. Potential use of various policy instruments based on the concept of extended producer responsibility (EPR) is analysed. The study indicates a handful of areas where further research is needed in order to fine-tune policy actions that would best address the situation specific to the case countries.

