Textile waste prevention and recycling - a Nordic perspective
Textile flow in Sweden

Net inflow 131,800 Tons
15 kg/person/year

Trade

Use

<0.1
3
0.3
8
4

Charity
Organizations

Export/relief
Consignments

Waste firms

Source of errors
Uncertainties

Recycling

Incineration

Fig in Tonnes
Source: Carlsson, A
Why do you need prevention/recycling

- Waste of **recourses** - 54-80% of used clothing is thrown away as MSW

- Reduces important **impacts** in production phase

- Positive **financial** impacts both for individual consumers and for society through job creation

Nordic Council of Ministries – Green Growth
Aim to increase reuse and recycling
Hagby “analysis” – what could be done

Sweden: 15 kg/capita textile (65%) is thrown away as MSW. Of these 3 kg goes to second hand but the rest:

- **MSW 100%**
- Possible to recycle 65%
- Of these:
  - High quality 5% (Russia, South America)
  - “Export quality” (Africa) 60%
  - Recycling as fibres 9%
  - Recycling as rags 10%
  - Residues for incineration 15%
  - Not recyclable 15%

In order to make it work….Collection
Collection examples...

- Internet trading
- Second hand stores directly
- Take-back in shops
- Charity containers
- Internet material bank
- Kerbside collection
Collection

- Internet trading
Collection

• Second hand stores directly (Red Cross, private initiatives)
Collection

• Take-back in shops
  ✓ Own brand sell in own shops: Fillippa K, Boomerang

✓ Own brand sell for chemical recycling: Patagonia, Haglöfs, Houdini

✓ Brand refund system: Klättermusen, H&M
Collection

- Charity containers
Collection

- Internet material bank (Finland) – business to business
Collection

- Kerbside collection
Collection

Problems with collection:

- Not financially viable to provide collection points in all parts of the country (solved with EPR?).
- Containers near the residence to the consumer
- Decreased quality due to internet trading
- Illegal collection (theft from containers, kerbside)
Sorting

• Manually

• Textiles for Textiles (T4T) – using Near Infra Read spectroscopy, fibre composition and colour (not mixed materials)

• RFID sorting – tag and sensor (not yet developed)

NOTE:
Not of the automatic can sort reusable from non reusable

High wages exclude sorting in Nordic countries
Recycling - Measures

Chemical:
• Polyester fibre recycling - Eco Circle (polyester)
• Renew cell (cotton, viscose)

Mechanical:
• Down-cycling

Thermal:
• Biogas (cotton)
• Incineration (all)
Polyester recycling

- Two main ways:
  - Polyester is *melted* and re-extruded into fibers
  - Polyester is *depolymerised* and re-polymerised (higher quality)

- *Eco Circle*, Teijin Fiber (Japan)
  - Recycling of Polyester fibers from monomers
  - Same quality as virgin material
  - Only own produced material (not mixed)
Re:newcell

Collection & sorting of textile waste → Shredding → Chemical pre-treatment → Chemical dissolution → Regenerated cellulose

Make-up

Recycling of chemicals

Scrap, reject and rest-product → Sorting & conventional treatment → Spinning of viscose fibre

Source: Youhanan, L (2013)
Down-cycling

- Cutting fabrics into rags (wipers)

- Shredded for use in other types of products (bedding flock, insulation, paper)

Ex Insulation: Bonded Logic – denim is treated with boric acid to make the material flame retardant
Biogas

1 ton of textile waste

- Sorting
- Shredding
- Separation
- Cellulosic fibers
- Biomass processing
- Biogas

Only cellulose can be digested.
Borås:
(0,5 kg of Ethanol)
or 380 l of methane gas/kg cotton

N-methylmorpholine-N-oxide (NMMO) can be used to pretreat cotton/polyester blends increasing the yield x2
Incineration

- Energy production: 15 800 MJ/ton of mixed textile waste

- Problems with ignition front propagating too fast leaving a significant amount of material above it unignited.
Recycling - problems

- Chemical recycling demands more energy than other recycling methods
- Mixed materials
- No value?
- Decreased quality – increased consumption?
- Creates employment or undermining local industries?
- Rebound effects – cheaper clothing – more consumption?

Monika Olsson, Industrial Ecology,
Recycling – problems cont.

- Unwillingness of some municipalities since this will mean a decline of dry waste going to the incinerator

- Hazardous/problematic new contents: Flame retardants, nano textiles, silver

- Market needs to improve

- Working environment - Hazardous compounds

- Not always environmentally favourable

- Re:newcell – viscose from cotton does not replace cotton
Policy measures, legislation

- EPA (Sweden) – goals for increased textile reuse and recycling:
  - 2018 – easy accessible collection systems for reuse
  - 2020 – loops for textiles resource efficient and free from hazardous comp
  - 2020 – 40% of textiles reused
  - 2020 – 25% of textiles recirculated
  - Producer responsibility and information for changed consumer behaviour
Policy measures, legislation cont.

- EU and Nordic labelling – to meet the criteria for Eco labelling 85% by weight of all fibres in the product must be of recycled origin

- EPR – in France – member companies pay fees based on the volume of products put on the market the previous year.

- Green public procurements – Japan (hats, uniforms, carpets)

- In EU no legislative measures have been taken to address textile waste prevention. But Waste prevention programme in member states
Waste Prevention Programme (Swe) (EU Directive on Waste 2008/98/EC)

Focus areas:
- Food
- Textiles
- Electronics
- Construction and demolition

Why these?
- Large amount
- Greenhouse gas emissions
- Dangerous substances
Consumer

- Recycling increases but consumption even more (most women)
- Less prone to take action to prolong the use of garments already in their possession
- Repair or not: value, visibility of mending, level of difficulty
Prevention measures

- Choose "Eco clothing" (less chemicals)

- **Labelling** – makes people buy recirculated material, organic etc

- Buy **second hand** – Wintage, flea market, internet

- **Renting /libraries**

- **New business models** – *services instead of products*

- Properly **stored**
Summary

• Lot of textile goes to waste
• Lot of initiatives of reuse and recycle
• New techniques for recycling emerging
• Difficulties with new and mixed materials and high costs
• Consumption and Prevention
• KOMPLEX problem