Sustainability Trends in the Textiles Industry

Textile production, sale and usage are a part of a global industry employing millions of workers and benefitting consumers all around the world. It is also considered one of the most environmentally hazardous industries, responsible for 8% of the global carbon footprint, similar to that of all the EU. The environmental impact of the fashion industry continues to be exacerbated through the rise of fast fashion, whilst other factors such as pesticide pollution, water withdrawal and climate change are also impacting sustainability.

This paper highlights the complexity of the issues involved. Whereas the European industry was once reshaped by competitive Asian imports, investment is now being propelled by Environmental, Social and Corporate Governance (ESG) considerations driven by both consumer focus and changes in regulations.

There are no simple answers but now is the time to act. Consumer behaviour must change and the industry needs to re-examine its social and environmental impact and invest to become more sustainable.

INTRODUCTION

In **2020**, the **global textiles industry** was valued at **over $1tn**, and expected to grow rapidly with **global demand for textiles expected to more than double by 2050.**

The production of textiles has many parts including agriculture, manufacturing, distribution and disposal. The chemical industry supplies raw materials for textile production and treatment - such as the production of synthetic fibres, processing chemicals, dyes, etc. - as well as chemicals that support and process the considerable amount of water needed. The end markets served are varied and include both **household** and **technical uses** (such as furniture, hygiene products and automotive interiors) and **apparel** which comprises **garments** and **footwear**.

Figure 1. *Textiles, Apparel & Luxury Goods Relative Index Performance*

Source: CapIQ

The **global production of textile fibres** has almost **tripled since 1975** and is **expected to double by 2050**. About **60% of textile fibres produced are synthetic polymers**, while **40% are natural**, cotton being the most important.

Synthetics use a variety of raw materials including coal, oil & gas and water to create polymer resins which are spun into polyester, nylon, polyolefins and polyamide. **Cotton**, which is a natural cellulose-based fibre, is the **second most important in terms of production**, at **23%.** Other cellulose fibres include jute, flax, hemp and linen. **Natural protein-based**

fibres such as silk and wool contribute to **less than 2%** of all fibre production.

KEY ESG ISSUES

The textile industry is hugely important to the global economy and yet it is **considered one of the most hazardous industries to the environment and society** all through the supply chain from crop cultivation, manufacturing, distribution, to the end of life of the items. The industry is becoming more globally aware of the urgent need to become more responsible with the use of resources and dissociating growth from resource consumption. However, the **rapid growth in fibre production** is having an **unprecedented impact** on people and the planet, and more needs to be done to reach the scale and speed necessary to slow down these impacts.

ENVIRONMENTAL

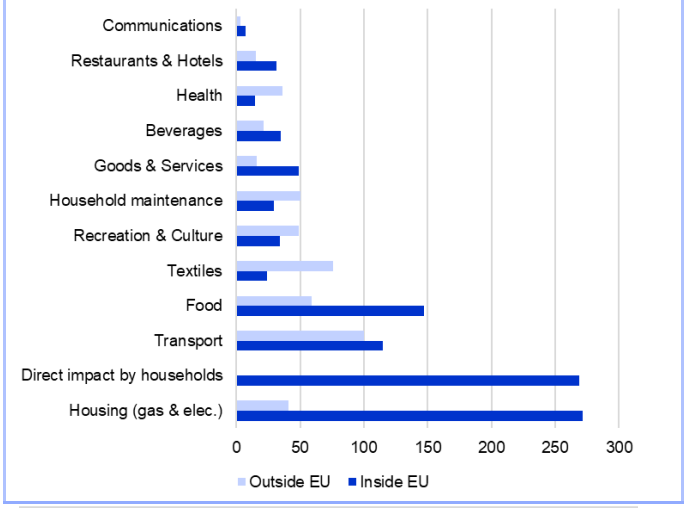
GREEN HOUSE GASES (GHG) EMISSIONS

The **global apparel and footwear industry** is responsible for **8% of the global carbon footprint**, similar to all the EU countries combined. This ranks the **textiles industry** as the **fifth largest contributor to GHG emissions globally**, according to the European Environment Agency (EEA).

Although the entire supply chain generates GHG emissions, **over half of them are released in three main stages**: **fibre production**, **yarn preparation** and **dyeing & finishing**.

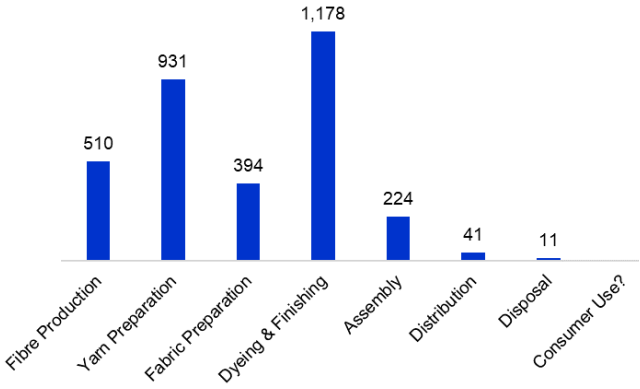
The **dyeing & finishing stage is the top producer of GHG emissions**. Unlike yarn preparation which only uses electricity to run the machines, dyeing & finishing **requires high temperatures of 100°C**, where heat is provided by coal and natural gas (contributing to 60-70% total GHG of this stage). As production is led in Asia Pacific (APAC), the total supply chain emissions are mostly due to the region's current reliance on coal and natural gas for generating heat and electricity. Most production is shipped so distribution accounts for less than 2% of total GHG emissions. Air freight is relatively less important but any further move to supply the world's appetite for immediate demand through increasing air freight will have a significant impact on carbon emissions.

Figure 2. *GHG Emissions in 2017 (indexed to Textiles)*



Source: EEA

Figure 3. *Climate Change Impact (10^6 metric tons CO_2)*



Source: Quantis '*Measuring Fashion*'

CONSUMPTION OF WATER

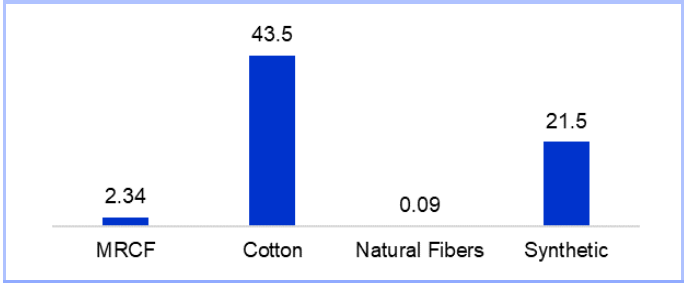
In **2015**, the global textiles and clothing industry was responsible for the **consumption of 79bn cubic metres of water**, according to the Global Fashion Agenda estimates. This devastating freshwater withdrawal is **putting water sources under immense pressure**, particularly in APAC regions. Freshwater withdrawal is **the permanent or temporary removal of surface or groundwater** to be processed in farms or plants. **Withdrawals over 40%** for a region are **considered critical** and **visible stress** on the region's function or **ecosystems becomes apparent**.

"The water consumed to grow India's cotton exports in 2013 would be enough to supply 85% of the country's 1.24 billion people with 100 litres of water every day for a year. Meanwhile, more than 100 million people in India do not have access to safe water" *— The Guardian, 20 March 2015*

The **fibre production stage** is the greatest **contributor to water withdrawal** from the environment, accounting for **31% of total water withdrawal** which is **mostly due to cotton cultivation**. Approximately **10,000 litres of water is required to produce a single kilogram of cotton**, as a vast amount of water

irrigation is used in the agriculture stage, estimated by the UN Climate Change. Although **synthetic fibres** account for over 50% of all fibre production, their **water withdrawal impact is half that seen with cotton** because they are **produced from fossil fuels** as opposed to crop cultivation.

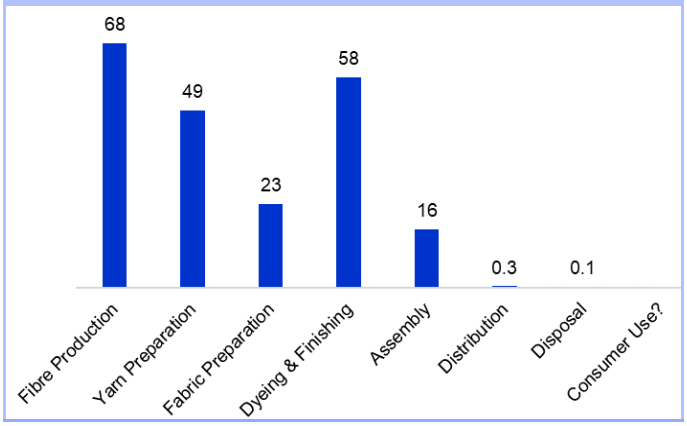
Figure 4. *Freshwater Withdrawal (10^9 m^3) by Fibre*



Source: Quantis '*Measuring Fashion*'

The **dyeing & finishing industry** is the second **largest contributor to water withdrawal** (at 23% total water use). Although the **APAC region dominates the dye market**, **North America is anticipated to have the highest growth rate**. In the manufacturing process, **huge amounts of water are used to wash and clean** the fabrics both before and after bleaching and dyeing. **Consumer use** is estimated to have one **of the largest water footprints** owing to the repeated **washing of garments**. It is, however, very difficult to monitor and quantify these impacts, which are increased by the ever-growing volumes of clothing purchased by consumers, and advances in rapid low-cost manufacturing driving new consumer behaviours like 'Fast Fashion'.

Figure 5. *Freshwater Withdrawal (10^9 m^3) per Stage*



Source: Quantis '*Measuring Fashion*'

PESTICIDE USE

Large proportions of agricultural land are needed to grow **cotton**, **the most pesticide-intensive crop**, **using almost a quarter of total global insecticide volumes**. After processing in the fibre production stage, **the water effluent is returned to the water supply**, polluted with pesticides, further damaging ecosystems.

Figure 6. *Natural cotton plants*

ENERGY

As **polyester** is manufactured **from fossil fuels** it consumes **more energy in the production stage than cotton**. Whilst growing, cotton consumes 1.65kg of CO_2 but it emits 4.7kg of CO_2 per kg throughout the supply chain. **Overall, cotton consumes more energy, with the consumer use stage accounting for 60% of total usage** due to repeated washing and cleaning. A study (quoted in the Handbook of Life Cycle Assessment of Textiles and Clothing) revealed that **100% cotton fabrics consumed 20% more energy in the laundering processes than 50-50 polyester/ cotton blends**.

DYES

In production, fabrics are bleached and cleaned with detergents to remove impurities, before being **dyed at high** temperatures (100°C). **Azo dyes** are the largest **group of colourants**, owing to their bright colours, ease of use and cost effectiveness compared to natural dyes. **Up to 200,000 tons of dye is lost to effluent every year** after the fabrics are produced and dyed because of **inefficient dyeing and finishing processes**, releasing chemicals into the wastewater.

In the **finishing stage**, **chemicals such as chlorobenzenes are used in polyesters**, and **chlorinated paraffins and formaldehydes are used for waterproofing and flame retardant effects**. However, the high resistance to biodegradation makes **removal of these agents from wastewater highly challenging** and they can enter ecosystems. If Azo dyes are ingested and metabolised, they present potential carcinogenic characteristics, causing damage to DNA.

MICROPLASTICS

The **repeated washing of garments** by the consumer,

especially synthetic fibres, is resulting in the release **of billions of particles of microplastics**. Polyester **accounts for 52% of total fibres produced**, and despite needing a lower wash temperature and water footprint than cotton, **one load of laundry of polyester discharges 700,000 microplastic particles into the environment**, according to a study conducted by Plymouth University. The **impact of microplastic pollution is not fully understood**, but studies show these **eventually end up in food chains**, blocking digestive systems of small animals and **disrupting ecosystems**.

Figure 7. *Dyed fabrics*

Figure 8. *A launderette*

LANDFILL

In the last 20 years, **production of textiles grew by 57% leading to a similar increase in landfill volumes**. Globally, **only 12% of clothing is recycled** and **only 1% is recycled into new clothes** (Ellen MacArthur Foundation). This compares with recycling rates of 66% for paper and nearly 30% for PET bottles.

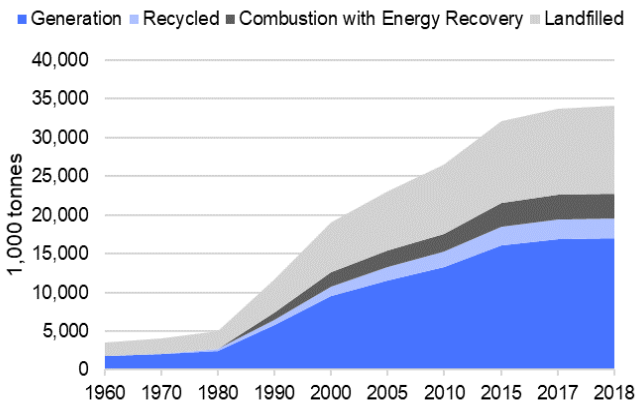
The **average consumer in America** disposes **of 36kg of clothing a year**, with the **average in Europe at 11kg**. With **only approximately 15% of textiles being eventually recycled**, the rest is going to **landfill (66%)** or being incinerated for energy (18%), according to the US Environmental Protection Agency.

FAST FASHION

Recent **innovations in supply chain management** amongst retailers have **enabled high speed mass production** of high fashion knock-offs at **low costs**. This process is called **'fast fashion'** and is driven by a **fall in garment price and high collection turnaround**, feeding the growing consumer appetite for new trends. The **price of clothing dropped 30% from 1996 to 2018, relative to inflation**, according to the EEA, with the **average consumer purchasing 60% more clothing items than they did 15 years ago**. Between 2000 and 2015, the average **clothing utilisation** (the number of times an item is worn) **declined by about a third**, while global volumes sold doubled to reach more than 100bn items per year.

The commercial advantage of fast fashion, is that

Figure 9. *Textiles Waste Management 1960—2018*



Source: U.S. Environmental Protection Agency

lower prices fuel consumer spending and lead to higher economic growth. In addition, the pressure of limited stock availability (before the next trend rolls out) also encourages **over shopping and impulse buying behaviours**. Fast fashion does, however, support urban regeneration, providing an incentive for high street shopping, which benefits other retailers on the high street, many of which are suffering in the wake of the pandemic. The wasteful attitude this promotes results in an **average clothing lifespan of just 3 years**.

SOCIAL

LABOUR CONDITIONS

Some regions producing garments for the fast **fashion industry** have been reported to **exploit cheap labour and poor working conditions**.

Child labour is a **significant issue** within the textile industry, as many aspects of the supply chain require low-skilled labour such as cotton picking during the fibre production stage. Employing child workers for the spinning mills is also reported to be widespread in certain regions. The industry still faces instances where people are employed in poorly regulated or unsafe conditions within finishing. Recent reports of working conditions in Leicester in the UK provoked outrage in the media.

The **consumer often has no idea where their textiles have come from** and trying to **trace back through the supply chain is near impossible** and cannot really effect change.

RECYCLING IMPACTS ON NASCENT MANUFACTURERS

A third of the globally donated clothes are resold in Sub Saharan Africa. Whilst demand exists for

Western clothes, the high influx seen between **1975 and 2000**, resulted in **Ghana's textiles employment falling by 80%**. This has led to other countries taking action. An example of this is that **Nigeria has banned imported textiles.**

KEY SOLUTIONS

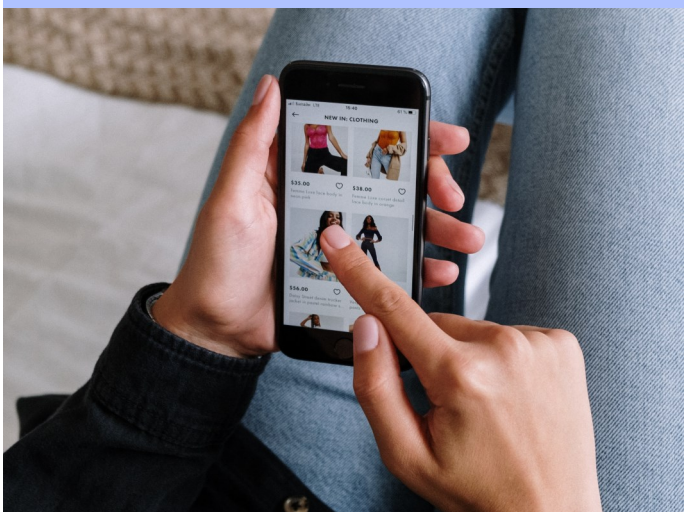
There are many initiatives the industry can follow to improve sustainability and conserve resources for future generations. **Ultimately, the goal is to steer towards a circular model, seeking to reduce waste, and keeping materials within the consumption and production loop for as long as possible**. This includes **using alternative, less harmful materials, chemicals and processes** and **pursuing technology innovations to improve economics and quality for recycling**. However, better communication and clarity of policy are needed to align **clothing design with recycling processes** and to stimulate **changes in consumer behaviour.**

RE-USE

DEPOP

A **resurgence in demand for second-hand garments** has led to an **evolution in business models** from simple online shopping to **'closed loop' models**. A popular app called **Depop** (UK) lets users buy and sell second-hand garments through its online marketplace, with the appeal of 'vintage' and unique clothing for its consumers. This model is **incentivising people to take care of their clothing**, and to invest in good quality clothing that lasts, knowing the future **resale value potential**. Depop was founded in 2011, and currently has over **30m registered users across 150 countries**. The downside is online exchanging of second-hand clothing is taking away potential trade from charity shops, which aim to raise funds to support vulnerable communities. Recognising the potential for this market in the longer term, **Etsy** (another online giant; US) **agreed to buy Depop for $1.6bn** in June 2021. This deal valued Depop at **23.2x sales** (FY20).

Figure 10. *Popular clothing app*



RENTAL

Other companies are **offering long-term warranties** that include **free repair** or instructions **for repair and upcycling**. **Rent the Runway** (US) offers a monthly **subscription** for consumers to **rent a specific number of clothing items** each month, allowing customers to change their wardrobe regularly without discarding unwanted clothing. This could **restrict overall demand for high quality garments that are bought to wear for limited numbers of events**.

SLOW FASHION

'Slow fashion' is a movement to **convince consumers to buy fewer and better quality clothing** with the aim of promoting the wearing of individual items of clothing more often. This discourages consumers from being tempted by all the latest trends. For this to be successful, **consumers must be willing to pay higher prices for longer lasting materials**. It is **too early to tell** whether **consumer behaviour** will shift towards choosing these **more environmentally sustainable options**.

INDIVIDUAL BRAND STRATEGIES

A number of brands have raised consumer awareness through campaigns, set to **educate consumers** on **choosing more sustainable options** when buying clothing. However, **although surveys indicate consumers support environmentally sustainable fashion**, this has not **been reflected in consumer trends** and slow fashion has only had limited success. In April 2021, **Levi Strauss & Co.** (US) launched the 'Buy Better, Wear Longer' Sustainability Campaign to raise awareness of the need to tackle the environmental impacts of clothing production. This would have the added benefit of **encouraging consumers to trade-up and swap to buying more durable apparel** (such as long-lasting Levi jeans), in **addition to wearing each item for longer**. On purchasing Levi jeans, the company offers the **consumer access to in-store tailor shops** to **extend garment life**. In 2011, **Patagonia's** (US) **sustainability strategy 'Don't buy our products' highlighted the negative environmental impacts** caused by consumerism and **aimed to dissuade the purchasing of clothing consumers do not need** - ultimately,

Patagonia's sales increased by 30% in the nine months following the campaign.

INVESTMENT AND M&A

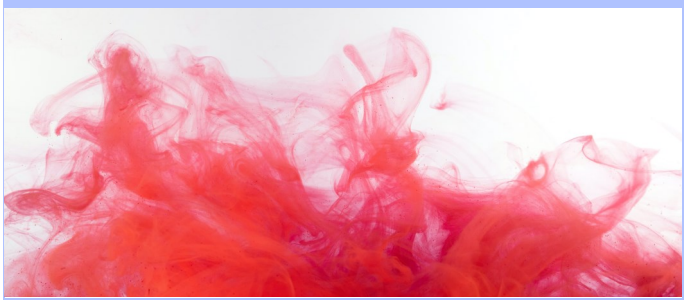
In June 2021, the e-commerce firm Etsy announced the acquisition of the shopping app Depop for $1.6bn, with a younger 'Gen Z' community and social media marketplace. According to the GlobalData analytics firms, **resale clothing market is set to reach $64bn in the next five years**.

REDUCE

BIO YARNS

Producing synthetic fibres from renewable resources, rather than fossil fuels, will help to **reduce GHG emissions in the production stage**. An emerging preferred fibre is **biosynthetics**, which are **made wholly or partly from renewable resources** such as starches, lipids, corn, sugar cane and beet. Dissociating from using fossil fuel derivatives for fibres like polyester will reduce total carbon emissions, whilst also overcoming the risk associated with future oil price volatility. Bio-based glycols have been available for some time, **Indian Glycols** (IN) has been a pioneer, but bio-PTA is proving more challenging. **Genomatica** (US), a producer of sustainable materials, who produces Bio-BDO for various end markets, recently announced it had partnered with **lululemon** (US), an athletic apparel brand, to produce bio-nylon for clothing.

Figure 11. *Novel dying techniques*



NEW DYE TECHNOLOGY

Development in new technologies in the manufacturing stage is **aiming to eliminate the reliance on harsh dyes** and **reduce the levels of chemicals released** into the environment. **DyeCoo** (NL), has experimented with **novel dyeing processes**, using pressurised supercritical CO_2 as the dyeing medium instead of water, **resulting in 98% dye uptake and no wastewater**.

Other companies have employed more 'traditional' approaches using spices, such as turmeric and elderberries, though these natural resources will inevitably compete for agricultural land. Considering this, **microbe dyes emerged**, a technology discovered by **Faber Futures** (UK). **Microbes change colour depending on the pH of the medium they are grown in.** Textiles are soaked in the bacteria and a chosen medium pH, and as the bacteria grows, the fibres are dyed, **using less water than conventional dyes.**

INVESTMENT AND M&A

Increasing consumer demand is encouraging new investments to expand production of materials that are perceived as **more environmentally sustainable**.

BASF's (DE) **E3 Sustainable Cotton program** launched in 2020 and enrols farmers into an independently audited scheme for growing **cotton efficiently, while reducing the impact on the environment.** The scheme is independently audited so that the end customers know exactly what their clothes are made of, how they are made, and where the cotton comes from.

In June 2021, **Solvay** (BE) announced the launch of a **partially bio-based polyamide-5,6 textile yarn**, using bio-based petanediamine and adipic acid feedstocks. The yarn is produced in their Brazilian industrial site, using **closed water circuits** and **zero effluent** emissions. Sustainable textiles accounts for 30% of the company's global polyamide portfolio.

Use of **cellulose acetate textiles fibres** is growing at **CAGR of 9% through 2024** (IHS markets). In May 2021, **Eastman** (US) announced plans to increase capacity of their Naia™ cellulosic filament yarn site in Barcelona to meet growing demand. Naia™ is a cellulose acetate fibre **made via a closed loop process from pine and eucalyptus wood sources** from sustainably **managed and certified forests**.

RECYCLE

CHEMICAL RECYCLING

Chemical recycling uses **several chemical processes** to **produce fibres of the same quality as virgin counterparts**. Fibres are **sorted, shredded and then depolymerised via chemical reactions to monomers**. The monomers are then polymerised back to the material. **Unfortunately, most materials are blends of different fibres** which **makes recycling the materials particularly challenging**. Cotton can be chemically **recycled to viscose,** however **only 100% cotton fibres**

can be used, because impurities affect the chemical reactions and therefore any dyed, bleached, or blended yarns are void from recycling. Other fibres such as **polyester** and **nylon can also be chemically recycled**.

MECHANICAL RECYCLING

Textiles can also be mechanically recycled, where **fabrics are returned back to the fibres**. A growing **amount of polyester in apparel originates from waste PET bottles** which are processed mechanically. The fabric/plastic is sorted into different material blends, and by colour, before it is cut and shredded to liberate the fibres (plastics are melted and extruded to form fibres). Although **less energy intensive than chemical recycling**, the process of shredding and cutting the fibres **reduces the overall quality and results in coarser yarns**, which **end up being downcycled** and used in composite material for insulation, carpets and mattress stuffing.

Clothing recycling has not seen the traction expected. The technology has been around for several decades, but it has not become widespread. The Italian city of **Prato in Tuscany** has been designing clothing for centuries, and due to the town being unable to afford expensive materials, **have been recycling used clothing into wools and knitwear since the mid-19th Century**. In addition to maintaining high garment quality, manufacturing expenses are reduced, and carbon emissions of produced wool shirts more than halved. The process strips the fabrics back to the fibres, called 'mechanical wool' and, by sorting by colour, eliminates the need for dyeing downstream. Fibres are purchased by high fashion brands, where they are spun, woven, and designed into garments. **This city processes 15% of all recycled clothing in the world equivalent to 25 tonnes per day**, and demonstrates how the entire industry could change.

CHARITY SHOPS

Unfortunately, **of the garments that are donated** and sent to charity shops, **as little as 10-30% are considered wearable and saleable**. The rest are either sent to landfill or burned.

DISASSEMBLY

As **only 1% of all textiles are recycled into new clothing**, one of the most effective ways to reduce waste is to **align clothing design with recycling processes**. Most clothes are made of a combination of different fabrics, such as synthetic and natural fibres and metals (zips) and can be challenging to separate. **Clever product design optimised for disassembly** (modular design) **can help to ease separation of fabrics for recycling** with fewer seams and less waste produced.

INVESTMENT AND M&A

Recent developments in recycling technologies saw the June 2021 **partnership** of **Lenzing** (DE), a producer of wood-based fibres, with pulp producer **Södra** (SE), to **transfer knowledge and advance recycling technologies to process 25,000 metric tons/year of textiles waste by 2025**. Södra developed the world's first process for industrial scale recycling of textiles waste, which combines 50% wood cellulose with 50% textiles waste to create a dissolving pulp. This pulp can be used to produce new clothing and other textiles products.

Similarly, in May 2021, **Nouryon** (NL) partnered with textiles recycling company **Renewcell** (SE), to **provide specialty chemical and engineering solutions** to Renewcell's new plant in **Sundsvall, Sweden**. The site, which is powered by renewable energy, will recycle textiles waste, such as used jeans and production scraps, to **produce biodegradable dissolving pulp**.

REGULATION

PACKAGING WASTE DIRECTIVE

Policy can be used to **fast-track changes** within the industry. The **EU Packaging Waste Directive introduced targets for member states to recycle 65% of all packaging by 2025**, followed by 70% in 2030 with specific targets for individual packaging materials. The **Landfill Directive** (The European Directive 1999/31/EC on the Landfill of Waste) **aims to reduce total municipal waste landfilled to 10% by 2035**.

BETTER COTTON INITIATIVE

In March 2013, the European **Parliament adopted an initiative on sustainability in the global cotton value chain**, welcoming the Better Cotton initiative (BTI), Cotton Made in Africa and Global Organic Textile Standards (GOTS). This is to increase sustainability of cotton and urge stakeholders to commit to the International Cotton Advisory Committee (ICAC) principles, to **minimise environmental degradation, water use and pesticides**. The Textile Exchange's Material Change Index (MCI) is the largest peer-to-peer comparison initiative aimed at **tracking the textile industry's progression on sustainable materials** sourcing, as well as its alignment with efforts to implement **Sustainable Development Goals to transition to a circular economy**.

CONCLUSION

The COVID-19 pandemic has brought about profound global social and economic shocks and focused consumer attention on environmental concerns. As the world economy recovers, consumers are likely to want to continue to want to use their buying power to promote more environmentally-friendly clothing trends.

This paper highlights the complexity of the issues involved. There are no simple answers but now is the time to act. Consumer behaviour must change and the industry needs to re-examine its social and environmental impact and invest to become more sustainable.

The way forward must be to reduce the largest impacts which do not create another, possibly larger, problem in the solution. It is important to develop a cotton plant that can grow well with much less water and is more resistant to pests. It is also important to invest in dyes that require less water and chemicals.

Highlighted by the purchase of Depop by Etsy earlier this year, many believe that these trends will reveal commercial opportunities for both established and new entrepreneurial companies. Those that can invest in the circular economy and sustainable manufacturing, as well as those that can support this industry in reaching its aims of becoming less environmentally hazardous are likely to become the next generation of winners.

In many cases, the move to greener textiles can be facilitated by the chemical industry and the smart use of new (and some traditional) chemical technologies and processes. Some companies have an aversion to taking risk, but this is the time for action. New technologies need capital and they need guaranteed demand for their recycled product. We at Natrium Capital are active in helping companies to review their portfolios & strategies, advise on transactions and on raising capital for new investments.

ABOUT NATRIUM CAPITAL

Natrium Capital Limited is an independent Chemicals M&A boutique set up by Alasdair Nisbet in 2012. Natrium Capital provides high level strategic and M&A advice primarily focused on the chemical, materials, biotechnology and clean technology industries. Headquartered in London, Natrium Capital and team advise on complex global cross-border transactions and have advised on over $100bn transaction value in the sector.

Natrium Capital is authorised and regulated by the Financial Conduct Authority.

SELECT PREVIOUS DEALS OF NATRIUM CAPITAL

SOLVAY

Jan 2021

Sale of Amphoteric Surfactants business in N. America & Europe to OpenGate Capital

Deal size not disclosed

Natrium capital

Gil Investments

Dec 2020

Sale of ICoNiChem to Eti Bakir

Deal size not disclosed

Natrium capital

DOMO

Aug 2019

Acquisition of Solvay's Performance Polyamide Business in Europe by DOMO Chemicals

Deal size €300m

Natrium capital

H.I.G. CAPITAL

Aug 2019

Acquisition of Covestro's Polyurethane Systems Business by HIG Capital

Deal size not disclosed

Natrium capital

CONTACT THE TEAM	ALASDAIR NISBET	LAURA MARSH	SOPHIE BEADSMOORE
Click here	CEO	Director	Analyst
	+44 7767 207 185	+44 7920 473 992	+44 7570 723 639

The information and views contained in this report were prepared by Natrium Capital Limited. It is not a research report, as such term is defined by applicable law and regulations, and is provided for information purposes only. No part of this material may be copied or duplicated in any form or by any means, or redistributed, without Natrium Capital Limited's prior written consent. For a full disclaimer see www.natriumcapital.com/disclaimer.

Copyright © 2021 Natrium Capital Limited. All rights reserved. www.natriumcapital.com