

WHAT TO WEAR?

WHY FAST FASHION IS COSTING THE EARTH

ARTICLE BY
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The glamorous world of fashion has ugly skeletons in its closet. Textile production is one of the world's dirtiest polluters. Huge volumes of low-cost garments are being churned out at high environmental and ethical cost, and at a pace that has doubled in only 15 years. The 'take-make-dispose' model of production is ripe for deep systemic change, but are we ready for a circular textile economy by 2049?

Anna K. is a typical 16-year-old European fashion consumer. Like many teens, she likes to refresh her wardrobe frequently with trendy streetwear and stylish new accessories. Being a high-school student on a strict budget, she favours low-cost brands and binges on January sales, treating herself to impulse purchases she may never wear more than once.

Anna admittedly looks cute in her glitter t-shirt, form-fitting jeans, and chunky-heeled gladiator sandals. But cute comes with a price tag that the planet can no longer afford.

Let's start with her thirsty cotton t-shirt, which guzzled nearly three thousand litres of water before it ever saw a washing machine. The fashion industry is estimated to consume around 79 billion cubic metres of water per year in cotton crop irrigation and industrial processing: that is enough drinking water for 110 million people for an entire year.¹

¹ Global Fashion Agenda and The Boston Consulting Group (2017). *Pulse of the Fashion Industry Report*. Available at <bit.ly/2GhsD8w>

Anna's t-shirt also leaves a toxic trail. Roughly 3 per cent of the world's farmland is planted with cotton, yet cotton accounts for an estimated 16 per cent of global insecticide usage and 7 per cent of all herbicides.² Organic cotton – though water-intensive – is a more sustainable alternative, but it currently represents less than 1 per cent of the world's annual cotton crop.

ALL THAT GLITTERS IS NOT GOLD

The metallic print on Anna's t-shirt is eye-catching for two reasons: it adds bling to her look, yet it also signals the presence of toxic phthalates. The indigo dye, too, is a cocktail of poisons. The bright colours and appealing prints of many garments are achieved with heavy metals such as copper, arsenic, and lead, together with hazardous chemicals such as nonylphenol ethoxylates.

The textile industry is among the world's top polluters of clean water, with the dyeing and treatment of textiles accounting for 20 per cent of all industrial water pollution.³ Despite initiatives such as Greenpeace's recent Detox campaign pressuring fashion giants to commit to zero discharge of hazardous chemicals, the use of toxic substances continues in the absence of strict global regulation.

This brings us to the 'Made in Bangladesh' label on Anna's budget-priced skinny jeans. Many fashion companies outsource production to factories in developing countries, where environmental regulations are observed laxly. Dangerous chemicals are often discharged, untreated, into sensitive waterways, where they contaminate groundwater with bioaccumulative, hormone-disruptive, and carcinogenic pollutants.

Besides cutting environmental corners, low-wage countries are notorious for labour rights abuses. It is estimated that 40 million people sew more than 1.5 billion garments in 250 000 factories and sweatshops each year, where countless workers are denied basic rights, fair wages, and ethical working conditions. Unsafe conditions remain rife in the industry despite headline-grabbing incidents such as the 2013 Rana Plaza disaster in Dhaka, Bangladesh, in which over 1000 workers were killed when the building collapsed. And, whilst a 'Made in Europe' label might suggest better conditions, many textile workers in Eastern and South-Eastern Europe similarly face poverty, dangerous conditions, and forms of exploitation such as forced overtime.⁴

As textile factories are typically located far away from affluent consumer markets,

² Ibid.

³ Ellen MacArthur Foundation (2017). *A new textiles economy: Redesigning fashion's future*. Available at <bit.ly/2S37q9t>.

⁴ Clean Clothes Campaign. *Made in Europe: the ugly truth*. Available at <<http://bit.ly/2HHso95>>.



many garments travel vast distances on oil-guzzling, carbon-spewing ships, aeroplanes, and trucks. Anna's skinny jeans have travelled halfway across the world from Bangladesh to Finland: that is over 6000 kilometres, yet the cost of this journey is ridiculously cheap – roughly 20 cents. Many garments are designed in one country, spun in another, sewn and finished in yet another, and then finally shipped to the retailer, leaving a dirty trail of transport emissions. And, at the end of its journey, an item that has travelled thousands of kilometres might never be sold, ending up shredded or incinerated as 'deadstock' clothing waste.

OCEANS OF DIRTY LAUNDRY

Anna's skinny jeans present a further problem: they are made of polyester, a petroleum product. Synthetic fabrics such as polyester require more frequent washing than natural fibres – odour-spreading bacteria love nothing more than a sweaty polyester garment. But when polyester is washed in a domestic washing machine, it exacerbates another grave global problem: ocean plastic pollution.

Polyester, nylon, and acrylic fabrics are all forms of plastic. Every time they are washed, they leach into the environment: a single load of laundry is estimated to release hundreds of thousands of fibres. These fibres pass through sewage and wastewater treatment plants into waterways and eventually the ocean, where they are ingested by marine life and make their way up the food chain. Microscopic particles of Anna's oil-based jeans might end up on your plate as a 'secret ingredient' in your next seafood dinner.

Last of all, Anna's strappy sandals show off her pretty ankles, but leave an ugly footprint. On average, the production of one shoe generates 14 kilogrammes of carbon dioxide.⁵ With 15 billion shoes produced each year, the industry contributes significantly to one of the greatest challenges facing humanity today: climate change. Textiles production releases greenhouse gas emissions to the tune of 1.2 billion tonnes annually – more than those of international flights and maritime shipping combined.

What is more, the adhesives and tanning agents used in shoe manufacturing contain hazardous chemicals such as chlorinated phenols, tribromophenol, and hexavalent chromium. Old shoes are typically discarded rather than recycled, usually ending up at landfills, where they contaminate both soil and water.

And the mountains of cast-offs keep growing year after year. After Anna has washed her cheap t-shirt five times, it has already lost its shape and colour. She tosses her faded top in the bin and heads off to hunt for a new bargain: up to 75 per cent of fashion apparel is sold at discount prices. Because consumers have less time and more disposable income than previous generations, it is cheaper and easier to buy a new item than mend old ones.

SYSTEM ERROR: LESS IS MORE

In total, Anna's entire outfit cost her less than 40 euros, yet the ethical and environmental price tag is immeasurably greater. But how big a share of the blame for all this pollution and wastage do Anna and the millions of consumers like her deserve?

"The biggest obstacle to sustainable fashion is the ruling fast-fashion business model. Fashion companies only know one way to make a profit: to focus on speed, producing high volumes at low cost, and selling cheap. This automatically fosters a throwaway culture," says Kirsi Niinimäki, Associate Professor of Fashion Research and leader of the Textiles Futures research group at Helsinki's Aalto University.

⁵ Jennifer Chu (2013). Footwear's (carbon) footprint. *MIT News*. Available at <<http://bit.ly/2WwxzFA>>.

The take-make-dispose model leads to extreme wastefulness, because more people are buying more clothes and discarding them faster and faster. “The market is oversaturated. It’s estimated that 30 per cent of all garments are never even sold. In order to sell more, retailers convince consumers that the items they own are no longer fashionable,” explains Niinimäki.

“It’s time for a strategic, system-level change. We need to slow down the process and creatively transform the way clothing is produced, sold, and used. The future textile industry must be based on the principles of circular economy,” she states emphatically.

The circular economy is a new economic model that proposes novel ways of designing products to generate less waste, prevent pollution, and minimise energy usage. Instead of instantly becoming waste after use, products are reused and recycled to extract maximum value before being safely returned to the biosphere.

Major textile brands are already experimenting with circular innovations. Adidas is transforming ocean plastic waste into high-performance footwear, while Speedo is making swimwear sourced from remnants and offcuts. At present the key challenge is not production technology, but psychology – it appears to be easier to turn plastic scrap into a shoe than to update consumer attitudes.



CONSUMERS
SHOULD BE
RE-EDUCATED
TO EMBRACE
CIRCULAR,
'SLOW FASHION'
ALTERNATIVES

As a specialist in re-directive design, Niinimäki believes consumers should be re-educated to embrace circular, 'slow fashion' alternatives. "Most consumers don't even know exactly what they're buying and how it's produced. When I tell people that two thirds of what they're wearing is made of oil, they're always shocked," she reveals.

"Back in the 1950s, 30 per cent of household income was spent on garments. Today the figure is less than 10 per cent, yet we own 20 times more clothing. Clothes are simply too cheap. It's time to root out the attitude that fashion should be inexpensive – we can afford to invest in better quality."

There is rising interest in a transition towards a circular model of textile production, but recycling rates for textiles remain low. Professor Niinimäki believes that regulatory instruments, taxes, and financial sanctions would be the fastest way to make a difference.

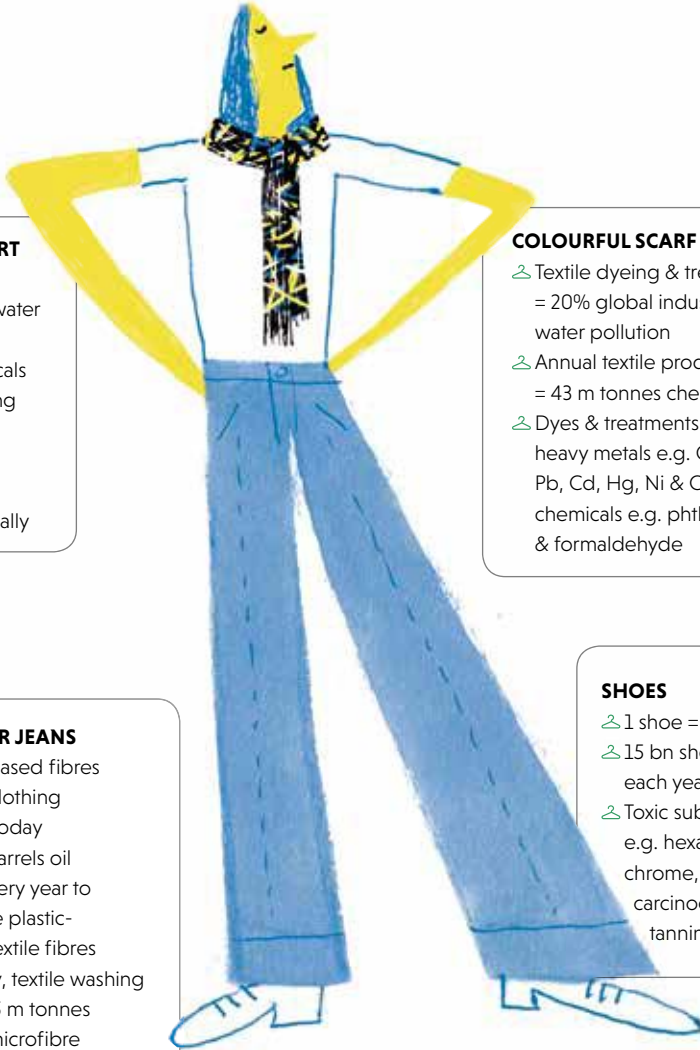
"There are many good laws in place in the European Union, but even the best legislation is useless if it's not applied or monitored in the countries where textiles are actually produced. We need strict regulation that is observed universally. Societal and environmental impacts must be measured systematically," she affirms.

The European Union restricts a great number of chemicals used in textile products marketed in Europe. Most of these restrictions are listed in the EU's REACH regulation, and REACH Annex XVII has newly been amended to ban dangerous levels of substances classified as carcinogenic, mutagenic or toxic for reproduction.

The European Commission is currently working on mandatory origin labelling for textiles. At present, 'made-in' labelling is voluntary. There is also no EU-wide legislation on the use of symbols for washing instructions and other care of textile items.

ANNA K.

2019



COTTON T-SHIRT

- ≈ 227 g t-shirt = 2700 litres water
- ≈ 1 kg cotton ≈ 3 kg chemicals
- ≈ Cotton farming = 16% global pesticides + 8 m tonnes fertiliser annually

COLOURFUL SCARF

- ≈ Textile dyeing & treatment = 20% global industrial water pollution
- ≈ Annual textile production = 43 m tonnes chemicals
- ≈ Dyes & treatments contain heavy metals e.g. Cu, As, Pb, Cd, Hg, Ni & Co + toxic chemicals e.g. phthalates & formaldehyde

POLYESTER JEANS

- ≈ Plastic-based fibres = 60% clothing market today
- ≈ 342 m barrels oil used every year to produce plastic-based textile fibres
- ≈ Annually, textile washing leaks 0.5 m tonnes plastic microfibre into oceans ≥ 50 bn plastic bottles

SHOES

- ≈ 1 shoe = 14 kg CO₂
- ≈ 15 bn shoes produced each year
- ≈ Toxic substances e.g. hexavalent chrome, a recognised carcinogen, used for tanning leather

- ≈ Textile production = 93 bn m³ water annually = 4% global freshwater withdrawal
- ≈ 97% materials from virgin feedstock
- ≈ 73% garments landfilled/incinerated at end of life
- ≈ < 1% closed-loop recycling
- ≈ Textile production = 1.2 bn tonnes CO₂ emissions annually

MARIA K.

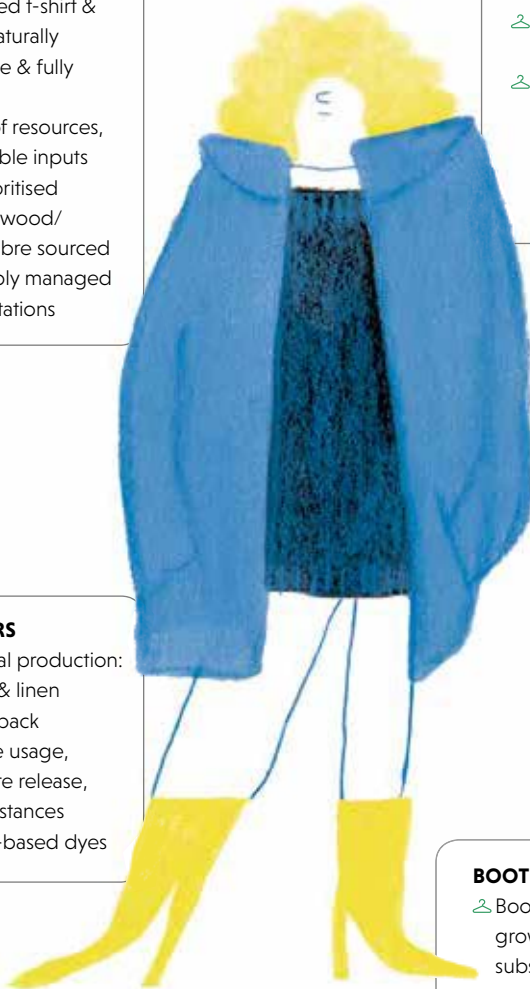
2049

T-SHIRT

- 🌱 Cellulose-based t-shirt & underwear: naturally biodegradable & fully compostable
- 🌱 Efficient use of resources, 100% renewable inputs
- 🌱 Recycling prioritised
- 🌱 Regenerative wood/ plant-based fibre sourced from sustainably managed forests & plantations

COAT

- 🌱 Weatherproof coat made of recycled fishing nets
- 🌱 Radically improved systems of yarn, fibre & polymer recycling = a business opportunity of nearly €100 bn annually



CASHMERE JUMPER

- 🌱 Online flea markets & fashion leasing services: access without ownership
- 🌱 Large-scale adoption of repair services = significant increase in clothing utilisation

HEMP TROUSERS

- 🌱 Rebirth of local production: hemp, nettle & linen make a comeback
- 🌱 Zero pesticide usage, zero microfibre release, zero toxic substances
- 🌱 Natural, plant-based dyes

BOOTS

- 🌱 Boots made of Zoa™, a lab-grown, animal-free leather substitute based on collagen
- 🌱 Rubber outsoles made of recycled tyres = virgin rubber saved & less landfill waste

- 🌱 Increased rate of clothing utilisation & recycling = reduced water consumption, landfill & incineration = significant pollution reduction
- 🌱 Safe, healthy material inputs = fewer health risks, no hazards for workers
- 🌱 Low-carbon materials, renewable energy + circular textile industry = estimated 44% reduction in GHG emissions

THE FUTURE
 FASHION
 INDUSTRY IS
 ONE IN WHICH
 THERE IS
 NO WASTE,
 ONLY RAW
 MATERIAL: ONE
 INDUSTRY'S
 TRASH IS
 ANOTHER'S
 TREASURE.

Another welcome regulatory instrument would be a carbon tax to encourage energy efficiency in factories and to boost the usage of recycled polyester, which has a much lower carbon footprint than virgin polyester. For now, however, recycled polyester is prohibitively expensive.

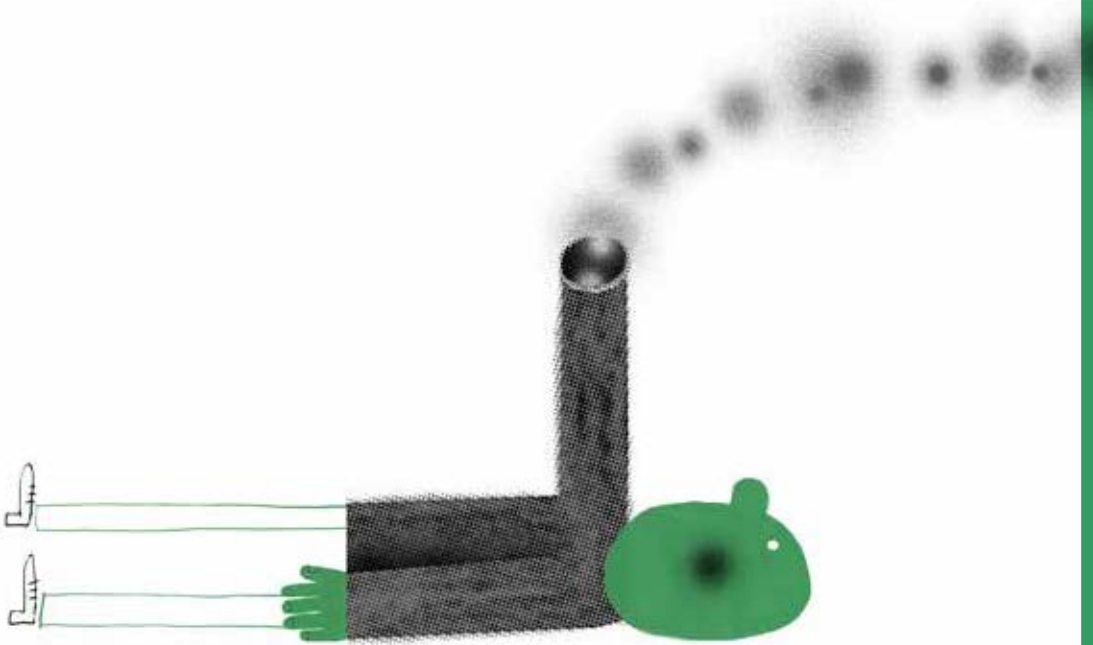
“There are many challenges in moving towards a more circular economy. There is no single policy measure that could solve all of them,” notes Professor Riina Antikainen, Director of the Programme for Sustainable Circular Economy at the Finnish Environment Institute (SYKE).

Alongside regulation, Antikainen proposes that monetary instruments, such as public investment, should be targeted to support more circular business models. “The textiles question should be considered from a holistic perspective, considering lifetime environmental and social impacts, and a broad roadmap for action and measures should be created.”

MORAL FIBRE: SOMETHING OLD, SOMETHING NEW

If the future of fashion is circular, where exactly are we headed? It is 2049, Anna K. is 46 and she has a 16-year-old daughter, Maria. Due to unchecked global warming, the Earth’s temperature has risen over 2 degrees Celsius, and increasing areas of land are plagued by severe drought. Most remaining arable land is reserved for food, and stringent regulations are in place to protect the planet’s dwindling water resources from further pollution. The suicide of fast fashion is a widely accepted reality.

Maria’s outfit generates zero waste. Most items are made of renewable raw materials such as wood, plants or algae. Some are produced from upcycled industrial side-streams and chemically or mechanically recycled materials. Traditional materials such as hemp, nettle, and linen have



made a big comeback, spurring the rebirth of local production. Following in the wake of the local food boom, local textiles are a hot trend in 2049. Fashion consumers insist on knowing the precise origin of every item they purchase. Many of Maria's friends are on a 'no-polyester diet'.

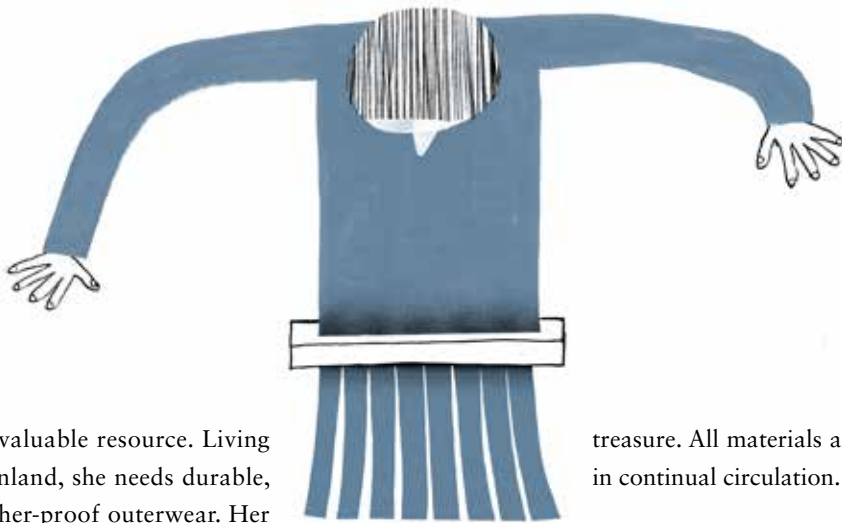
Today she is wearing trousers made out of sustainably farmed local nettle, which thrives at northern latitudes without requiring the use of pesticides. Many small-scale hemp farms in Europe do their own harvesting, spinning, designing, and manufacturing onsite. These micro-labels produce small batches of durable, quality-focused fashion in collaboration with local designers.

Because toxic chemicals have been outlawed globally in textile processing and finishing, the earthy colours of Maria's apparel are achieved with plant-derived dyes and wood extractives.

As a lover of vintage fashion, Maria acquires luxury garments through peer-to-peer sharing and pay-per-use leasing services similar to Uber and Airbnb. The sharing economy provides both convenience and value for fashion buffs, as it is cheaper to rent expensive items than buy them outright. 'Access without ownership' is the credo of the 2049 fashion consumer.

Maria's vintage cashmere jumper is from an online flea market. The lifespan of high-quality, self-cleaning natural materials such as cashmere can be extended by many years with careful upkeep. Maria pays a monthly fee to have a fixed number of garments mended to increase the longevity of her valued fashion treasures.

Many items in Maria's wardrobe are sourced from agricultural and industrial side-streams, directing waste back into the circular economy



as a valuable resource. Living in Finland, she needs durable, weather-proof outerwear. Her winter coat is made of repurposed nylon sourced from discarded fishing nets. The outsoles of her animal-free leather boots are made from recycled automotive tyres. In 2049, virgin rubber is no longer used in footwear, and tyres no longer end up at landfills.

Her underwear is made of new wood-based fabrics similar to lyocell, a fully biodegradable form of rayon made from dissolved wood pulp. Lyocell fibre can be produced in a closed-looped system incorporating recycled cotton scraps, resulting in a silk-like, ecofriendly alternative to synthetic fibres.

CIRCULAR: THE NEW BLACK

The future fashion industry is one in which there is no waste, only raw material: one industry's trash is another's

treasure. All materials are kept in continual circulation.

While Maria's wardrobe may sound utopian, this vision is neither fanciful nor unrealistic. "We are already seeing exciting innovations in textile production technology. Wholly new materials are being developed out of waste and side streams. Some are produced using microbes or fungi, or with the help of biotechnology," describes Professor Pirjo Kääriäinen, a specialist in design-driven fibre innovation at Aalto University.

"There are many promising fashion innovators doing interesting work with recycled content and enzyme technology to minimise usage of virgin resources," adds Kääriäinen. She offers the example of Modern Meadow, a New Jersey startup that has invented a lab-grown, animal-free leather substitute called Zoa™, the first biofabricated material based on collagen.

“Another pioneer is Pure Waste, a Finnish company that has made significant investments in cutting-edge mechanical systems to produce 100 per cent recycled fabrics and yarns,” she notes.

She also commends the efforts of Patagonia, an American outdoor clothing brand that began making recycled polyester from plastic soda bottles in 1993. Patagonia have recently launched a new fabric blend of recycled cotton and recycled polyester, and CEO Rick Ridgeway has hinted at a future in which a cotton t-shirt could actually take carbon out of the atmosphere.

“But for recycling innovations to be harnessed effectively, we need more cross-value chain collaboration. For instance when a chicken is slaughtered for human consumption, the feathers are plucked and discarded. Those feathers could be utilised creatively in the fashion industry,” suggests Kääriäinen.

She believes that a fully circular, sustainable fashion industry is an achievable goal, not just a pipe dream: “We might not have a choice! When raw materials grow scarce enough, we will need all available land for food production. I believe the solution is reverting to small-scale local crops such as nettle, combined with recycling innovations and biotechnology – a combination of ancient tradition and 21st-century science,” she predicts.

Professor Niinimäki agrees: “Today we consume four times more textiles than back in the 1970s. 50 years ago, we took better care of our garments. I believe the change can now go the other way. It’s simply a question of reversing scale.”

Niinimäki sees the challenges of the textile industry not only as a threat, but also as a powerful spur for innovation. “There is a huge untapped value creation opportunity. Of course the fashion of tomorrow will be more expensive, but we simply have to accept that we should be paying more for the clothes we own. Perhaps then we would also be motivated to look after them better.”



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