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WSA

PERFORMANCE & SPORTS MATERIALS



A yarn that can combat climate change

Zero-waste manufacturing

Slow scale-up for biotech textiles

Enzymes that break down plastics

THE INTERNATIONAL MAGAZINE FOR PERFORMANCE & SPORTS MATERIALS

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Front cover:

Pentland Brands has made a commitment to help 100 million consumers live active lifestyles, improve the lives of 1 million people in low-income communities and become a net zero business by 2032, when it will celebrate 100 years in business.

IMAGE: BERGHAUS/PENTLAND GROUP

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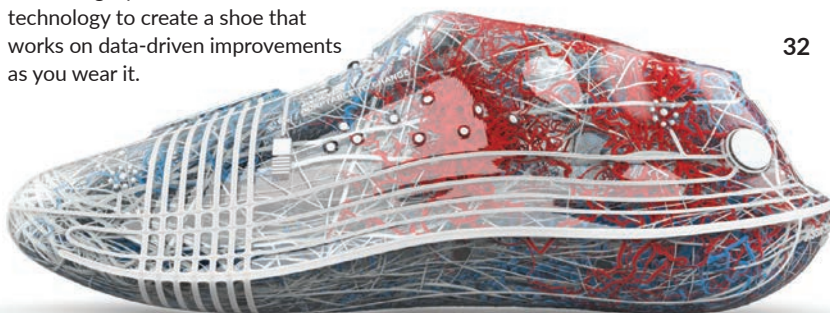
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Global news

Belgium Home interiors group Ikea is running a trial in Belgium to encourage consumers to hand in used duvets and pillows so that down and feathers can be washed and reused in new products. A feature in a previous issue of WSA, 'Smarter thermal insulation', argued that down's exceptional longevity makes it "a prime contender for multiple lifecycles". Ikea's project in Belgium will run for six months, after which time the company will evaluate the results and, possibly, then expand it to other countries.

France Advertising standards bodies in France have upheld a complaint from a consumer about claims adidas has made about its Stan Smith Forever shoes. It said advertisements for the shoes in France in the early part of 2021 were at odds with ARPP's policy on sustainability claims in publicity campaigns. It agreed that claims around a figure of a minimum of 50% for recycled material were unfair because they did not make it clear enough that this statement referred only to the material used to make the upper of the Stan Smith Forever.

Germany Berlin-based online clothing platform Zalando has become an investor in textile technology group Infinited Fiber Company, joining earlier investors that include adidas, H&M Group, the investment arm of fashion group Bestseller and China-based viscose producer Sateri. Infinited Fiber's technology turns cellulose-based raw materials, including cotton-rich textile waste, into its Infinna regenerated textile fibre. It describes this fibre as having "the natural, soft look and feel of cotton", is biodegradable, free of microplastics, and suitable for recycling.

Austria Specialty fibre manufacturer Lenzing has announced Cord Prinzhorn in the role of chief executive of the group, on an interim basis, from November 4. Mr Prinzhorn has been a member of Lenzing's supervisory board since April, a role he will, temporarily, stop fulfilling while serving as temporary chief executive.

Sweden A government-funded innovation agency in Sweden, Vinnova, is helping to fund a project called the Swedish Wool Initiative. Non-profit Axfoundation set up the Swedish Wool Initiative in 2020 following reports that, in 2019, Swedish companies had imported 1,650 tonnes of wool. At the same time, only 37% of all the wool produced by Swedish farmers was used. Outdoor brand Fjällräven is one of a group of companies involved in discussions to find the best way to use the Vinnova funding to put the project into effect.

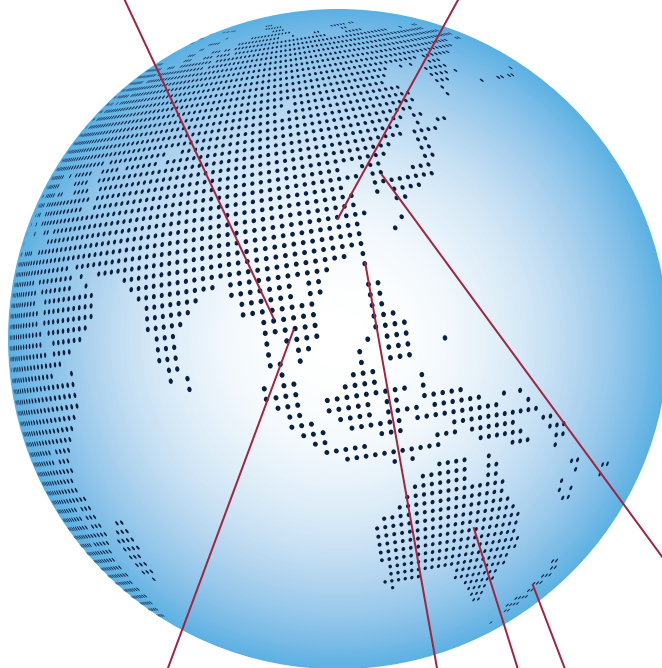
Finland Outdoor apparel brand Icepeak has collaborated with fellow Finnish company and renewable fibre developer Spinnova on an over-the-shoulder sports bag for the Finnish Olympic team, for whom Icepeak has provided the official uniform for the 2022 Winter Olympic Games in Beijing.

Kenya The American Apparel & Footwear Association (AAFA) has signed a memorandum of understanding with the Kenya Association of Manufacturers (KAM). Kenya and the US recently expressed interest in expanding trade and investment between the countries. The African Growth and Opportunity Act (AGOA) currently promotes trade between them, but negotiations to establish a free trade agreement between the two countries began in July 2020; AGOA is scheduled to expire in 2025, although it may be renewed.

Spain Basque outdoor brand Ternua has said its new winter collection includes its most technical trekking jackets ever. These garments use its proprietary Storm Fleece Pro technology for breathability, wind resistance and water resistance. Ternua introduced this woven textile technology several seasons ago. It has a single layer but combines the properties of softshell and fleece, blocking wind and moisture without the need of a laminate, according to the company, as a result of the high density of the surface.

China Shanghai's Donghua University was recently formally approved as a "modern textile frontier scientific research base" by the city's education commission. The university was especially praised for its existing strengths in textile science and engineering and, as a newly accredited research base, Donghua will reportedly organise high-level teams to focus on solving major problems in these areas.

Thailand The polyester fibre manufacturing arm of Japan's Teijin Frontier will launch a facility to convert used domestically-produced plastic bottles into recycled polyester chips to feed its demands for ECOPET recycled filament yarn. The facility will start operating in January 2022 and is expected produce 7,000 tonnes of recycled polyester chips annually by fiscal 2025.



Cambodia Outdoor clothing and footwear group VF Corp is teaming up with charity WaterAid to support Cambodia's vaccination programme "to protect the health of workers and keep the supply chain steady". Factories in South East Asia have closed in recent months as officials tried to stem the spread. However, this has resulted in loss of income and food shortages.

Taiwan Taiwan's bureau for overseas trade has already begun working with manufacturers to track their carbon footprint accurately and find ways to reduce their environmental impact, ahead of rules on exports to the European Union (EU) becoming stricter. Deputy director-general of the bureau, Cynthia Kiang, recently told a high-level meeting of industrial leaders that manufacturers should start preparing already for changes that will come in as a result of the EU's Carbon Border Adjustment Mechanism.

Canada The Canadian Olympic Committee (COC) and Canadian Paralympic Committee (CPC) have together announced the onboarding of Vancouver-headquartered activewear brand Lululemon as the "official outfitter" of Team Canada. The first games to mark the partnership will be 2022's Olympic and Paralympic Winter Games in Beijing, for which Lululemon will provide Team Canada with specially designed apparel and accessories for all opening, medal and closing ceremonies, plus media engagements and athletes' village ensembles.



South Korea Functional compression garment brand Skins recently established a presence in South Korea via Seoul-headquartered fashion group Modern Works. The brand will launch with an online platform ready for the spring-summer 2022 season. There are also plans for Skins to partner with domestic wholesalers, including department stores.

- South Korean outdoor label BlackYak has partnered Gore-Tex on a technical collaboration named K-Gore. Gore-Tex's membrane technology has been laminated to the outer shell of BlackYak jackets, with a seam-sealing method applied to the entire seam to enhance its waterproof function. The jacket also features a high neck, hood and "antibacterial" pockets.

New Zealand Outdoor group Kathmandu Holdings has reported revenues of just over \$650 million in its most recent business year. The New Zealand-based group, whose brands include surf brand Rip Curl, outdoor clothing brand Kathmandu and hiking footwear brand Oboz, said this figure represented growth of 15% year on year. It said it wants to build a global presence for each of its brands. As part of this, Kathmandu, a popular outdoor clothing brand in Australasia, will now seek to launch in Europe and in Canada.

Australia Industry body Cotton Australia recently took action to help solve what it calls one of the sector's most enduring challenges, the shortage of seasonal workers. It set up an online jobs service to connect cotton growers to prospective employees. Cotton farmers will be able to post details of vacancies on the site and view applications, which job-seekers will be able to submit to the site using a simple online form. Queensland's state government has helped fund the project.

People



CREDIT: MATTHIAS RÜBY

Vaude CEO is first winner of EY sustainability award

Consultancy firm EY has named the chief executive of outdoor brand Vaude, **Antje von Dewitz**, among the winners of its Entrepreneur Of The Year competition in Germany.

For the first time this year in the German edition of the competition, EY included sustainability as one of seven categories and it was this award that was presented to Ms von Dewitz. She received the award at a ceremony in Berlin on November 4.

Delighted to be the inaugural winner of the sustainability award, she said Vaude had been carbon neutral in its operations in Germany since 2012 and would achieve global carbon neutrality in 2022.

She said EY's introduction of this particular award made it clear that sustainability and business belong together. "All companies need to address global challenges such as climate change," she added. 🌍

Award for HeiQ CEO too

Chief executive and co-founder of textile technology developer HeiQ, **Carlo Centonze**, has also been named as the winner of an EY Entrepreneur of the Year award in Switzerland. EY announced Mr Centonze as the winner in the Industry, High-Tech & Life Sciences category of this year's competition there. 🌍

Leadership team changes at the ICA

The International Cotton Association (ICA) has voted in a new leadership team. Managing director of Formosa Trading, **Alex Hsu**, takes on the role of ICA president. His first vice-president is **Tim North**, global head of merchandising at ECOM USA, while **Kim Hanna**, president TransGlobal Inspections was elected as second vice-president.

On accepting the role of president, Alex Hsu said: "These are challenging times for all of us in the cotton community and my hope is to be able to guide the association back towards normalcy." Taipei-based Formosa Trading is Mr Hsu's family business; it has been a cotton selling agent for 50 years and has operations in China and Indonesia. He joined it in 1993. 🌍

Founder of Polartec dies

The former chief executive of performance textiles producer Malden Mills, **Aaron Feuerstein**, has died at the age of 95. His family said he had suffered from complications from pneumonia following a fall at his home near Boston. Malden Mills was founded by his grandfather, but under Aaron Feuerstein's leadership, the company went on to invent polar fleece fabric in the 1980s, leading to the launch of the Polartec brand in 1991. He came to prominence following a fire at the company's factory in Lawrence, Massachusetts, in 1995 because he insisted on paying all 1,300 workers in full throughout the restoration project. 🌍

Composite strength

The CEO of carbon fibre composites supplier Carbitex is retiring after more than four years at the helm. In that time, **Ron Boninger** has helped build partnerships with footwear brands, triple production capacity and increase revenue six-fold as the company capitalised on brands' desire for carbon plate technology. Footwear veteran **Rob Langstaff** will take his place as CEO. Mr Langstaff has held senior roles at adidas, Brooks Running and most recently as served as senior vice-president of international business at Keen Footwear. 🌍

Love of the game

Former Nike designer **Christopher Bevans** has worked as guest designer on an inaugural project with Fila and will continue the partnership throughout 2022. A special edition of the Fila Renno tennis shoe is the product that the partners have focused on to start with. An avid tennis fan and player, Mr Bevans said his love of the game had been his inspiration. 🌍

CEO change at Carbios

Enzyme-based plastic recycling specialist Carbios has named **Emmanuel Ladent** as chief executive, following the resignation of co-founder **Jean-Claude Lumaret**. Mr Ladent most recently managed the Michelin Group's largest business line, the Automotive Global Brands division. Tyre manufacturer Michelin is a long-term supporter and partner of Carbios. 🌍

Change at the top for Messe München

Event organiser Messe München has announced that **Klaus Dittrich** will step down as its chief executive in mid-2022.

The company that runs the ISPO events has already decided that two existing members of its management board, **Reinhard Pfeiffer** and **Stefan Rummel**, will become joint-managing directors when Mr Dittrich retires.

Klaus Dittrich joined the board of Messe München in 2002 and became the company's chief executive in 2010.

CEO steps down as Mammut enters new phase

Swiss outdoor brand Mammut has announced that its chief executive, **Oliver Pabst**, is stepping down.

The company said it had successfully completed the change of ownership announced in April when London-based private equity firm Telemos Capital acquired the brand and that the board and Mr Pabst had agreed that it was now time for "the next phase".

Executive chairman, **Greg Nieuwenhuys**, will become chief executive on a temporary basis while Mammut recruits a permanent successor to Mr Pabst.

FESI additions will bring fresh energy to board

The Federation of the European Sporting Goods Industry (FESI) has appointed **Charlotte Cox**, president of EMEA at UK-based Pentland Brands, and **Stefan Rosenkranz**, managing director of BSI (German sporting goods association), to its board.

Jérôme Pero, FESI secretary-general, said they will bring fresh ideas and energy. "Next year promises to be full of new challenges for our industry. I'm really looking forward to working alongside our new board members to deliver on FESI's priorities when it comes to corporate responsibility, trade, digitalisation and the promotion of sport and physical activity."

All together now

Puma has brought together 450 employees from two offices in Massachusetts to a new location in Somerville, north of Boston. **Bob Phillion**, president of Puma North America, said the move would support Puma's growth in North America. He said the new headquarters was "a space that reflects our 'Forever Faster' mentality".

Plastic-free

A former adidas executive board member and brand president, **Eric Liedtke**, has established a new streetwear brand with a zero-waste and plastic-free commitment. Articles made by the company, branded Unless, have therefore been designed to "harmlessly decompose" at end of life, it stated.

Personal values

Former Ecco and Bestseller marketing executive **Sean Tindale** has been appointed to the role of chief marketing officer at antimicrobial textile technology provider Polygiene. He took up the post at the end of September. He said the company's mission of helping people lower their environmental footprint was in keeping with his personal values.

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Industry & Innovation

Odour test

The American Association of Textile Chemists and Colorists (AATCC) has developed a method to measure the reduction of odour on materials treated with antimicrobial technologies. It works with existing test methods to show a correlation between bacterial reduction and odour control. Antimicrobial provider Microban International was one of the early adopters and said the 211-2021 test method can provide "definitive scientific evidence for claims".

Wool's worth

Technical wool insulation provider HD Wool's new Apparel Insulation technology has been incorporated into the recent outerwear collections of brands including Purdey, 7L (Seven Layer) and Hajk. HD Wool has described its latest outdoor- and lifestyle-oriented offer as 100% natural, renewable and highly durable, with high levels of temperature regulation and moisture management properties.

Beijing innovation centre

The Beijing Institute of Fashion Technology (BIFT) has opened a Sports Fashion Innovation Academy. China's State Council has issued a national fitness plan for 2021-2025, intended to promote the development of national fitness and "meet the people's fitness and health needs". One of the main tasks for the country, listed within the plan, was to integrate fitness with health, education and tourism.

Like nature

Fibre producer Spinnova and outdoor brand Icebreaker are working together to develop circular midlayer products with recyclable blends of merino wool and Spinnova fibre. Alistair Smith, director of global product design at Icebreaker, said Spinnova's method of producing renewable fibre from wood or waste "mimics nature's own processes".

Single polymer

Technical fabric developer Pertex recently revealed Shield Revolve, which it described as a more sustainable and technical material with both waterproof and breathable properties. A mono-material laminate, meaning that each fabric layer is made from a single polymer, Shield Revolve is 100% made from recycled polyester.



Solar energy saves yarn producer €1 million

Biella-based yarn manufacturing group Marchi & Fildi has celebrated the tenth anniversary of the launch of a solar energy project. Solar panels now cover an area of more than 16,500 square-metres at three of the group's facilities: its production plant in Biella, its dyeing mill at nearby Cerrione and its logistics centre 12 kilometres away at Verrone.

Marchi & Fildi has calculated that, in the course of the ten years since it began to use solar power, it has generated almost 23 million kilowatt-hours of energy, using 7.3 million in its own operations, with the rest feeding into the grid. Its calculation is that the project has already saved the group €1 million in energy costs. Commenting on this, chief executive, Massimo Marchi, said: "This has been one of the crucial factors on our path towards making sustainable end products."

Peppermint's pull for Polartec

Specialist performance fabric developer Polartec has announced that it will now use peppermint as the basis for metal-free odour resistance functionality in its fabrics. It said peppermint oil would offer a renewable, sustainable and biodegradable alternative to the metal-based technologies it has used previously to inhibit odour at the source. Peppermint oil is effective in inhibiting the growth of odour-causing microbes in fabric, it stated.

In research and development trials, the oil was able to achieve a 99% microbial reduction, even after 50 wash cycles. In field trials with garments, Polartec rated the odour control as better than or equal to the protection offered by metal-containing treatments.

Senior product marketing manager, Karen Beattie, said the new peppermint oil-based treatment was part of a wider sustainability programme called Polartec Eco-Engineering.

Technical textiles breakthrough for Shima Seiki

Knitting machinery developer Shima Seiki has announced its entry into the field of technical textiles.

The Japanese technology provider attended the A+A 2021 exhibition in Düsseldorf in October and presented knitting as an alternative to more established methods for manufacturing products for the safety equipment market.

Breakthroughs in hardware, software and new materials, it has explained, mean that "what was impossible to knit in the past can now not only be knitted,

but made to perform even better”.

It had on display its SVR123SP computerised flat knitting machine, featuring a dedicated loop presser bed that permits full use of inlay technique for the production of hybrid fabrics that feature knit and weave characteristics. According to Shima Seiki, these constructions are well suited to the production of safety-oriented functional fabrics.

From carbon to foam for footwear

A partnership between Swiss footwear brand On, tech company LanzaTech and polyolefin solutions provider Borealis has begun to convert carbon emissions into foam for running shoes.

The trio have launched CleanCloud, a foam material made from EVA foam, made using carbon emissions as a primary raw material.

Technology from LanzaTech captures carbon monoxide from industrial sources or from landfill sites before it is released into the atmosphere. Once captured, these emissions enter a fermentation process. The carbon-rich gas ferments naturally and is converted to liquid ethanol by bacteria. The ethanol is then dehydrated to create ethylene, which is polymerised by Borealis to become EVA (a copolymer of ethylene vinyl acetate), the material that On works with to create a performance foam for shoes. 

Long-term link

Viscose fibre producer Kelheim Fibres has signed a letter of intent to set up a long-term commercial partnership with Renewcell, a start-up specialising in producing new materials from recycled textiles.

They will work together to develop commercial-scale production of high-quality viscose fibres from up to 10,000 tonnes per year of Renewcell's Circulose, the 100% textile recycled material it produces.

Renewcell chief executive, Patrik Lundström, said the initiative would prevent waste and reduce the need for virgin resources. 

Ocean fibres research welcomed by Lenzing

A new study from marine research centre the Scripps Institution of Oceanography (SIO) has confirmed that wood-based cellulosic fibres biodegrade in the ocean in a short period of time at the end of their life cycle, making them a sustainable alternative to fossil-based fibres.

Researchers at SIO, which is part of the University of California at San Diego, confirmed this finding during an independent project to try to understand end-of-life scenarios for discarded textiles.

Under various real oceanic and controlled aquaria conditions, they found that wood-based cellulosic fibres fully biodegrade within 30 days, while the same tests showed fossil-based synthetic materials, including polyester, were practically unchanged after more than 200 days.

As a major producer of wood-based cellulosic fibres, Austrian group Lenzing welcomed the outcome of the project. Board member Robert van de Kerkhof commented: “We have a circular economy business model. We take wood from sustainable forestry and use a highly efficient system of processing the raw materials to produce fibres that return to the ecosystem at the end of their lifecycle.” 

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Backtrack

11.11.2021

Vietnam halt hurts Merrell, but Saucony and Sperry spur Wolverine growth

10.11.2021

Strong consumer demand for products, adidas claims

Polartec announces 2021 Apex Design Award Winners

09.11.2021

Performance footwear set to become fashionable again

Doors open to Uniqlo's first Beijing flagship

08.11.2021

Arc'teryx's Rebird concept takes off
'Right foundation' makes Canada Goose optimistic about next year

Gore officially partners Fashion For Good

05.11.2021

Historical investment for Spanx

US agency sends warning for BPA in textiles

VF Corp among first to pilot TextileGenesis eTrackit

04.11.2021

Puma's new Circular Lab launches compostible suede experiment

Competition authorities say JD Sports must sell Footasylum

Nike scales climate action with cross-industry tie-ups

03.11.2021

Textile Exchange publishes first Biodiversity Insights Report

Lyca launches online portal

Norda in 'world first' with G+ and Dyneema

02.11.2021

Pentland aims to help millions through ambitious targets

Investors back Evrnu's fibre regeneration platform

Canada Goose turns out with Angel Chen once again

01.11.2021

Hoka and Moncler take to the mountains

Old ski boots to be given new life

The North Face in ongoing Korean 'eco' push

Anniversary edition of Fila basketball shoe

Limitations on space make it impossible for us to run more than a carefully selected sample of industry news in WSA. However, we publish hundreds more stories on www.sportstextiles.com, one of the most comprehensive archives of news anywhere on the web for textiles, apparel, footwear and equipment for sports and outdoor. Below are just some of the headlines that have appeared on the site in recent weeks.

29.10.2021

Platinum rating puts Archroma in top 1%

Nilit invests in coastal habitats

Performance Days confirms live dates

Hohenstein in heart-monitoring space mission

28.10.2021

New growth for Cotton made in Africa

Puma positive despite ongoing problems

Ralph Lauren-backed cotton scheme aims to empower growers

27.10.2021

Better-than-expected quarter for Unifi

First partner already on board for HeiQ's new yarn

Success for Shanghai but Shenzhen shows postponed

26.10.2021

VF's targets include supply chain mapping and chemicals

Li-Ning set to launch premium sub-label

Squid Games tracksuits prop up garment manufacturers

25.10.2021

Fila launches 'performance down' in South Korea

Outerwear and DTC strong for VF in Q2

Order intake almost triples for Rieter

Another acquisition for JD Sports

22.10.2021

PrimaLoft wins Derryck Draper award

Adidas says MTBR proves circular concepts work

Dow and Ralph Lauren share lower-impact dyeing process

21.10.2021

US associations ask government help to 'end forced labour'

Eurojersey publishes first 'Footprint Report'

20.10.2021

UK clothing and textile sector exceeds carbon and water targets

Reebok uses grid panels to make graphene 'commercially priced'

Shanghai's Donghua celebrates 70 years

18.10.2021

Nike alumna carves out zero-waste career

China-Africa textile cooperation a key topic at Belt and Road conference

Innovation on display from Radici at Index

Under Armour creates chief consumer officer role

15.10.2021

Dipping demand leads to waste at DyStar

Vuori's \$400 million VC boost

Voting opens for EOCA's new funding round

14.10.2021

Reebok adds PrimaLoft insulation to Beatniks

Transformers cotton report aims to uproot 'misinformation'

Hyosung helps Big Agnes ascend new heights

13.10.2021

Directa Plus outfits Italian cycling team

MSF project receives Eurojersey backing

TreeToTextile hires top team to upscale

12.10.2021

Textile event reorganisation for Messe Frankfurt

1984 Michael Jordan Nikes to break records

11.10.2021

Tour de France yellow jersey will be made in Italy

Charles Ross to co-host PCIAW summit

know THE SCORE





A yarn for climate change

To see 100 tonnes of yarn as the starting point for a viable replacement for the 80 million tonnes of polyester and nylon that apparel manufacturers use every year takes vision. Time, money and partners will also be required, but perhaps the vision has to come first.

It is 16 years now since co-founders, Carlo Centonze and Murray Height, decided to set HeiQ up as a spin-off from the Swiss Federal Institute of Technology Zurich, where they had met. Dr Height, who is now running HeiQ's subsidiary in his native Australia, was at the time researching silver-based materials as a solution to odour in clothing. On a hike in the Alps with Mr Centonze, they reached the conclusion together that he was onto something and HeiQ is the fruit of that realisation.

In the years that followed, they brought their odourfree technology to market, followed by cooling technology, a fluorine-free water repellent, an oil repellent and, in 2019, the Swiss environmental award-winning HeiQ Clean Tech for sustainable polyester dyeing. More recent innovations have included an antiviral and antimicrobial technology called Viroblock, which won the company the Swiss Technology Award in 2020.

All the while, HeiQ was wrestling with a bigger question: how can we clothe 8 billion people



NEWCOMERS

Swiss textile technology developer HeiQ has launched AeoniQ, a recyclable, biodegradable cellulose-based yarn that it says offers the ease-of-use, the performance levels, the versatility, the affordability and the scalability to allow the textile industry to consign polyester and nylon to the past.

while stopping textiles from contributing any further to the destruction of the environment? This autumn it has what it thinks could be the answer: a new, cellulose-based yarn that it believes really does have the potential to take the place of polyester and nylon.

The new yarn, HeiQ AeoniQ, can come from a wide range of renewable resources, including wood pulp and algae. The yarn is recyclable, biodegradable and will add nothing to the microplastics problem in the rivers, lakes and oceans of the world. At a pilot plant it will begin operating in Austria in March 2022 to produce AeoniQ, HeiQ will run a 99% closed-loop manufacturing operation, using energy that is 100%

The yarn that has the potential to provide a green alternative to the 80 million tonnes of polyester and nylon consumed each year, AeoniQ from HeiQ.

ALL CREDITS: HEIQ

from renewable sources. Mr Centonze describes its environmental impact as “outstandingly low” compared to that of all other fibres.

A first for the industry

“It’s the first cellulosic yarn capable of replacing polyester and nylon,” he explains. “The problem is that every person on this planet consumes an average of 14 kilos of textiles per year. This means 111 million tonnes of textile fibres are produced each year, a gigantic quantity, a mountain.” Of this total, he describes 80 million tonnes as being particularly problematic because this is the volume that polyester and nylon contribute. Their inherent problem, Mr Centonze explains, is that these fibres are not biodegradable. Polyester, he points out, takes up to 1,000 years to break down in the environment and, therefore, we don’t even know exactly how the degradation of polyester will work; it is too soon to tell, about 900 years too soon.

“However,” the HeiQ co-founder continues, “polyester and nylon are the only fibres today that are capable of serving the demands of the market. More people means more clothing and it looks as though that is likely to mean more polyester and nylon. We cannot produce more cotton or wool because we need arable land to grow food, so there will be less land available for those natural fibres.”

Why circularity is difficult

End-of-life issues are another part of the challenge. Carlo Centonze’s calculation is that only 1% of textiles are part of a closed-loop recycling programme today. The rest fails to come back into the textile value stream. Most of this, 73%, goes into landfill or incineration. First among the factors that make garment circularity so difficult, according to HeiQ, is that they are not designed or made to be recycled. The high cost of recycling can also make recycled materials more expensive than virgin ones.

“It’s time to change,” the chief executive says. “Consumers are demanding change and are holding brands to account now. They expect strong environmental, social and corporate governance and for brands to be stewards of the planet and of people. It is essential for brands to be authentic and to inspire consumers. The good news is that if brands stick to these principles, people are now willing to pay more for their products, rewarding them, for the first time, for sustainable behaviour.”

He argues that consuming 80 million tonnes of petroleum-derived fibres per year is incompatible with this and that the solution has been staring everyone in the face. Cellulose is the most abundant biopolymer on earth and HeiQ claims to have been successful in using it, through a method it is keeping secret, to create a sustainable, high-performance, cellulosic yarn and explains that it will be possible, in time, to manufacture this product at the scale required. AeonIQ, Mr Centonze insists, is “designed for eternal circularity, from nature, for nature”. It is a continuous, cellulosic, filament yarn that can be “recycled eternally”



without loss of performance and is “sustainable and scalable by design”. Carlo Centonze says: “We can take back textiles made out of cellulose and fully recycle them in our process. This is one of the big advantages of our platform.”

Carbon capture

Sources of the cellulose that goes into making AeonIQ will vary greatly but they must be in keeping with three principles the yarn’s developer has set out. The Swiss company wants all of the raw materials to provide a decarbonising balance by capturing carbon dioxide from the atmosphere as they grow, to have no impact on the availability of agricultural land for food crops and to have been produced without pesticide or fertiliser. This will enable a circular material flow, Carlo Centonze says. “The spinning technology we have developed will work with any source of cellulose. Among the sources we can use is sustainable pulp from the forestry industry or, even better, algae sustainably farmed offshore. Algae represent an important sink for carbon dioxide as well as a source of cellulose that we can use in our processes.” Onshore bacteria and micro-algae are further possible sources, as are recycled materials from pre-consumer production waste and from post-consumer, end-of-life garments. He emphasises the role these sources can play in providing AeonIQ with good potential for decarbonisation.

He contends that these factors will combine to have the following effect on the carbon footprint of textile manufacturers who opt to use AeonIQ instead of polyester. For every tonne of polyester that they take out of their production process, substituting it with AeonIQ instead, they will make a carbon footprint saving of up to five tonnes of CO₂-equivalent. Using the new yarn, HeiQ argues, will break the link between clothes and fossil fuel-based fibres and side-step the carbon cost of disposing of these at the end of a garment’s life. Instead, AeonIQ will promote renewable raw materials, growing them to absorb greenhouse gas emissions, harvesting them and growing them again. Production methods for AeonIQ will also



Left: The science seems clear to HeiQ co-founder and chief executive, Carlo Centonze. AeonIQ, a recyclable cellulosic yarn, made from entirely renewable resources, has the potential to replace polyester and nylon.

Right: Martin Gebert-Germ, with 30 years’ textile industry experience, joined HeiQ in November to lead its Austrian subsidiary.

have a lower impact and the yarn can be recycled and reused time after time. The compound result of all this, according to HeiQ's calculation, is a five-to-one carbon footprint improvement per tonne of textiles.

Technical profile

Its pilot plant will be located in the town of Herzogenburg, 60 kilometres west of Vienna. In parallel with building the plant there, HeiQ has also set up a new Austrian subsidiary, with Martin Gebert-Germ as its chief executive. Mr Gebert-Germ officially joined HeiQ at the start of November from technical yarn manufacturer Glanzstoff, now part of the Indorama Group. In total, he has 30 years' textile industry experience.

Of AeoniQ, he says: "The most important point is that it can be texturised while keeping its high tenacity and, up till now, this has not been possible with any other cellulosic fibre. Spin-dyeing is possible and we will also be able to shape the functionality at cross-sectional level. HeiQ's secret here is the method it has developed for spinning AeoniQ, but once spun, the yarn will work with nearly all textile processes. This means business-as-usual for manufacturers because they will be able to use all existing equipment for weaving, knitting and dyeing. They can use standard dyes and existing functional finishing such as antimicrobial functionality." He adds that the fabric that knitters and weavers will be able to make from the yarn will be ideal for people to wear next to the skin. It can match the quick-dry and stretchability properties of polyester and nylon, Mr Gebert-Germ adds, the smoothness and coolness of viscose and the touch and cosiness of cotton. Combinations with other fibres will also be possible, he explains.

HeiQ will produce the new yarn with titres or concentrations that range from dtex 50 to 167, filament counts of between one and four dtex, elongation of 12% to 20%, with a low shrinkage rate and a tenacity that Martin Gebert-Germ describes as outstanding and at polyester levels, registering between 25 and 40 centi-Newtons per tex. "All of this makes it perfect as a substitute for polyester," he insists, because, although it is a manmade fibre, too, it comes from completely renewable and natural sources with a novel, sustainable, closed-loop manufacturing process.

No oil means stable prices

He goes on to say that the cost structure of AeoniQ will be stable (factories will use the nearest, most abundant and affordable source of cellulose, provided it is in keeping with the three principles outlined above). Preliminary autumn 2021 calculations put the price of AeoniQ at €4.50 for a 100gsm fabric. In the same calculations, HeiQ's figures for other materials (of the same area and weight) put viscose and polyamide 6.6 at €5.10, polyamide 6 at €4.80, polyester at €4.15 and cotton at €3.70. "We're in the middle," the new chief executive of HeiQ Austria says, "so our customers will be able to use AeoniQ to make



apparel at a reasonable price, not related to the fluctuations of the oil price and without any agricultural land demand."

He also makes the point that, while the yarn itself appears similar to some filament viscose yarns that are already on the market, the process to make it is "totally different" and much more sustainable. For example, the process in place for filament viscose today cannot accommodate recycled material, the process for AeoniQ can.

Call for partners

Work is already under way in Herzogenburg and HeiQ's pilot plant will come into operation during the second quarter of 2022, with the first delivery of yarn expected in April. This plant will have the capacity to produce only 100 tonnes of AeoniQ per year, but Carlo Centonze is adamant this will be enough for the brand partners that come forward to be early adopters of the yarn. There will be enough for these brands, who will be limited in number to 20, to make sales samples, prototypes and capsule collections. And there is scope for brand partners to join forces with HeiQ in the "creative space" that he says AeoniQ offers, for example in work to integrate durable functionality and performance benefits into the yarn. Efforts are under way already to raise further financing of \$300 million to build a mass-manufacturing plant by the last quarter of 2024. HeiQ is still working out the best location for this first large factory (gigafactory is the term it uses), but it has estimated that it will have a production capacity of 300,000 tonnes per year, meaning that, by early 2025, the company will be able to offer what he calls "recurring mass deliveries" of AeoniQ.

It is looking to secure, initially, five operational partners (in addition to the 20 brand partners), Mr Centonze says, manufacturers who will build and run these additional mass manufacturing plants, similar to the HeiQ one, around the globe and, thus, contribute to the scaling up of AeoniQ. "This is a climate-positive technology," the HeiQ chief executive says, "and we want to make sure it is

adopted as quickly as possible by as many as possible.” Yes, it would take a network of around 2,500 of these mass-manufacturing plants around the world to be able to substitute all of the polyester and nylon in production at the moment, but HeiQ has designed the new yarn to be scalable and insists that the potential exists to make 80 million tonnes of it per year, if entrepreneurs, inside and outside the textile and apparel sector, help take the technology adoption forward forcefully.

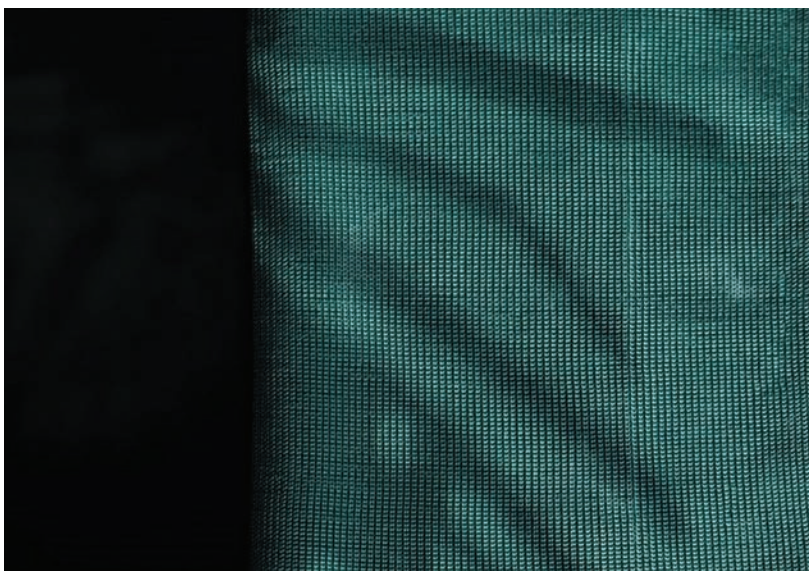
Its search for partners does not end there because it also wants to bring two strategic partners on board to work with it “at a very deep level” to keep innovating with AeonIQ and bring the new ideas to market. In fact, the first of these strategic partners is on board already – The Lycra Company, with its \$1 billion in sales and 3,000 employees. Future strategy there will centre on sustainable solutions for the textile industry, chief executive, Julien Born, says. “We are proud to partner with HeiQ in the technical development and commercialisation of this fibre,” he adds. “The industry is ready for innovations such as AeonIQ. We are well positioned to learn quickly and maximise the huge potential of this new technology.”

For Carlo Centonze, this reference to “huge potential” is no exaggeration. “What we have created is a scalable and competitive technology,” he says, “with secure, multiple sources of sustainable raw material for production of the yarn. It’s a drop-in technology for the textile value chain. We think it’s the next big innovation in sustainable textiles and capable of replacing the \$240 billion polyester and nylon yarn market in the next decades.”

Government interest

If the yarn leads to fabrics that are as versatile, functional, abundant and affordable as HeiQ suggests, it has the potential to reduce the apparel sector’s carbon footprint in a spectacular way. Mr Centonze says there is no reason why national governments cannot be AeonIQ investors, too. The presentation of the new yarn came a few days before the start of the 2021 United Nations Climate Change Conference (COP26), at which politicians from about 200 countries worldwide offered solemn pledges and promises of decarbonisation. One idea from one company in Switzerland presents all of those with textile mills in their countries to take meaningful action right away.

The sums are staggering. For the network of gigafactories around the world to reach 2,500, a total investment of around \$750 billion will be necessary. But here is what that money would buy. These factories would create and sustain thousands of green jobs and generate billions of dollars in revenues every year. They would produce a yarn that would make ‘design for recycling’ and a circular textile industry much easier objectives to attain. And if they were able to replace all 80 million tonnes of polyester and nylon per year, with each tonne of AeonIQ they



would make a carbon saving of five tonnes, which would be 400 million tonnes in total. Of course, with a recyclable yarn at the heart of a properly circular textile industry, the annual figure of 80 million tonnes of new yarn would soon reduce, but still, it serves us well for the purpose of illustrating the size of the prize.

According to independent nonprofit organisation the International Council on Clean Transportation, 400 million tonnes of CO₂-equivalent is more than half of the emissions attributable to all the passenger flights that commercial airlines flew in 2019. Textiles take a pounding when it comes to carbon footprint, but has any other industry come up with an idea with the potential to compensate for more than half of all the passenger air travel in the world?

Fabric knitted or woven from AeonIQ will be ideal for use in next-to-skin garments, HeiQ says.

Brands have had no option

Carlo Centonze responds modestly to this semi-rhetorical question and says he is sure many other entrepreneurs are developing new ideas and technologies to help the world address its most pressing problems. “That’s what entrepreneurs do to solve problems,” he says.

Asked how willing apparel brands really are to move away from polyester and nylon, he says: “It’s very simple. All brands, without exception, are aware of the problems associated with using fossil fuels to produce fibres, yarns and fabrics for clothing, but what alternative have they had until now? Cotton is a wonderful fibre and it’s biodegradable, but it’s using up tremendous water and land resources and is not scalable any more. We need to cover the needs of the world, which is to clothe 8 billion people. Here, we have new technology that is sustainable and can meet the scale required. I believe brands will be very willing to substitute polyester and nylon for this. And consumers will very quickly push the brands to do so, once they realise the option they have here: textiles with a higher sustainability content that they will not have to overpay for. Very quickly they will switch to brands that embrace stewardship for the planet and people.” 



The PET biorecycling technology developed by Carbios can treat PET plastics of all colours and polyester textiles. Annual production of PET is 70 million tonnes.

CREDIT: JÉRÔME PALLÉ

A new chapter for Carbios

It was a sunny day in late September when local officials, company managers and many scientists and engineers convened in Clermont-Ferrand, a town in the centre of France, famous since 1889 as the home of tyre manufacturer Michelin. Biotech start-up Carbios has a shorter history, ten years, but shares Clermont-Ferrand as a place of origin. The September gathering took place to mark that ten-year history, to celebrate bio-recycling technology that Carbios calls ground-breaking, and to see a newly installed demonstration plant that it believes will prove the point to the textile and apparel sector and others.

Cementing its links to the city's industrial and technological heritage, Carbios has set this demonstration plant up in a large warehouse on Michelin's historical production site in the district of Cataroux. Its centrepiece is a 20-cubic-metre reactor that depolymerises two-tonne batches of PET plastic, of all colours, in ten hours, with a 90% yield.

This story began in 2011 when Philippe Pouletty, general manager of biotech investment fund Truffle Capital, identified a technology

The inauguration of a demonstration plant marks a new milestone for trailblazing, ten-year-old French biotech start-up Carbios. This will serve to further validate its enzymatic recycling process for all forms of PET, plastics and textiles, and pave the way for the next stage, a facility with the capacity to recycle 40,000 tonnes per year.

patented by the French National Research Institute (CNRS) and set the company on a course to reinvent plastic recycling. He brought Dr Alain Marty, a professor and scientist at Toulouse White Biotechnology (TWB), on board to lead the multi-partner endeavour that would identify a key enzyme, then engineer and optimise it to create a recycling process, C-Zyme, that is now in operation at the Cataroux site.

Describing the development process, Dr Marty, now Carbios's chief scientific officer, says he was

initially sceptical that enzymes could break down plastics. The research team began by examining polluted environments to see what microorganisms were present and, thus, potentially had a natural propensity to degrade PET. An initial phase of research launched in 2012 as part of a government-funded programme known as Thanaplast. By 2015 the team had identified a possible enzyme for its purposes, naming it PETase.

Carbios scientists were a bit miffed, in 2016, when a team of researchers at Kyoto University published a paper in *Science*, which drew widespread media attention. But, says Dr Marty, the Japanese team's enzyme, dubbed ideonella sakaiensis, had been found to depolymerise only 1% of PET in three days. Meanwhile, the French team was making steady progress. "In 2019, we were processing between 200 and 400 grammes of PET in a one cubic-metre reactor, increasing temperatures, and achieving a 90% conversion of PET in ten hours." This, says Dr Marty, is when "the dream became reality".

Engineering enzymes

Enzymes are made up of a sequence of amino acids, of which it is said there are 1,000 different variants. These biological catalysts are commonly used to break down materials into smaller molecules. In Carbios's depolymerisation process they function as scissors, cutting the polymer into its basic components. Finding the right combination of amino acids took several years, and it took another couple of years to engineer a specific PETase strain capable of operating in temperatures around 100°C, says Dr Marty. In April 2020 the team published the results of its research, "An engineered PET depolymerase to break down and recycle plastic bottles" in *Nature*. The article was featured on the cover of that issue of the journal, which was a source of great pride for the team and founders Philippe Pouletty and Jean-Claude Lumaret, who was until recently Carbios's chief executive.

The start-up chose not to produce the enzyme itself, but rather to partner with Novozymes, a specialist manufacturer of enzymes, to produce the biocatalysts. Identifying and producing the enzyme is, however, only part of the recycling process the French biotech company has developed. The other essential focus of its research was to find a way to make PET readily digestible by the enzymes. This is now a key part of its intellectual property and the company remains tight-lipped about this critical phase, but Alain Marty mentioned certain key elements of it in a presentation he gave on the day of the inauguration. "The pre-treatment involves extrusion followed by fast cooling which makes PET amorphous," he says. It is also described as a method of expanding the polymer to increase its surface area to make it more accessible to the action of the enzymes. "It is a purely mechanical process that makes the plastic accessible to the enzymes," Martin Stephan, deputy chief executive of Carbios, tells WSA.

“The demonstration plant serves as a wake-up call for the textile and apparel industry”

MARTIN STEPHAN, CARBIOS



The recycling method developed by Carbios can process PET packaging of all sorts, including food trays, and containers of all colours, even carbonated beverage bottles such as water brand Perrier's green bottles that are lined with a polyamide film making up 7.5% of its composition, says Dr Marty. "The enzymes are not inhibited by the presence of common contaminants in plastics," he adds, citing colourants, titanium dioxide and carbon black. This is a major advantage over mechanical PET recycling methods that are mostly suited to clear bottles, and thus involve time-consuming and costly sorting.

A positive context for PET

"Conventional mechanical recycling of PET produces a low-quality polymer that cannot be used for packaging in contact with food," says Martin Stephan. There is also a limited number of times PET can be mechanically recycled. "Our enzymatic process yields a PET polymer that is identical to virgin PET," he points out.

Of chemical recycling methods, such as glycolysis and methanolysis, Mr Stephan says their action is less targeted than that of enzymes, generating impurities that are difficult to extract from the recycled material. The Carbios C-Zyme process is highly specific and only degrades PET, thus simplifying purification. He also points out that enzymes operate at lower temperatures and atmospheric pressure. "A biological process uses

From left to right, Kader Hidra, Chief Financial Officer, Prof. Alain Marty, Chief Scientific Officer, Martin Stephan, Deputy CEO, and panel moderator, Marie-Virginie Klein, from the Carbios PR agency, Tilder.

CREDIT: CARBIOS



The new 20 cubic-metre reactor was developed by a technical partner, Technip. In ten hours, the enzymes depolymerise 90% of the PET. The liquid then goes through a carbon filter which removes colourants and contaminants, before a final purification stage which involves the crystallisation of terephthalic acid (PTA) and distillation of monoethylene glycol (MEG).

CREDIT: WTP

water, as opposed to chemical processes that require solvents,” says Alain Marty.

The flexibility of Carbios’ patented technology with regards to colour has attracted a consortium of packaging makers keen on securing access to high-quality recycled PET (rPET) as regulatory pressure builds up to increase recycled content in plastics. These include L’Oréal, Nestlé Waters, PepsiCo and Suntory, with L’Occitane and, appropriately, Michelin the latest companies to join the club. The new demonstration plant will be producing recycled PET that Michelin will be using in its tyres.

“Demand for recycled PET is much greater than supply,” says Mr Stephan. As the ability to recycle PET becomes an industrial reality, plastics manufacturers are progressively phasing out difficult to recycle plastics, such as polypropylene and PVC, to switch to PET. This allows them to label their bottles and containers as recycled and recyclable, and contributes to growing demand for rPET.

The Carbios version is currently two times more expensive than fossil fuel-based PET, but Mr Stephan is confident that the company will, in time, be able to reduce costs, much like the petrochemical industry has done.

What’s next?

The demonstration plant, which will allow the research teams to fine-tune the production process, is the last step before a full-scale facility comes into operation. Carbios is currently scouting PET manufacturers in Europe where a 40,000-tonne capacity biorecycling facility could be built.

The company is in discussion with three PET producers that have expressed interest, and a decision will be taken before the end this year, says Mr Stephan. Carbios will be investing €100 million in this first industrial-scale unit that could

begin operations in late 2024. It plans to license further iterations.

As for Carbios’s in-house team of scientists and engineers, its initial mandate, set by founder Mr Pouletty, was to develop an enzymatic recycling process for ten different polymers. “If we count Carbiolice, a subsidiary that has developed an enzyme-based additive to make biosourced PLA polymers compostable, we have only achieved 20% of our initial plan,” says Dr Marty. Other successes so far have come with polyethylene (PE) and polypropylene (PP). “But they have carbon-to-carbon bonds that are particularly difficult to separate,” says Dr Marty. “Amides, as in polyamide, could be an option, whilst ester bonds, as those of polyesters, were easier to crack.”

Another key direction for future developments is the recycling of textiles made from polyester, says Mr Stephan. Plastics make up only one-third of PET use, while two-thirds of global production end up in textiles, he points out. The demonstration plant will serve as a wake-up call for the textile and apparel industry, he claims, adding that he expects to be able to make an announcement related to apparel recycling next year. It is believed that the Carbios process could recycle polyester used in blended fabrics, leaving cotton, elastane, buttons and zippers untouched and easy to extract after depolymerisation. This would constitute yet another breakthrough compared to the mechanical recycling of textiles.

For now, the biorecycling technology developed by Carbios will contribute to reducing plastic waste as it can accommodate a wide variety of plastics, and ultimately textiles, in a fully circular and infinite loop. Other chapters may be written if the research teams find enzymes that break down other polymers. Founder Philippe Pouletty says he has no doubt Carbios will be a world leader in plastics recycling, and is a success in the making. 🌍

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Founded in 1955 and based in Cittadella, North East of Italy, Imbotex is an Italian leading manufacturer of natural, technological and recycled textile paddings. Using innovative, high-tech production processes and materials with an increasingly close eye on nature and the environment, we offer responsible paddings, encouraging the reduction of resource consumption as virgin raw materials, water and energy and supporting the importance of recycling and upcycling for the growth of a sustainable production and consumption model.

Long before the pandemic put a damper on a well-oiled, but rampant, global apparel supply chain, enterprising companies were investing in and developing new solutions to address overproduction. Micro-factories, 3D knitting and digital platforms are some of the technologies that could fix a few of the more glaring kinks in the garment-making process.

Smart, seamless, zero-waste production

Consumers are being asked, every other day or so, to buy less and buy better. It is a simple enough request, and a key message touted by sustainability campaign groups of all colours. The same message could be directed at brand and retailer purchasing teams when they place orders with manufacturers: buy less and buy better, or rather, make less and make better.

Addressing the structural and systemic overproduction of apparel is far from simple. Companies organise their production runs one year ahead of delivery to stores and hypothetical purchase by consumers. They have little visibility on which styles will be successful, which colours will sell, and which sizes will be most popular.

For some, the solution is to reshore production, bringing it closer to where a product is sold. Automated micro-factories that have access to sales data could adjust production accordingly. Digitalising the supply chain and connecting a network of suppliers is a solution that technology-oriented start-ups believe can better align supply with demand. Another option could be the development of 3D knitting and weaving, by which a product is 'fully fashioned' in one go and with little-to-no waste.

Japanese fashion conglomerate Fast Retailing, the owner of Uniqlo, is applying all three principles in its Innovation Factory, a joint venture launched in 2020 with Shima Seiki, a Japanese maker of flat knitting WholeGarment machines. Product design takes into account customer feedback and sales in real time. The microfactory also adjusts production to sales and shares this information with subcontractors overseas. This is part of the retailer's Ariake Project, which aims to reduce CO₂ emissions and waste by creating and manufacturing only the products that are necessary, albeit on a limited scale, based on a single product category.

In France a similar project is under way. Chamatex, a textile manufacturer based in Ardoix, patented a woven jacquard upper it calls Matryx, which is the basis for the creation of a highly automated shoe-making facility it opened this September. This Advanced Shoe Factory 4.0 (ASF), a €10 million investment, has a production



capacity of 500,000 pairs a year and has begun producing shoes for Salomon. "It allows greater flexibility with regards to quantities and deliveries compared to producing in Asia," says Chamatex CEO, Gilles Réguillon.

Automated knitting

Trerè Innovation, a manufacturer of high-tech knitted products based in Asola, Italy, has invested \$6 million in an automated on-demand manufacturing and stock system. Its operations are directly connected to the Electronic Data Interchange (EDI) software of key clients, such as Intersport and Sport 2000, and was launched this May. "An order placed before noon can be manufactured in four hours and delivered in stores the next day," company CEO, Marco Redini, tells WSA. The concept works best for basics, such as socks and underwear made on the company's circular knitting machines. Each sale, or set number of sales, automatically activates the placement of a new order. Plans to implement the system predate the pandemic and it is "part of the new services we offer," says Mr Redini. When the company launched its very first range of shoes featuring knitted uppers, under the Uyn brand late last year, it also integrated new services that go well beyond what suppliers traditionally offer. "We have an in-house stock of some 100,000 pairs

The Innovation Factory of Japanese retailer Uniqlo is designed to accelerate the development of sample knit products based on customer feedback. Shima Seiki, a partner in the venture, provides the machines, which the retailer displayed for the reopening of a store in Tokyo.

CREDIT: UNIQLO



which allows retailers to keep their own stock at a minimum while we manage the bulk,” says Mr Redini. Online retailers or marketplace vendors can have orders sent directly to consumers.

Seamless 3D knitted garments can be made on different types of machines. Trerè Innovation has optimised and customised circular knitting machines made by Italian company Santoni. Flat-bed, full garment-making machines are the specialty of Shima Seiki, in Japan, and Stoll in Germany. Based in Reutlingen, Stoll merged in 2020 with Karl Mayer, a maker of warp-knitting machines, which also manufacture garments in one go; its headquarters are in Obertshausen. This is the technology Italian company Cifra has chosen for its Warp Knit Seamless (WKS) platform. “This process generates no waste and garments require very little sewing or cutting,” says company CEO, Cesare Citterio. This 3D knitting technology also allows for customisation options as its no-run knit construction means garments can be raw cut to personalise the length of sleeves or leggings for instance.

Mr Citterio does not believe on-demand manufacturing of one garment at a time is feasible on an industrial scale, but he sees a growing trend in relocating manufacturing, and making it more efficient by adjusting production to sales. His factory, based in Verano Brianza, along with his

Uyn, a high-tech sports apparel brand launched by Trerè Innovation, specialises in seamless body-mapped performance clothing.

CREDIT: UYN

network of international partners, is flexible enough to adapt to demand. Cifra's raw material comes in the form of bobbins of yarn, not bolts of fabrics. When a brand places an order, it is basically reserving a set quantity of yarn, and production runs can be modified as needed. This flexibility can be useful for brands that sell online, like Gymshark, says Mr Citterio, as these companies know exactly what they are selling in real time. "We can adjust production to sales," he explains. "We cannot make one product at a time, but we can offer flexibility in terms of designs, shapes and sizes."

With the many disruptions in manufacturing and shipping during the lockdowns, he says the need for local suppliers and shorter supply chains is growing among brands and retailers. Warp knitting machines are fast and efficient, and, for Mr Citterio, ideally suited to zero-waste customised production runs. But they do have limitations. "A single yarn will be used to make the entire product, we cannot insert, for instance, an X-Static yarn, at a given place," he says. The machines also require high-strength yarns, and natural fibres are a challenge. Cifra is, he states, one of the few companies in the world to knit merino wool on Karl Mayer warp knitting machines. The yarn it uses is a special merino and polyamide blend spun by Südrolle.

Digital and virtual designs

Smaller-batch production was a trend well before the pandemic, says Jörg Hartmann, head of fashion and technology at Karl Mayer Stoll, had gained added momentum when factories closed and shipping became complicated. Flat-bed Stoll knitting machines are highly automated and allow a wide range of customisation options, he says. They nonetheless require advanced programming skills to operate. This has inspired the company to simplify its software and make its technology more tangible by offering pre-set stitches, shapes and styles.

Stoll has introduced new software that allows a designer to develop virtual prototypes, and keep a product in virtual state as long as possible before production. This, he points out, contributes to sustainability by reducing prototype shipments between design teams and factories and can lead to significant CO₂ savings. It is conceivable that an end consumer will make the final decision on a product design and automatically activate its production. "We have the technology that connects the machines; all one would need is a browser tool that plugs into Stoll software. It could work for online retailers," he says.

Again, manufacturing one product at a time is not necessarily cost-efficient or feasible. But, for Stoll, it is possible to make customisation and industrialisation converge. Mr Hartmann hypothesises that a manufacturer could set up and set aside Stoll knitting machines for a key customer and offer a limited array of customisation options. A brand could then allow its retailers to develop their own colourways,



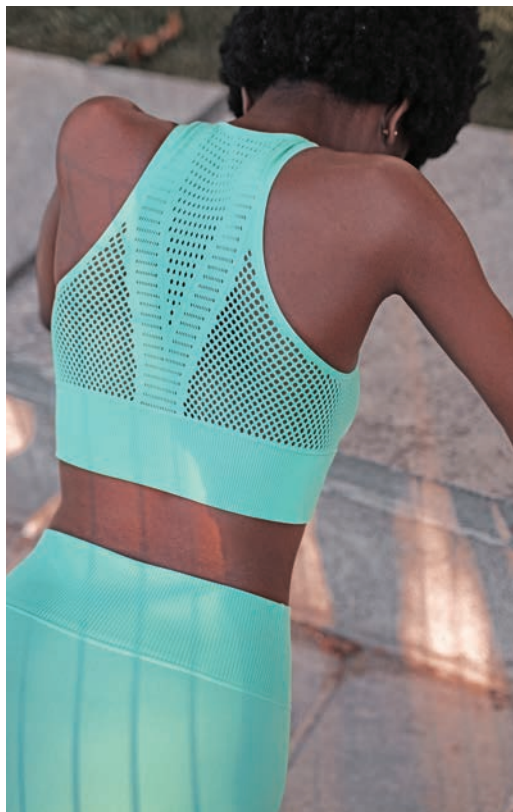
graphics or designs to propose 'exclusive' product ranges, in a system modelled on drops, he says.

This concept would require easy-to-use software and a set of product templates offering various customisation options. This is a line of thinking that design studio Eva x Carola, which works with Santoni, has in mind with regards to on-demand knitwear. Customisation can be challenging, says Carola Leegwater. "Manufacturing is not a problem, but the machines would need to be easily programmable, which is not yet the case," she says. It can only work within a specific framework. The waist, sleeves or legs of a garment can be longer or shorter, but it would not be possible to switch yarns from polyamide to wool, she says.

"Santoni machines are more intuitive than before, and designers are more comfortable with product development software," says Eva de Laat,

Trerè Innovation says it produced 250,000 pairs of Uyn shoes in its first year. They were launched in October 2020.

CREDIT: UYN



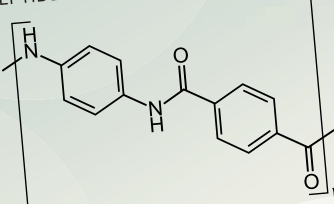
Products made on Cifra's WKS platform need little-to-no finishing.

CREDIT: CIFRA

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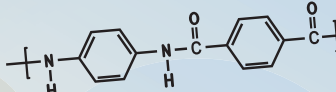
THE SUSTAINABLE FUTURE OF NYLON

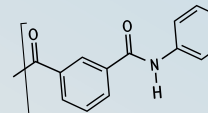
BIODEGRADABLE NYLON?
COPOLYMER
[NH-(CH₂)5-CO]_n N₂H(CH₂)4COOH USAGE OF NYLON

RECYCLED NYLON
PEPTIDE
NYLON 510
[NH--CO]_n

ENVIRONMENTAL IMPACT
REGENERATED RAW MATERIALS
NYLON 10.10
[NH(CH₂)9CO]_n

POLYAMIDE
PRE-CONSUMER RECYCLED NYLON
[NH-(CH₂)6-NH-CO-(CH₂)8-CO]_m

NYLON 6.9
POST-CONSUMER RECYCLED NYLON
[NH--CO]_n

NYLON 6.10
REGENERATED RAW MATERIALS
[NH--CO]_n

SYNTHETIC FABRIC
SUSTAINABLE SOLUTIONS
[NH-(CH₂)6-NH-CO-(CH₂)8-CO]_n

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the other designer in the duo. She cites the MyKnit project Santoni presented at ITMA Shanghai as an example of a manufacturer-to-consumer, or M2C, concept. It offers the possibility of custom designing a headband using software that does not require advanced engineering skills, she says.

The network effect

A number of start-ups seek to rewire and digitalise the apparel supply chain to make local production possible and reduce overstock. They see, in the current dynamics, a positive context for their solutions that monitor demand to adjust supply.

A laboratory for fashion on demand, New Industrial Order (NIO) is the brainchild of a team of Dutch designers. Tirza Brems, a former buyer for retailer Hema, is chief operating officer. Using advanced knitting machines such as Shima Seiki's WholeGarment technology, NIO seeks to better align supply with demand. The start-up has created a series of white label Knitcode templates that streamline and optimise stock management. "We are starting with four simple and basic designs, including a scarf and a beanie, that our clients can customise," she tells WSA. NIO would manage on demand production for brands and retailers, using its yarn and Knitcode templates. She believes it can reduce stock by 15% to 20% without impacting a brand's profits. "We can increase margins by rationalising the supply chain; there will be less risk of a container getting stuck in the Suez Canal," she says.

Offshore mass production, says Ms Brems, is very much a matter of logistics; decisions are made a year ahead and cannot be changed. This leads to "a lot of chances lost, and a lot of risks taken". The only way to make reshoring viable is to limit the number of products and customising options. Ms Brems also points out that there is a lot of unused capacity in knitting factories that could be put to better use with NIO system's network of machines, collectively known as Knitcloud. "This is our unique selling point," she says, "we need to shift the system to produce less and produce better."

To keep costs down, a company could produce a portion, say 50%, of its expected runs before the



Design studio Eva x Carola has an ongoing collaboration with Santoni, Woolmark and wool spinner Südwole. A recent project involved the making of seamless 3D knitting cycling kits.

CREDIT: THE WOOLMARK COMPANY

season, and adapt manufacturing to sales for the remaining 50%.

Relocating and reorganising production is the task that French start-up Tekyn has given itself, and is setting up with 15 brand partners. Every week, as sales data are uploaded to the platform, manufacturing is adjusted to demand. When it launched in 2017, Agnès Vernier, CMO, says the industry was not ready. But covid accelerated digitalisation and boosted demand for local production. The company has set up an automated cutting facility, located in Saint Denis just north of Paris, that prepares the kits for sewing and uploads data automatically to the platform. These services are made available to workshops, and two 4.0 cutting lines are now in place in Romania and Bulgaria.

The system, which won the 2020 ANDAM Innovation Award, is based on a digital collaborative platform, covering all manufacturing



This shoe features a woven jacquard upper that is part of the automated manufacturing techniques at work at the new Advanced Shoe Factory 4.0 built by French technical textile maker Chamatex.

CREDIT: SALOMON SPORTS

stages, including weavers, workshops, brands and retailers. A mobile app allows each operator or connected machine to upload data in real-time. Fabric and trimming supplies are integrated into the system, constantly adjusting stocks to needs. This, Ms Vernier says, leads to reduced costs and better sell-through.

She further points out that “there is a direct link between on-demand production and ecodesign principles”. Having access to data in real time makes it possible to rationalise component and material choices. Not only labels, buttons, but also fabrics, she says. “One brand had used three different viscose fabrics for its collection and soon realised it was better to shift all three styles to a single viscose fabric reference.”

In the US, Refashiond is looking to set up a digital and physical network designed to facilitate access to, and scale up, local manufacturing. Founded by Lisa Morales-Hellebo whose career spans technology and fashion, it is based on three key pillars. Through Refashiond Ventures, the start-up intends to provide early-stage financing to technology innovators that ‘refashion’ global supply chains. An ecosystem of suppliers and manufacturers will provide the infrastructure; Gerber Technologies and digital print specialist Kornit are a part of the network’s early partners. The brain of the system, its OS or operating system, is the micromanufacturing hub that will be set up in Queens, New York, early next year.

“Reshoring production closer to where products are sold can eliminate the 30% to 40% margin-erosion due to discounting and deadstock,” says Ms Morales-Hellebo. She believes the apparel industry can be much more efficient and sustainable if changes are brought into how it operates behind the scenes; she is fully focused on ushering in a fourth industrial revolution.

Industry 4.0 is up and running at factories like those of Cifra and Trerè Innovation. In a few years’ time, Marco Redini believes that the companies that have not set up automated, just-in-time production will have disappeared. But this requires some form of vertical integration, either through a network of companies or internally. This thinking inspired French spinner Union Textile de Tourcoing (UTT) to invest in an automated knitting facility that produces beanies for Decathlon. These are not only made in France, but made next door to the sports retailer’s headquarters in Villeneuve d’Ascq.

Automation is no doubt an essential piece of the puzzle that can make the reshoring of production feasible on a small yet industrial scale. The example of 3D knitting, a form of roboticised garment manufacturing, shows that it is possible within a clearly delimited framework. The ability of digital platforms to connect the dots by monitoring real-time sales and production was, until recently, the missing node in a future, smarter and more sustainable apparel making system. 

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Biomanufacturing future fibres

The many companies and start-ups that are developing biotech processes using algae, bacteria or enzymes believe these novel vat-made raw materials could kickstart a material transition away from finite fossil resources. This is the vision that drives San Diego-based Genomatica, as Steve Weiss, marketing executive for the biotech company, tells WSA. He believes this field of research known as synthetic biology has the potential to shake up industry economics.

Synthetic biology is said to apply engineering principles to microorganisms to coax them into producing chemicals and other useful ingredients. This is a common practice in the food, fuel and pharmaceutical industries. Strains of yeast, microbes or microalgae need to be identified and optimised or, in other words, genetically modified. They feed on sugar that they convert into a desired material, be it a protein, an alcohol, or an oil. Their feedstock being plant-based, these biomanufactured substances are considered renewable. But this grossly simplified description of the basic workings of synthetic biology does not do justice to the complexity of the science. Each stage of the process poses its own set of challenges, and few projects have reached commercial scale. German biotech silk start-up AMSilk, for one, has been working on making a biotech silk protein fibre since 2008. It took French company Carbios ten years before setting up a demo plant that uses enzymes to recycle PET (see page 14). It could be argued that creating a microorganism that can break down a polymer is simpler than engineering one, or several, that put a polymer together.

DuPont's Sorona is the often-cited example of a (partially) biomanufactured fibre that has successfully come to market. Research into the innovative stretch polyester (a PTT fibre, or 3GT) began in the late 1990s. It became commercially available in 2000 and is made from bio-PDO (1,4-BUTANEDIOL) which represents 37% of its composition by weight; the remaining 63% is terephthalic acid (PTA) derived from crude oil. Its use in apparel was slow to take off until it found specific applications where it delivered properties that other fibres did not, such as providing elasticity to denim fabrics. Twenty years later it is well-established in apparel but the future of the fibre is up in the air, as DuPont has announced its intention to sell its Biomaterials business unit, which includes Sorona.

New materials are brewing in labs and reactors the world over. They promise to usher in an era in which engineered microorganisms manufacture the building blocks to make tomorrow's renewable and sustainable chemicals and polymers. However, producing them on an industrial scale and turning them into fibre is proving to be difficult.

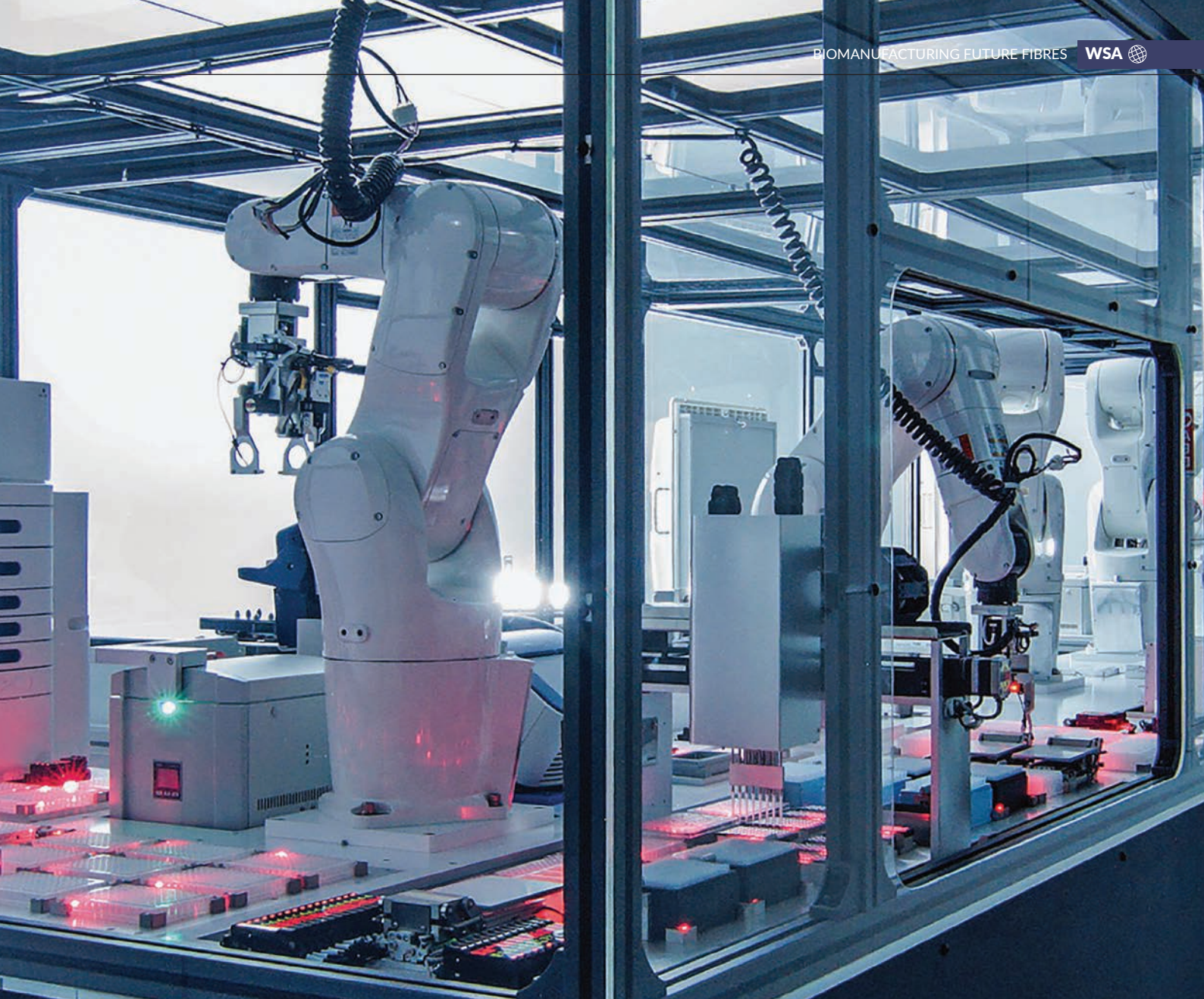
Bugs and sugar

Synbio is basically bugs and sugar, but the devil is in the detail, especially at scale, says Mr Weiss. Reaching the necessary productivity and yields to make these materials commercially successful is challenging. In addition, you need to separate the desired chemical from the fermentation broth and process it to reach high purity levels to ensure that the plant-derived chemical can be used exactly as its corresponding fossil-derived one. Pressure on price can be high if a biotech substance is designed to replace petrochemicals that are now considered commodities. "In the early years of industrial chemicals and polymers, they were all considered specialty products," points out Charles Dimmler, founder and CEO of Checkerspot, a company developing new materials using microalgae.



Spiber's Brewed Protein polymer in powder form, which can be processed into various forms depending on specific needs and applications.

CREDIT: SPIBER



A few biotech fibres are close to market launch, for example at Aquafil using Genomatica technology, and at Spiber, in Japan, with a biomanufactured protein fibre.

The Japanese biotech company has built an industrial-scale plant in Rayong Province, Thailand. Commercial production is set to start at the end of 2021, says company spokesperson Ayana Nakajima. The company does not disclose its expected capacity, but Ms Nakajima says it is 100 times that of a pilot plant in Japan, at full scale. The facility will be producing the company's patented protein polymer through microbial fermentation. The pellets produced in Thailand will be shipped to Japan for extrusion into yarn.

Spiber's novel biotech material, which it calls Brewed Protein, could find uses in several end markets. "For textile applications, one of our priorities is to develop a soft and smooth fibre that has a cashmere like texture," says Ms Nakajima. The company is targeting upscale brands and believes it will appeal to those that seek to phase out animal-based raw materials. "There is high demand for non-animal derived alternatives to cashmere, wool, silk, leather and fur," she says,

which are also protein fibres. The high price of the new material, which is said to be comparable to cashmere, is one reason high-end applications are seen as having the most potential. But the company's ultimate goal is to develop a fibre for mass-market uses to accelerate replacement of conventional materials, she, she says. Unfinished Brewed Protein fibre has been found to achieve over 70% biodegradability when tested in accordance with ASTM D6991.

A second production facility for the Brewed Protein polymer is in construction in Iowa, US, through a partnership Spiber has formed with Arthur Daniels Midland (ADM). It is expected to be operational in 2023 at the earliest.

Growing interest for biotechnologies has allowed Spiber, like many start-ups in this space, to attract high profile investment funds from the likes of Carlyle. In the past few months, Spiber raised close to €490 million and has announced plans for a future IPO. "These resources will go to scaling up our development processes and ongoing research into other possible markets, such as the automotive and medical sectors," says Ms Nakajima.

Robots are increasingly used to speed up the screening and synthesising of custom genes which power the biotech bugs

CREDIT: SPIBER

Agribusiness giant Cargill is showing interest, too. It has invested in AMSilk as part of a new round of funding led by Novo Holdings, the investment arm of Danish enzyme maker Novozymes, which is also a new shareholder in Genomatica. These operations have added €29 million to AMSilk's resources, and \$118 million to Genomatica's. This past August, Canadian athleisure brand lululemon also contributed new funds to Genomatica. It is the first time it has invested in a sustainable materials company. More than half of the brand's raw materials are nylon-based, says Mr Weiss.

Genomatica has already commercialised two biochemicals derived from the fermentation of plant-based sugars instead of fossil fuels, bio-BDO (butanediol), a key ingredient for polyurethanes, and bio-butylene glycol, used in cosmetics and personal care. The company is now working to commercialise caprolactam, used to make nylon 6. With its historical partner Aquafil, the company is on track to build a demonstration-scale plant, which will increase its production capacity 50 fold, says Mr Weiss, intimating that this would be of the order of 50 tonnes. Aquafil will build and operate the downstream operations of this demonstration plant at its facility in Slovenia, where it will convert Genomatica's precursor to bio-nylon 6 yarns, films and engineered plastics.

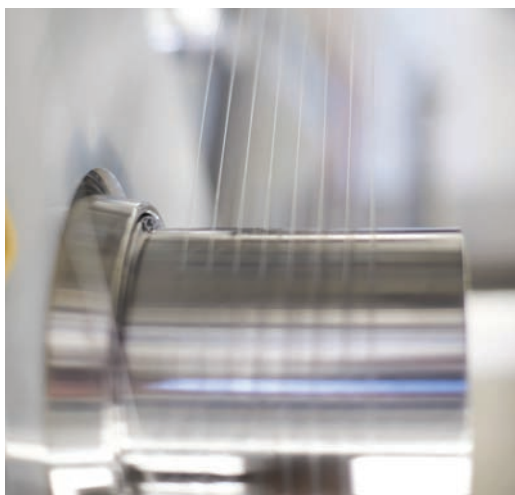
Nylon 6.6, which is a different form of polyamide, is also in the biotech company's plans. "The prime ingredient for nylon 6.6 is a target of interest and Genomatica has patents that could be used in nylon 6.6 production," says Mr Weiss. Global production of nylon is 6.5 million tonnes, of which 2 million are nylon 6.6, according to Textile Exchange's 2021 Preferred Fibre Report.

Not only nylon

Genomatica's bio-BDO is being produced on an industrial scale by Novamont in Italy, where a 30,000-tonne facility has been in operation since 2016. It uses the chemical to make compostable bioplastics. A second plant is now in the works, which Mr Weiss says will bring total global capacity to 100,000 tonnes a year.

The project is led by Cargill and German chemicals company Helm through a joint-venture that will produce bio-BDO, licensing Genomatica's technology. The facility, which will be built on Cargill's biotechnology campus and corn-refining plant in Eddyville, Iowa, could begin operations in 2024. The two partners list spandex, polyurethane coatings and biodegradable plastics as possible uses for its BDO. In its biotech version it saves "up to 93% of greenhouse gas emissions when replacing chemical intermediates made from fossil sources," the company claims.

Alameda California-based biotech company Checkerspot is also developing algae-derived intermediates for urethanes. Its Algal Core foam is already being used to make skis, but the material could be applied to make fibres, membranes and adhesives. Its physical properties are comparable to those of petrochemical urethanes, and may



German biotech company AMSilk produces proteins that it seeks to turn into high-performance fibres for sports applications.

CREDIT: AMSILK

even surpass them, Charles Dimmler tells WSA. "Our process is more sustainable and can have better performance properties," he says, adding that "there is no need to compromise between performance and sustainability." The company is seeking to improve the material's resistance, which could address some of the performance limitations of conventional urethanes, he says. "We've only just scratched the surface of what microalgae can do. They can be coaxed to make exactly what we want," he says.

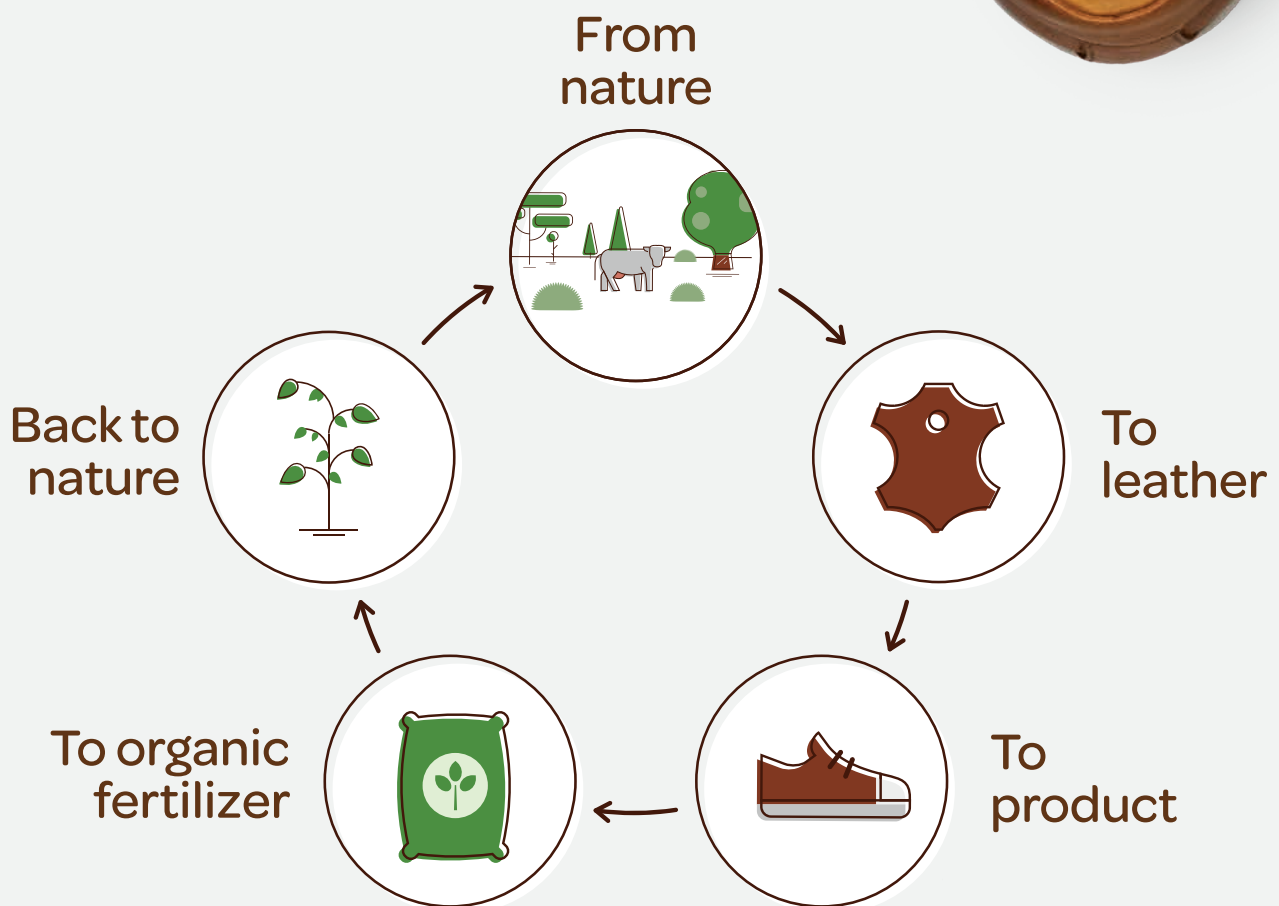
Other commercial products in Checkerspot's portfolio include chemicals for textile processing. It has a long-standing partnership with Beyond Surface Technologies, a Swiss maker of green chemistry solutions for textiles. Its bio-based miDori wicking finish is based on Checkerspot technology and took ten years to fully develop. The two partners are also working on a project with W.L. Gore to make a DWR finish from algae-derived biochemicals.

With new funds, and new staff, AMSilk, based in Munich, is pursuing research into its biotech silk and the scaling up of its production to multi-tonne scale. In 2016 adidas had presented a pair of trainers made from the Biosteel fibre. The company is seeking to develop products suited to multiple sectors, including cosmetics, medical applications, fashion and performance performance textiles, Ilja Ischenko-Schäffer, head of performance fibre sales, tells WSA. "Our main goal is still to develop a spider silk yarn in a bioreactor, with no animals or insects involved, while delivering the properties expected of a natural spider silk." He points out that the new funds from Novo Holdings and Cargill provide more than just financial backing and are a very positive development for AMSilk. The company says it has many new projects under way with high-profile companies.

There is, admittedly, no lack of innovation in labs and start-ups, nor of funding for this promising field, but scaling up these biological processes to bring chemicals and materials to market is proving to be slow. Promoted as sustainable and renewable, though tangible data is kept under wraps, this expected material transition from fossil fuels to biotech brews has yet to make its case clearly and unconditionally. 🌱



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Double-stranded helix

Questions such as “Who made my products?” and “Where do the materials in my products come from?” are not only increasingly pertinent to the ever-expanding sustainability conversation, but are also all the more bound up with consumer buying behaviours around the world. The much-scrutinised task of delivering verifiable traceability of supply is not easy, as Haelixa and Qima tell WSA, but each describes the other’s methods as complementary to their own.

At its core, the joint mission is to verify the claims made about a product, whether related to origin, quality or processing. This necessarily requires a highly tailored and intelligent approach, specific to each traceability project. Essentially, the Swiss firm is responsible for developing a custom, physical DNA marker and then applying this as a water-based solution directly to either raw materials – such as natural or manmade fibres – or a more processed product such as yarn. Qima takes care of onsite auditing.

Getting physical

Physical traceability’s moment has come, says Haelixa. The business states that its DNA markers effectively turn textile and apparel articles into material carriers of verifiable product information which “cannot be tampered with” from source to retail. Significantly, this differentiates its own system from paper-based chain of custody documentation, for instance, which it suggests could more easily be lost or even subject to attempts at verification fraud, mainly due to products’ physical detachment from their accompanying authentication data. The Haelixa-Qima partnership enables an approach which, by design, can be backed up by “reliable” systematic sampling and testing, the two companies tell us.

A crucial component to all of this is Qima’s “boots-on-the-ground” presence, inclusive of an



RISE TO THE CHALLENGE

A new partnership between Swiss provider of DNA-based traceability solutions Haelixa and Hong Kong-headquartered supply chain compliance specialists Qima seeks to offer apparel brands answers amid a climate of supply chain uncertainty.

85-country strong network of inspectors and auditors, whose job it is to not only ensure that Haelixa’s DNA markers are applied correctly during the wet process, but also to sample finished and intermediate products for verification purposes. Again, the key word here is “reliable”, a sentiment which the Hong Kong-based firm hopes to deliver on by implementing methods and strategies which “go beyond traceability”. These include offering brands more of a bird’s-eye view of their supply chains, as well as zooming in on product quality (via on-site inspections) and undertaking certification, lab testing and audits to verify social, structural and environmental compliance.

Haelixa describes its marker as harmless to both humans and the environment and adds that the vegan, genetically modified organism (GMO)-free and both Oeko-Tex Standard 100- and Global Organic Textile Standard (GOTS)-compliant solution can easily be integrated into existing textile processing. Technical verification takes place in its own lab through the use of a polymerase chain reaction (PCR) test, which it says can provide “reliable and forensic” data that may in turn be uploaded onto either an enterprise resource planning or blockchain system or integrated into the brand, retailer or manufacturer’s Qima dashboard.

Peace agreement. Swiss clothing companies Calida and FTC like the idea of using Haelixa's technology to embed maximum supply chain transparency in a loungewear collection they have worked on together.

CREDIT: CALIDA



“ In today’s global and complex supply chains, the two companies believe their joint services will be necessary. ”



A dream on the skin

Traceability technology from Haelixa has been in use at specialist knitted garment producer FTC since 2020 and, through FTC, it has also become part of a capsule clothing collection for Swiss brand Calida. The wider Calida Group has an important presence in the outdoor apparel market because its brands include Lafuma and Millet. And until early 2020, when it sold the brand to South Korean group K2, Alpine brand Eider was also part of the Calida Group.

In the course of 2021, it made public its intention to sell Lafuma and Millet, too, and to concentrate on its intimate apparel and loungewear business, which includes the Calida brand. It describes its collection with FTC as “a dream on the skin” because of the softness of the fabrics and their ability to contribute to wearers’ wellbeing. This owes much to FTC’s commitment to a particular fibre: cashmere.

Founded in the Bavarian town of Rosenheim, which is close to the Alps and, roughly, halfway between Munich and Salzburg, FTC relocated to Switzerland in 2005. It takes its name from ‘Fair Trade Cashmere’ and says it runs every aspect of its business, from growing feed for the goats to managing its finished garment manufacturing partners in China, with fairness in mind. It insists it is committed to “accepting and living” responsibility for every part of its supply chain.

By 2020, however, FTC had reached the conclusion that, in addition to detailed information about its own supply chain integration and farmer protection programmes, it also needed to offer retailers and consumers “neutral, objective, physical proof” of the origin and quality of its products. It decided that DNA marker technology from Haelixa would allow it to create “maximum transparency”. Calida has clearly become convinced too and has been happy to include ‘Marked and Traced By Haelixa’ hang-tags on the garments in the collection.

Encoding credibility

Qima discloses that data from its audits over the course of the covid-19 pandemic has shown an increase in the rate of ethical and safety risks in supplier factories, seemingly exacerbated by the global public health crisis. The company states that during the third quarter of its fiscal 2021, for example, over one third of businesses reported ethical issues in their supply chain. More than a quarter received a failing grade for critical non-compliance in the area of worker safety,

alone. These observations of what Qima describes as a “concerning trend” have only further compounded the need for increased visibility across supply chains – not later, but now.

Similarly, Haelixa emphasises that most brands only know – and hence only have visibility of – their top-tier suppliers. It also cites additional pressure from authorities and regulations, such as the recently passed German Supply Chain Due Diligence Act, which seeks to make businesses more accountable for their supply chains, especially in relation to human rights violations and unsavoury environmental practices. There is also the ever-hot topic of greenwashing and unsubstantiated sustainability claims. Both partners have perceived that firms headquartered in countries where there is a legislative push to counter these issues are perhaps more inclined to seek out traceability technology for the moment. However, due to today’s global and complex supply chains, they say, such services will be necessary “in all countries where businesses operate”.

In their own words, the complementary Haelixa-Qima offer has been met with “very positive” feedback thus far. Today’s supply challenges demand a collaborative model, they conclude, in order to help the industry progress from highlighting isolated instances of transparency to proving full and deep-rooted traceability. 🌐

The process behind marking garments with Haelixa’s DNA technology begins at the wet stage and ends with a specially designed, traceability-enabled ingredient hangtag.

CREDIT: Haelixa



In addition to Haelixa’s recent partnerships with Calida and FTC, it is also currently in discussion with several large clothing brands alongside Qima as they begin to roll out their shared system.

CREDIT: Haelixa



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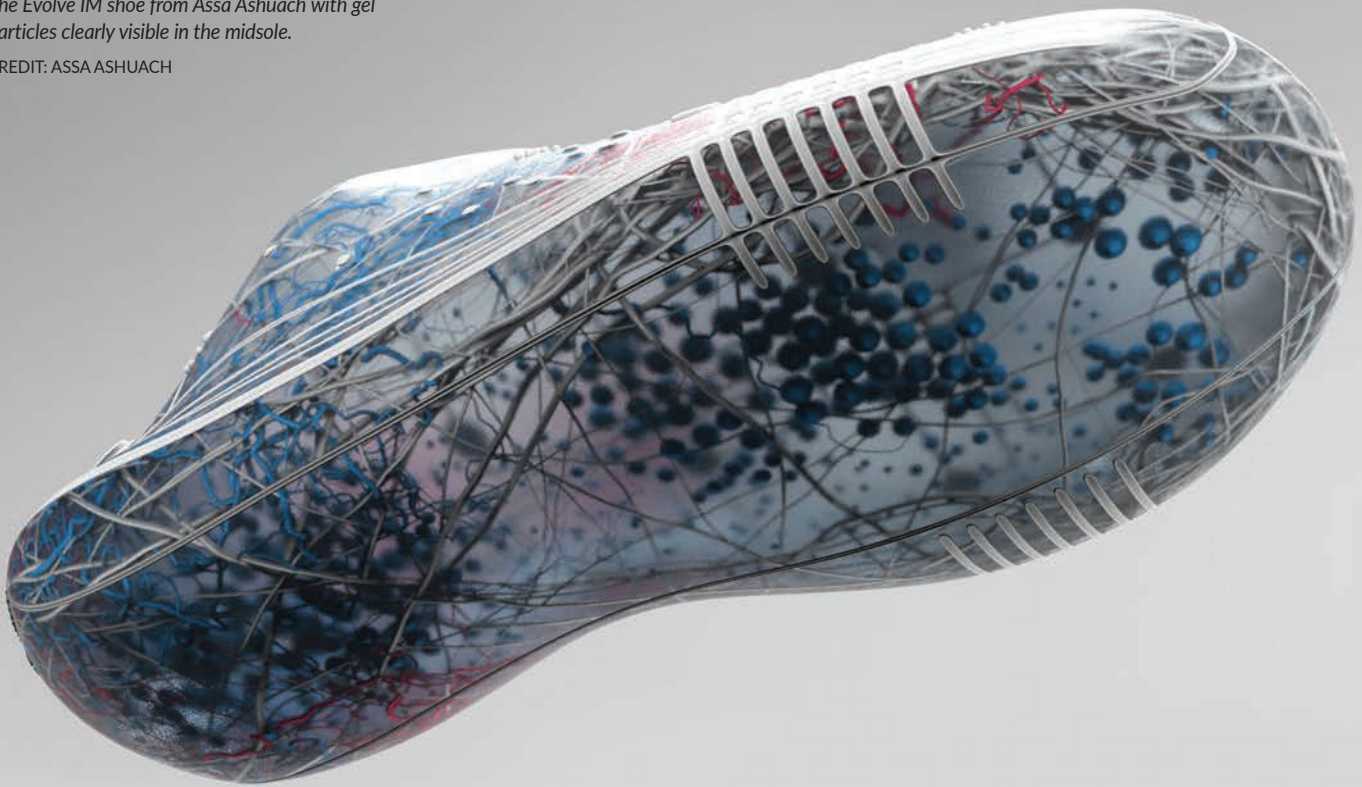
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The Evolve IM shoe from Assa Ashuach with gel particles clearly visible in the midsole.

CREDIT: ASSA ASHUACH



Data-driven design

Digital design specialist Assa Ashuach has started to share details of a collaborative footwear project that he has led. It forms part of a wider European Union-funded research programme called Re-FREAM, in which artists, scientists and designers have worked together with the aim of rethinking manufacturing processes for the whole of the fashion industry, including shoes.

Assa Ashuach's contribution has taken him on an exploration of new materials and fabrication methods, resulting in what he calls a more sustainable approach and a wearable, user-centred design. A new "biometric evolutionary shoe", the Evolve IM, is the product to have come out of this.

It uses embedded, 3D-printed sensor technology which can collect the biometric data of the wearer of the shoe. Other technology it uses includes thousands of gel particles of different densities, produced by polymer 3D printing solutions specialist Sratasys, and these, too, can capture information, in this case details of how the shoe works when it is worn. The value of all this, according to Mr Ashuach, is that data from each wearer can go directly into the Cloud to help footwear designers and manufacturers make improvements when the time comes to produce new versions of their shoes.

He explains that this, in essence, is what he means when he refers to the footwear as "evolutionary". He talks of a new evolutionary approach to design in general. "The basic



FOOTWEAR TECHNOLOGY

New, advanced methodologies for footwear design and manufacturing have come out of a concept called Evolve IM, run by London-based designer Assa Ashuach.

proposition is that the first generation of a product will learn so as to improve the second generation," he explains. "Objects have sensors built in and they, the sensors, learn. They study use over a period of time so that products can improve themselves."

Optimised by nature

In this scenario, objects, such as shoes, will no longer be "living in isolation", as Assa Ashuach puts it, but will instead be part of an ecosystem. Its adaptability to change that enables survival, he says, tipping his hat to Charles Darwin. "Bamboo learns as it grows; it has a certain form of bio-intelligence," he insists, adding that the same is true of leather, which he describes as "a fascinating, probably unbeatable material" that has been growing on animals for thousands of years and is, therefore "optimised by nature". Looking at kangaroo leather through a microscope is, he claims, like looking at cashmere.

Working on Evolve IM led Mr Ashuach to study footwear and feet quite intensely. "It's not my natural habitat," he admits. "I worked with Nike for many years, but more in research and innovation." Something that has fascinated him is the discovery that "we cannot just virtualise everything". Looking at lasts helped him see the importance of human wisdom too and to produce a shoe that is "a dialogue between the physical and virtual". The gel particles provide a good example of this because, as well as providing data to help improve new versions of the shoe, they have an immediate, physical role in the here and now too. They are there to provide cushioning in the shoe. And because they have fluidity, they can provide bespoke cushioning for each foot.

Health concerns

Seeing this work provided the designer with what he calls "a moment of joy". His first thought had been to create air bubbles for this function, but this proved too difficult, because of "machine constraints". He then began to think about filling the midsole of the shoe with liquid, but decided this would be too difficult too. "We started to play with the chemistry," he explains, "and found material that could do what we wanted in gel form. We used it to create this new midsole that reads pressure distribution under your foot." He has visions of this leading to a new system for podiatrists to use because it would be possible to integrate the Evolve IM or a future shoe using similar technology into a system to alert medical professionals if a vulnerable person's weight changes or if pressure points on the foot or excess humidity there look likely to become health concerns.

Colourful celebration

For his next innovation, he turned to 3D printing on fabric, designing colour-changing particles with different shapes integrated into the fabric of the shoe's upper. He created scripts to run through hundreds of different colour combinations randomly, based on "certain trigger points" before choosing the one he liked best. What he calls the white skeleton on the upper, which looks a bit like piped icing on a birthday cake, is conductive. "I was trying to celebrate the new technologies we have," he remarks. The sensors are visible and you can even see the gel particles underneath.

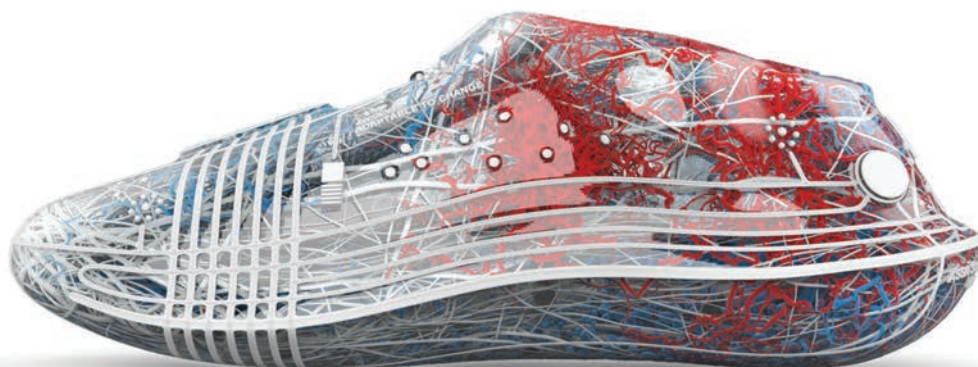


Experimental designer
Assa Ashuach.

CREDIT: ASSA ASHUACH

Mr Ashuach explains that the Evolve IM consists of only two parts, a support-free bottom and a flat upper that moves into place and take shape during an assembly process that he insists could be carried out in any location by a small team of people. This ties in with Re-FREAM, which has the stated aim of making fashion manufacturing something that can happen once again in towns and cities across Europe and anywhere else in the most advanced economies of the world. Specifically, though, the wider project supported research in three European hubs focusing on ideas to support the main objectives. The three hubs are Linz, Berlin and Valencia. Urban production of fashion using additive manufacturing, electronics and innovative materials can "create a new value chain for the fashion industry", the Re-FREAM team says.

Prototype shoes from Assa Ashuach are ready to be part of this and, perhaps unsurprisingly, work is also under way in his studio to develop follow-up versions that he will produce in the near future. The studio's connection to the Linz hub in particular has already born considerable fruit. How much impact Mr Ashuach's ideas will make on mainstream footwear production remains to be seen but no one could accuse him of being anything other than broad in his experiments and thoughtful and creative in what he has managed to produce so far. 🌐



The shoe sends data to the Cloud showing how the product works on the wearer's foot, enabling designers and manufacturers to capture information that will help them make improvements in future versions of the shoe

CREDIT: ASSA ASHUACH



SUSTAINABILITY

The European Commission is considering its strategy for highlighting sustainability attributes on labels on clothing and footwear, but a new coalition says the formula it is based on is outdated and must be revised or it could lead to 'the worst greenwashing on earth'.

Sustainability labels: have your say

The European Union is aiming to shift to a climate-neutral and circular economy, which means products need to be more energy-efficient, durable, reusable, repairable and recyclable. Because the fashion and textile industry has such a big environmental footprint, the European Commission (EC) is reviewing sustainability claims on apparel and footwear. There are more than 200 environmental labels active in the EU, and more than 450 worldwide, which leads to confusion.

The EC's 2020 Circular Economy action plan favours Product and Organisation Environmental Footprint (PEF) methods. PEF was first proposed by the EC in 2013 and uses lifecycle assessment (LCA) data to evaluate the environmental impact of materials. Following a three-year consultation, the aim is to introduce a labelling system that

collates the data and provides consumers with the information to make informed decisions about how products affect the planet. This will be interpreted into an easily digestible format – perhaps colour coded to represent 'good, average, bad' – for sectors such as water and chemicals use, greenhouse gases and resource depletion. As well as labelling, this could take the form of information at the point of sale (on shelves or brochures) or on websites and smartphone apps.

Base of misinformation

So far, so laudable. But a new consortium called Make the Label Count (MTLC) is calling for some big revisions of the PEF methodology, as it says the data it is based upon is outdated. Worse, it goes as far as potentially becoming "the biggest example of greenwashing on earth – much greater

The wool associations believe its properties, and the livelihoods of those in the industry, are not properly accounted for in the current methodology.

CREDIT: THE WOOLMARK COMPANY



than one single company can come up with", according to Prof Ingun Grimstad Klepp from Oslo Metropolitan University. She joined Livia Firth, CEO of consultancy Eco-Age, at an event to launch the campaign, which is spearheaded by 11 associations and companies, including The Campaign for Wool, Cotton Australia, the International Silk Union and the International Wool Textile Organisation (IWTO).

At the launch, Ms Firth stressed the new labelling system must be based on facts and science. "Unfortunately, we're in danger of doing the opposite," she comments. "To build the label on a base of misinformation and skewed science would be unforgivable. It could potentially unleash billions more items made of non-biodegradable petrochemical-based garments on to a global waste system that is unable to cope."

Prof Ingun Grimstad Klepp suggested PEF is neither known, trusted nor fair. "The problem is the huge overproduction and overconsumption of fossil-based fast fashion. When the system doesn't address this, it will fail to do its job to help the consumer choose product that will harm the environment less. To launch the system as it is today would be a great step backwards."

Natural barriers

The main protagonists behind MTLC represent natural fibres. They believe that as it stands, natural fibres are unfairly penalised. They say the inherently circular attributes, including renewability at start-of-life and biodegradability at end-of-life, need to be included, and the impact of forming natural fibres is fully accounted for in PEF but not the full impact of forming fossil fuel-based fibres (accounting starts at extraction). The same system boundary should be used for natural and fossil fuel fibres.

MLTC also says the socio-economic impact of fibre production and textile manufacturing is not considered in the current methodology – for instance, how many people make their livelihoods from cotton growing in developing countries – and sustainable agricultural management practices that replenish the land are not accounted for. MTLC says the PEF needs to better address the negative impacts of fibres and manufacturing, but also take into account the positive ones.

Far from trying to misrepresent, the EC is behind the idea of making the label count, says Paola Migliorini, deputy head of sustainable production, products and consumption at the EC. "We are trying to move to a more sustainable system. This is part of a larger plan. We want to take the opportunity to rebuild better."

The larger plan will address design, extending a product's lifecycle, improving recyclability and recycled content, reducing emissions and waste in manufacture, and will address microplastics. "The landscape is complex and the landscape of solutions might appear confused as there are several initiatives," she admits. "But the idea is to have a textiles strategy that takes the strengths of these and provides clarity."



Investment needed

But, how easy will it be for the EC to incorporate MTLC's requests into the PEF and its methodology? Some aspects already have a wealth of research and data behind them, but for others, more investment is needed, according to independent analyst Veronica Bates Kassatly. Although not a member of MTLC, her research substantiates some of its concerns.

"The EU cannot ethically and scientifically launch a generic PEF unless they commission and fund a suite of LCAs. And they need to commission and fund a suite of matching SEIAs (Social and Economic Impact Assessments) to go with it," she tells us. "This is going to cost a lot of money and will probably take several years. But I understand that the PEF is not expected to be

Dalena White from IWTO says the PEF does not reflect the EU's own sustainability and circularity goals. "The aim is to offer consumers clear and transparent information to make informed decisions, and this should be the aim of any legislation involving textiles."

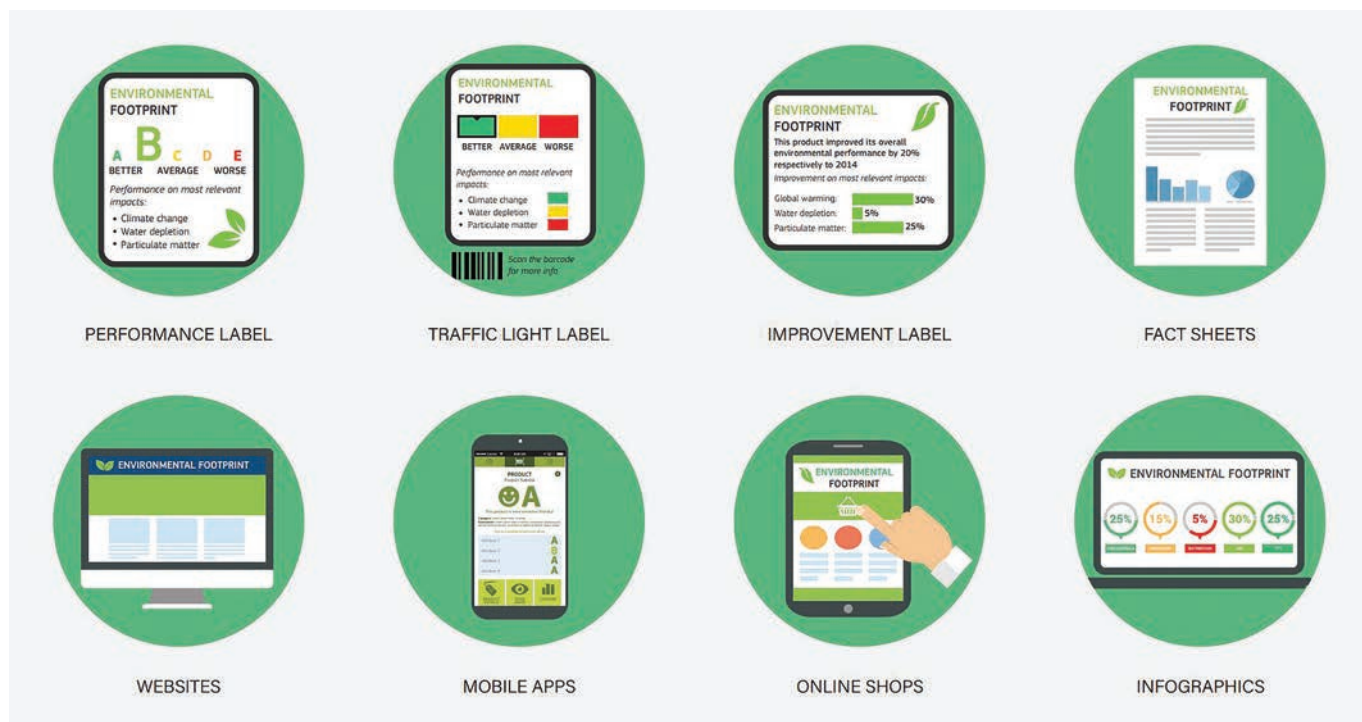
CREDIT: THE WOOLMARK COMPANY

WHAT THE PEF COVERS

- Ozone depletion
- Human toxicity – cancer effects
- Human toxicity – non-cancer effects
- Eco toxicity – freshwater aquatic
- Particulate matter/ respiratory inorganics
- Photochemical ozone formation
- Acidification
- Eutrophication – terrestrial
- Eutrophication – aquatic freshwater
- Eutrophication – marine
- Land use
- Resource depletion – water
- Resource depletion – fossil fuels
- Resource depletion – minerals and metal
- Climate change
- ionising radiation, human health

WHAT MTLC WANTS TO ADD

- Renewability and biodegradability
- Accounting for microplastics
- Equitable comparison of fibres
- Duration of service
- Social impacts
- Production practices



introduced for quite a while, as once the Commission has agreed on the framework it still has to be passed by MEPs. There would be time to collect the data that everyone had agreed the PEF should use while the political process followed its due course.”

She explains that for the main fibres at least, the data on renewability and biodegradability exists, it would just be a question of drawing it together and agreeing on how this measurement would be added. There is no agreed data or methodology for measuring microfibre release and impact (see WSA Issue 1 2021) but there is a large body of research, so if there was agreement in principle, this should not take more than a couple of years to achieve.

Dalena White, co-spokesperson for MLTC and secretary general of IWTO, agrees substantial research has been done on the impact of microplastics and it should now be incorporated. “The field of sustainability is a constantly evolving science and methods by which we measure the impact of textiles should be continuously reviewed and modified where needed to match the latest science available,” she tells WSA.

Durability parameters

For Pascal Morand, director of Fédération de la Haute Couture et de la Mode (which represents high-end fashion brands) and a contributor to the EC’s consultation process, great things have already been achieved with the PEF. But, he says the notion of durability needs to be addressed. Under the current system, durability is measured by material strength, but garments are much more complex. He gives the example that a sports jacket would seem better than a luxury wool coat or a lace dress in this category, merely because synthetic materials are physically stronger, but that does not mean these items are less durable in

terms of how long they last, and the emotional attachment people might have. “Our industry approves the idea of having a European reference and a commitment,” he says, “but it is important to give correct information to consumers.”

Ms Bates Kassatly suggests longevity of a product could be the most relevant sustainability metric but there is virtually no data on how many times the average cotton t-shirt or cashmere cardigan is worn, or whether it is likely to go on to have more than one life. “I have no idea how long it would take to get that aspect together,” she says. “I have suggested that, pending more comprehensive analysis, the EU/Gruener Knopf [a German government-run textile label] should put a cigarette packet-type of label on all apparel: ‘Warning: If you wear this garment fewer than X times, your purchase is unsustainable and may increase global warming.’”

Work in progress

The consultation process began last year and has involved various segments of the industry (although Prof Grimstad Klepp suggests these have been “the biggest brands and those that have earned money from making too many clothes and want to continue”), and will involve at least two rounds of public consultation. The technical document is not expected to be published before 2023 – although Ms Bates Kassatly points out the EU is a political entity, so how long it would all take would partly be a question of politics, and a function of whether the leading brands objected to the proposed additions.

“We are asking industry to provide us with the data that underpins the methodology; we don’t think it’s been hijacked by one sector or another,” concludes Ms Migliorini. “The aim is to ensure that we don’t transform it into greenwashing and it’s underpinned by science.”

Examples of how environmental impact scoring might appear on all clothing and footwear products sold in the EU.

CREDIT: EC

Those wanting to find out more, or have their say, can visit the EC’s website or www.makethelabelcount.org.



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Sports shoes save the day

Germany's main shoe industry association, HDSL, whose members include many famous names in sports and outdoor footwear, reported half-year growth in 2021, but secretary general, Manfred Junkert, says there are still difficult challenges ahead.



DIALOGUE

**Manfred Junkert,
Secretary general of HDSL.**

Your figures are very interesting: footwear sales in Germany of €1.44 billion in the first half of 2021, a 12.5% increase compared to the same period last year. How many pairs of shoes did companies sell in Germany in the six-month period?

It's usually a little below 400 million pairs for the full year, so it must be 200 million or something close to that.

This is compared to the problematic year of 2020, but it's good for there to be growth. You have said 12.5% is a small figure but it doesn't look like a small figure. It looks very good.

It looks like a big figure, but to be realistic, that's only a half-truth. It's 12.5% because we have the sporting goods industry. Sports, safety shoes, slippers and children's shoes are all segments that are very good at the moment but things are much more complicated for typical streetwear shoes. There have been no concerts, no business events and people haven't been going out. Because they were staying at home, there was no need for more traditional types of shoes. If our figures focused only on that segment, there would be a minus before them, not a plus.

Even so you have made the point that there still has to be progress to recover the levels of 2019, before covid. What will need to happen to make it possible to recover those 2019 figures? What do you hope to see?

Well, first of all, consumers like to go out. If normal life comes back and people can again go to concerts, to discos or whatever they want to do, they will want to have new shoes and new outfits for that. That's how it used to be. And of course, we hope the shops won't have to stay closed any more. If they are open throughout the year, if manufacturers have nice shoes, and if people are ready to buy new stuff, we can hope for a bounce-back effect. Maybe if people have gone a whole year without buying single pair of new shoes they might buy two pairs now.

Did you witness some of your member companies trying to make good use of the time when they were quieter to think of new ideas?

Yes, absolutely. Everybody did, but in many different ways. First of all, in their collections. They created new styles for what they think demand will be in the future, thinking about new segments and asking themselves if they needed to be more original in some fields. And many companies also worked on becoming more digital. Shops were closed and companies saw the importance of having an e-commerce business or of becoming better in that field. Our members also spent time thinking about and working on sustainability. They took time to think about new materials.

Was it a surprise to you that this work on sustainability did not stop important footwear brands from being taken to task for greenwashing?

Well, sustainability covers a wide range of topics and I suppose there is always a danger that companies will use bits of the information for greenwashing. What we think is that it's essential to give good guidance to the consumer and to the whole of the footwear industry about what is sustainable. We expect new labels to come out of all of this.

What does this say about the supposed benefits of an extended global supply chain, with all the added levels of complexity and the increased difficulty in managing all of that?

Well, I can give you a personal opinion. We have had a discussion in Germany and across Europe about the proposed supply chain law for transparency and good conscience. It's been in force in Germany since July. Companies have to be able to prove that everything in their supply chains is correct, in social terms and environmental terms. Politicians seem to think that, with this, they can solve all of the world's problems. But if you produce footwear, and you are talking about 400



“Our growth is 12.5% because we have the sporting goods industry”



million pairs a year in Germany, it's a lot of material for which to make sure you have the correct documentation. With companies being forced now to have all this documentation, it is better for them to have fewer suppliers. If you have only a few, two or three, it's easier to document what they are doing. If you have a large number of suppliers, this will be more complicated. On the other hand, if you have just one supplier and now, in the time of coronavirus, that supplier fails, you will be out of business. But companies are almost being forced to put all their eggs in one basket because, under the new law, that means less documentation.

This leads us to the question of the difficulties that we are now witnessing with the transportation of goods, the closure of ports, increased costs and the possibility of product shortages, with consumers perhaps not being able to buy all the things they might want to buy at Christmas time. Is this, on the face of it, good news for those among your member companies who are still manufacturing in Germany or in other parts of Europe? And if there are

benefits for those member companies in this situation, is there a way of making that benefit permanent rather than just a temporary fix before everyone goes back to the old ways when the shipping problem is sorted?

Basically, it would be logical to argue like this, but even if you are producing in Europe, you have special parts that come from all over the world. If one part is missing, you cannot finish your product, your shoe. If the eyelets are missing, you cannot finish the shoe. This has happened in automotive with the chips.

If one of your member companies comes to you and asks for your advice on how to avoid the same problem happening to them as has happened in automotive, what would your advice be?

I would tell them that, no matter whether they produce in Germany, somewhere else in Europe or in Asia, they have to make sure they can source all the parts they need to make their shoes. It's not a matter of where you are producing. You need all the components, and that's the difficulty. 

Secretary general of HDSL,
Manfred Junkert, at Micam in
September 2021.

CREDIT: MICAM

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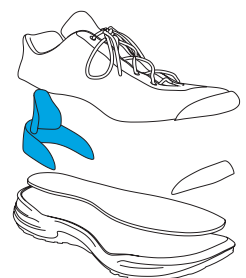
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