

The world is over—

Across the globe, two billion tonnes of waste are generated each year, according to the [World Bank](#). Consumers are confronted with waste on a daily basis, from expired foods in their refrigerators to unworn clothing in their closets and non-recyclable packaging in their rubbish bins. Brands, retailers and manufacturers are confronted with it too – across the supply chain, inventory loss and inefficiencies lead to wastage, while overproduction and misestimations lead to disposal of unwanted stock.

Modern living has accelerated this exorbitant buildup of waste. Mass consumption, throw-away culture and the lure of convenience have resulted in a landscape where many do not consider the wasteful implications of their shopping habits. For instance, one [survey](#) of 4,000 women found they own 40 beauty products on average, but only use five – leaving 87% wasted.

As retail continues to shift to online – a long-term trend accelerated by the Covid-19 pandemic – there will be even more waste. Already, containers and packaging make up 28% of the waste that ends up in American landfills according to the EPA and in December 2020, an [estimated three billion packages](#) were shipped for Christmas in the US – up 800 million from the year prior.

The sheer scale of global waste has created a sense of urgency as governments, businesses and consumers' alike recognise we cannot continue to dispose of stuff at will without consequences. Indeed, solving waste has become a lifesaving endeavour during the pandemic. Facing global PPE (Personal Protective Equipment) shortages, hospitals have streamlined their inventory management to repurpose unused items which normally would have been discarded.

Globally, new trends are emerging that focus on building a circular economy, where nothing is wasted and everything is fed back into the system in an endless loop of recycling and reusing. Circularity requires businesses to find value in resources already in circulation and reframe how they perceive waste in the first place. 'We have to ask what is waste? And what do we consider valuable?' says Tyler Chaffo, Manager of Global Sustainability, Avery Dennison Smartrac.

Building a zero waste future requires rethinking the economics of waste, and problem-solving from multiple angles in order to create end-to-end solutions that both lessen waste and prevent it from the outset. Innovation in materials can make products and packaging more recyclable, and more likely to stay within the loop longer. Technological and digital ID innovations will give us unprecedented visibility over the supply chain, creating more efficient inventory management and allowing businesses to eliminate unnecessary waste. 'There will be no silver bullet,' says Chaffo. 'It's going to be many, many solutions, working in harmony to drive positive outcomes.'

The following drivers, trends and futures in this report examine some of these solutions, that when taken together paint a picture of how a zero waste future might be achieved, in order to create a world where waste is not only mitigated, but eliminated.

flowing with waste.



Increasingly sustainable mindsets, debates over consumption and plastic waste, new waves of legislation and a realisation amongst brands and retailers that avoiding waste is good for business are all driving forward a zero waste future.

Drivers



Emily Sear, Protest Gear for Adapt. Photographer, Henry Dean

Sustainable Mindsets

Consumers' demand for action on sustainability – commingled with a realisation amongst brands and retailers that waste reduction offers tangible value – is pushing new circular systems.

Consumer awareness over sustainability has undergone a massive shift in the last decade as the reality of climate change has made itself apparent. Regular extreme climate events such as flooding, wildfires, hurricanes and sweltering heat waves have turned climate change into a lived experience for many. Indeed, in a Pew Research Centre survey of 20 nations in Europe, Asia and North America, 70% of people reported experiencing climate change where they live. Since 2015, there has been an increase of at least six points in those believing climate change to be a very serious problem. In the US, for instance, the share raised from 45% to 53% while in Japan it leaped from 45% to 70%.

The coronavirus pandemic has also heightened the need for sustainable behaviours. The consultancy firm Kearney found that nearly half of consumers are more concerned about the environment due to the pandemic. Moreover, 78% believe companies should be helping them 'make decisions that improve environmental outcomes'.

For businesses, catering to this demand is proving to have positive economic benefits. Enterprises who embrace a sustainable mindset are not only appeasing their customer base but finding tangible value in waste reduction. For instance, in a bid to reduce its carbon footprint yogurt brand **Stonyfield Organics** turned waste into a resource. Any packaged yogurt that cannot be sold is now being 'depackaged' and sent to a wastewater treatment digester, producing energy for itself whilst materials like cardboard are recycled and resold. 'Every cup of yogurt we make has the same carbon footprint, whether it's eaten by the consumer or not,' says Lisa Drake, director of sustainability innovation at Stonyfield. 'If at the end the product is waste, there's nothing to show for it.'

Less or Better?

There is a current tension in how we tackle waste in a society defined by mass consumption. Should the focus be on reducing the waste through the 'reduce, reuse, recycle' philosophy? Or should we be looking to create new systems, materials and products that are better suited to a circular economy from the start?

Jan Boelen, a curator and the artistic director of **Atelier Luma** believes that the answer cannot lie in simply creating more stuff and hoping that it gets recycled. 'We need a systemic change,' he says. 'We should change which kind of materials we source, how we manufacture, what we use them for.' Boelen believes the future of zero waste involves investing in creating new materials from renewable sources, such as algae. To that end, creating better and more circular materials is on the radar of major companies, such as **H&M**, which has inked a five-year deal with **Renewcell**, a textile recycling company that has invented Circulose, a material made from unusable textile waste.

Others believe that the answer to preventing waste is to create less waste from the start. For instance, some in the apparel industry are leaning into the pre-order model, where products are created based on demand. 'It's hard to predict demand so [a pre-order model] removes any potential wastage,' says Cassie Holland, founder of Scottish knitwear brand **HADÉS**, which offers a mix of pre-order and pre-made products.

Others are looking to digital ID technology to more efficiently manage inventories, identifying and reducing waste from the start. For the food industry, this could mean producing less based on demand visibility. In the beauty world, products are often thrown away due to expiration dates prior to reaching the shelves, or are not disposed of properly once they get diverted into unofficial or unauthorised sales channels (ie. the grey market). Here digital IDs offer a system to track products, improving inventory accuracy and thereby reducing waste.



Sustainable materials company Renewcell has developed Circulose, a new, eco-friendly fabric that reduces reliance on virgin cotton, oil production and tree harvesting



The Transboundary Loophole by Noud Sleumer uses satellite images to create an open atlas of independent e-waste sites to lay bare a global market and its localised impacts

Legislative Tsunami

With the World Bank predicting that global waste production will increase by 70% by 2050 if no action is taken, governments are legislating their way towards zero waste industry.

Longstanding governmental programs, such as deposit return schemes, where consumers pay a deposit on single-use containers and are refunded upon return, have found remarkable success. In Norway, for instance, 97% of all plastic bottles are returned and only 1% end up in the environment, according to [The Guardian](#). While this scheme incentivises consumers to recycle, governments have also pushed for businesses to take on more responsibility for the waste they create. Over the last 20 years, Extended Producer Responsibility (EPR) policies – which require brand owners and manufacturers to be responsible for the entire lifecycle of a product, including its post-consumer disposal – have become popular mechanisms to minimise the environmental impact of waste in places like Canada and Europe.

The EU is now seen as a world leader in combating waste, aiming to become a climate neutral circular economy by 2050 through its European Green Deal initiatives. The EU's commitment to amending its Waste Framework and Packaging Waste directives, its directive curbing single-use plastics, its Circular Economy Action Plan and its new Chemicals Strategy all signal a joint effort to increase recycling, minimise toxic waste and create a baseline of sustainability across member states.

Leading the charge is France, whose government enacted the world's first Anti-waste Law in February 2020. With over 100 new measures, the law aims to change companies' production methods and consumer behaviour while boosting a circular economy. Some of the most important measures include mandating environmental qualities of a product on its packaging and banning companies from destroying unsold goods such as food and clothing. In the UK, a Plastic Packaging Tax will come into force in 2022, which places a levy of £200 a tonne for any plastic packaging that is not made of at least 30% recycled plastic.

Even some of the world's top producers of waste, China and the US, are implementing ad hoc laws against waste such as California's Mandatory Recycled Content bill and China's recent restrictions on single-use plastics, which includes a nationwide ban of plastic bags and a 30% reduction of single-use plastic items in restaurants by 2022. Both show that the legislative impetus for brands to change their practices is far from slowing down.

Indeed, with China deciding to ban certain types of waste imports including mixed plastics in 2018, the US has been forced to reckon with its own waste. In February 2020, the Break Free From Plastic Pollution Act was introduced in Congress, which would mandate EPR and a national deposit return scheme, setting up the potential for the US to become a leader in waste management.

For enterprises, international organisation Global Reporting Initiative (GRI)'s recent Waste Standard, launched in 2020, offers companies' the means to understand their waste creation in a new light. It expands how companies report on waste throughout their value chain, considering its impacts not only on the environment but also society and the economy.

All these shifts are in response to pressure from society. 'Consumers are demanding change which in turn is driving public policy decisions,' says Nedelcheva. 'Legislation encourages sustainable choices by making unsustainable choices more expensive. One or two brands enacting change is not enough to move the market, legislation and good recycling infrastructure need to be in place.'

Trends



The classic 'reduce, reuse, recycle' approach to waste is undergoing an overhaul, with innovative businesses changing how waste is perceived, diverting it from landfills and eliminating it altogether.

Valuable Waste

By definition, waste is thought of something that nobody wants or can use – it is there to be discarded. But waste should be viewed not as useless, but as something that can be harnessed as a resource. Landfills, for instance, are brimming with precious minerals within discarded electronics. Researchers have found there is more gold, palladium and silver within landfills than in natural ores in the ground.

Plastic waste also presents an opportunity. There is almost too much plastic in the world to recycle within existing infrastructure. ‘The European Union’s goals for 2050 and recycling are ambitious,’ says Flor Peña Herron, Sustainability Project Leader at Avery Dennison. ‘Currently the infrastructure in place to collect and separate the materials is not sufficiently developed to enable recyclers to reach these goals.’ Spanish clothing brand **Ecoalf** views plastic waste as a material. The brand works with fishermen worldwide who collect plastic while trawling for fish in the ocean. This ocean plastic waste is then processed into a new polymer yarn used in Ecoalf’s clothing. ‘Waste is only waste if you waste it,’ says Javier Goyenache, founder of Ecoalf. ‘We cannot think of waste or trash as something we don’t need’.

The apparel industry wastes an estimated 15–20% of fabric during production but recycling fabric from the cutting room floor is another way to reintroduce waste into the supply chain. Avery Dennison’s Albert Yarn is produced from the loom waste created during label production and can be GRS (Global Recycled Standard) Certified. This gathered waste is then recycled into a 100% polyester fabric, a raw material that can be used to create new labels. The fabric is entirely traceable, since it comes entirely from one factory.

Beyond textiles, food offers one of the biggest opportunities to create a circular system, considering an estimated 30% of food produced globally is wasted, according to the [FAO](#). Spent grain from the brewing industry – the solid malt that is left behind after the mashing stage – is one instance of waste being reimagined as a new product. In New Zealand, the **Upcycled Grain Project** uses spent grain to create crackers, snack bars and energy balls while Japanese brewery **Rise & Win Brewing Co** flavours its beer with discarded yuzu peels from local farmers, and offers its spent grain as compost in exchange. Increasingly, brands will have to showcase where their recycled content comes from, with the Upcycled Certification Standard encouraging more transparency standards for upcycled goods.

Citrus fruit waste also forms the basis of papermaker Favini’s facestock collaboration with Avery Dennison, Fasson rCrush Citrus. In citrus juice production, 60% of the fruit is discarded. The sustainable Crush paper uses this waste to create facestock that is made of 15% citrus pulp and 40% post-consumer waste, combined with Avery Dennison adhesives, which ensure the label is durable and recyclable.

rCrush Citrus

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CupClub

CupClub is an innovative returnable packaging service for reusable coffee cups that integrates Digital ID technology to provide complete supply chain traceability, helping retailers reduce single-use plastic packaging through trackable products and an in-built loyalty scheme. CupClub products produce half the carbon footprint of single-use disposable cups over a typical lifecycle.

CupClub

Returnable Loops

For a long time recycling has been equated with throwing a plastic bottle or a paper box into a certain bin. But now brands are expanding the idea of what can be recycled, creating return systems and novel products where recyclability is part of the appeal.

Typically less than 5% of post-consumer shoes are recycled, according to the Better Shoe Foundation. But start-up **Thousand Fell**, whose shoes are made from 100% biodegradable, recyclable and upcyclable materials, aims to change that. The brand encourages its customers to send worn out shoes back with \$20 credit towards the next pair. The old shoes are broken down into recycled raw materials that re-enter the fashion supply chain. Pharmacy and personal care chain **Boots** is also incentivising recycling through its beauty product recycling scheme, where customers receive loyalty points in exchange for returning empty beauty containers. In the scheme's first two months, customers recycled one tonne of plastic and over 100,000 products.

Swiss running brand **On**'s latest subscription service Cyclon hints at the future of recyclability-as-service. Each customer pays a monthly fee to use their Cyclon running shoes, which are made from recyclable bio-polymers. Once the shoes are worn out, they can return them for a new pair as part of the subscription while the old shoes are recycled.

Digital ID technology is enabling these returnable loops, allowing brands and retailers to track their products, ensuring they stay within the circular system. **CupClub**, for instance, works with high street coffee chains to offer returnable, reusable, recyclable polypropylene coffee cups. CupClub wants to make using the reusable cups as convenient as disposables by setting up collection bins throughout the city. The cups are equipped with RFID tags, allowing the company to follow them along their journey from retailer to consumer and back again. Ultimately, CupClub's service uses only half the CO₂ of disposables.

Unilever is also leveraging technology to monitor the success of its latest refill trial in Europe. Consumers can buy personal care products such as shampoo and shower gel in refillable aluminum bottles, which have QR codes printed on their label, to ensure full traceability during the entire lifecycle from first purchase to each repeated refill.

Embedding Eco-Design

One key route to reducing waste is designing it out at the initial phases of concept development. 'Eighty percent of the decisions you make during the design phase will determine how sustainable your product will be in the end,' says Rob Groen in 't Wout, Marketing Manager Films at Avery Dennison. The World Economic Forum (WEF)'s Net Zero Challenge [report](#) suggests that key to businesses tackling supply chain emissions is to redesign their products and value chains for sustainability. Indeed, some brands are already embedding principles of eco-design into their products from the beginning, to ensure that the environment is at the core of their proposition, rather than an afterthought.

Eco-design is an all-encompassing belief system that ensures products are designed not only from the perspective of the materials used but from a holistic sustainability viewpoint. 'There is more than just the environmental impact. There is also social impact and economic impact,' says Peña Herron. To that end, Avery Dennison has implemented eco-design guidelines that help brands design sustainable packaging, taking its entire product lifecycle and existing recycling infrastructures into account. 'Everything is related to education because the first parameter of sustainability is if you don't need it, don't make it,' adds Peña Herron.

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Rob Groen in 't Wout, Marketing Manager Films, Avery Dennison

Eco-design at Avery Dennison



Patagonia is another brand leading the way on eco-design. Working alongside the Rodale Institute and organic brand **Dr. Bronner's**, Patagonia has created a new certification to showcase products that are not only organic but stick with principles of regenerative agriculture. Any farms **Patagonia Provisions** (the company's food brand) works with must adhere to standards for soil health – using practices that sequester carbon and improve the soil – as well as animal welfare and farmworker fairness. This ensures that products are created with both the health of people and health of the planet in mind.

Similarly luxury clothing brand **Another Tomorrow** embedded principles of eco-design into its founding ethos. Founder Vanessa Barboni Hallik set out strict principles for her brand, stating that nothing created can harm the environment or animals, and workers must have safe conditions and living wages. To meet this requirement the brand only uses four materials, thanks to their low environmental impact.

Brands are expanding the idea of what can be recycled, creating return systems and novel products where recyclability is part of the appeal.

Floating Farm

Sustainable, urban agriculture is the ethos of Floating Farm, a Dutch dairy producer operating on a floating barge. They turned to CleanFlake™ technology to better enable the recycling of their PET packaging, and switched from a standard PE label. This helps separate the label during the recycling process, resulting in pure PET flakes that can be re-processed into food-safe applications.



Floating Farm, Rotterdam



Floating Farm, Rotterdam

Enhanced Recyclability

Recycling plastic packaging is often complicated by the different types of plastics, films and label adhesives used on the pack, however, innovations in materials and design are making it easier to do so.

One solution is mono-materials – creating packaging all from the same material, which ensures the package can be easily recycled at its end-of-life. Home cleaning brand Splosh offers customers refillable products that come in plastic green pouches which can be sent back to the brand for recycling. While plastic bottles used in laundry and home care brands are usually downcycled, Splosh can turn its pouches into new products thanks to its mono-material. ‘The new recycled products will retain the colour of the original pouches which gives them a higher value than the products they were made from,’ says Splosh founder Angus Grahame. This transforms the economics of recycling.’

Another obstacle to recycling can be the package label, which often contains permanent adhesives that contaminate the package and reduce recyclability. But advancements in films and adhesives are turning these obstacles into opportunities to enable recycling. Dutch dairy brand Floating Farm turned to Avery Dennison’s CleanFlake™ technology to ensure its packaging aligned with its overall ethos as a sustainable urban farm. To enable the recycling of its PET container, the brand switched from a standard PE label to one using CleanFlake™. The adhesive easily separates allowing the label to slip away during the recycling process, resulting in pure PET flakes that can be processed into food-grade recycled PET.

PET is a plastic that can be recycled over and over and has a relatively high collection rate. In the US, PET collection has remained at a steady rate of 29% for the last decade, according to NAPCOR and in the EU it stands at 58.2% on average. Polypropylene (PP), another commonly used plastic for packaging, has a recycling rate of just 3%. But new methods of recycling coupled with infrastructure development promise to enhance material recyclability in the future, expanding which plastics can be recycled.

Chemical recycling – which uses heat, pressure and solvents to break down used plastics instead of mechanically crushing them – offers a route to creating recycled polypropylene (rPP) from post-consumer resin (PCR) that is of the same structural quality as virgin PP. Unilever demonstrated the potential of rPP in its collaboration with petrochemical manufacturer SABIC. In 2019, they created Magnum ice cream pots from food-grade rPP using chemical recycling. Initially launched with 600,000 tubs in three markets, the company is now rolling out 7 million tubs across its European markets with plans to go global during 2021. Avery Dennison has also worked with SABIC to create the first ever rPP label. The label is food-approved and offers a sustainable alternative to standard PP labels.

Digital ID technology offers another promising route to enhanced recyclability. By giving materials and products digital identifications, companies can trace materials throughout the recycling process and ensure that materials are diverted to the correct recycling facilities, enabling more to be recovered.

Carbon Labelling

Many consumers don't know where to begin when it comes to making environmentally sound choices. In a survey by Futerra, 88% of American and British consumers stated they wanted brands to help them be more environmentally friendly in their daily lives. Carbon output is one metric brands are now using to help consumers understand the impact products have on the environment, with some adding carbon labels to their products to help consumers make more considerate choices.

The food industry is pushing carbon consciousness, with restaurants and packaged good brands alike beginning to add carbon footprint labels and prioritise climate-friendly diets. For brands looking to decrease their CO₂ impact, the WEF suggests that reducing food waste, improving feeding and increased use of low-intensity fertiliser can avoid 25% of emissions. The Cool Food Pledge is a platform by the World Resources Institute that helps food businesses track the current climate impact of their menus and products and develop new meals and recipes with a lower impact.

While the Cool Food Pledge is working behind the scenes, food brands like American fast-casual chain **Just Salads** and Swedish supermarket store **Felix** are bringing carbon labelling to consumers. Just Salads is the first restaurant in the US to label its entire menu with their carbon emissions, while Felix opened a standalone Climate Store, where each product is priced according to its carbon output.

Carbon awareness is making its way into other sectors as well. Some beauty brands are touting the carbon neutrality of their products and packaging as a way to signal their sustainability credentials. Male skincare brand **Bulldog** announced recently that its signature Original Moisturiser is now certified Carbon Neutral. The official label on the packaging signifies that the carbon footprint of extracting and processing the product, as well as the packaging have all been offset. The packaging itself is made of sugarcane bioplastic, which reduces emissions by 19%. Joey Zwilling, co-CEO of **Allbirds**, the footwear brand that publishes its carbon emissions directly on the soles of its shoes, predicts that one day, 'carbon footprint labels will be as widespread as nutritional stickers on food packaging'.

But measuring carbon can be a difficult task, considering the multiple stakeholders that give off carbon during production. To make carbon labelling as widespread as Zwilling predicts requires greater oversight of the supply chain. Technologies such as Avery Dennison's atma.io's connected product cloud – which assigns unique digital identities to products and stores them in an end-to-end platform – are making this possible, allowing brands to understand their carbon footprint at an item level. Using digital ID technology, businesses can trace goods throughout their production cycle, and dynamically calculate carbon emissions as they move through the supply chain, offering greater insight into their carbon footprint beyond a static calculation.

adidas and atma.io

Avery Dennison's atma.io's connected product cloud is enabling circularity and unique consumer-product interactions for global sportswear brand adidas.

"adidas integrated atma.io's connected product cloud into our Infinite Play initiative to scale our ability to buy-back products and give them a second life," said David Quass, Global Director, Brand Sustainability for adidas. "The program has been the first of many use cases we look to enable with atma.io and Avery Dennison to achieve our connected product vision and our sustainability goals."

Extended Lifespan Apparel

Feeling pressure from sustainability-minded consumers, the fashion industry is rethinking the meaning and value of apparel, using technology to limit waste and extend the life of clothing.

Globally, the world consumes 80 billion new pieces of clothing every year, according to the Wall Street Journal and the fashion industry thrives on newness. But designer Christopher Raeburn believes the entire system needs an overhaul. He launched **Raefound**, a non-seasonal range of old, unworn military clothing and accessories that he himself sourced, with the value being Raeburn's personal curation. Its tagline is: 'Nothing new, nothing wasted'. 'Making more stuff isn't the answer to the environmental crisis that we're in,' the designer says. 'We need to do a better job considering the production [of clothing and] our relationship to waste.'

Designer Priya Ahluwalia has a similar ethos, breathing new life into deadstock fabrics and vintage clothing and repurposing them to create her men's collections. To offer customers' insight to this approach, **Ahluwalia** partnered with Avery Dennison during Global Fashion Agenda's CFS+ on a bespoke intelligent label that delves into the past, present and future of a sweater from her SS21 collection. By scanning the label, it is possible to discover where the material was sourced from, how to care for it to extend its life and how to dispose of it responsibly when the time comes. Hong-Kong brand **The R Collective** created a similar digital ID label for its upcycled garments, in collaboration with **Levi's**. The upcycled denim has an Avery Dennison-powered label, which provides advice on how to care for the garments to give them longevity as well as recycling tips.

Making connected garments not only enables brands to educate consumers but it also empowers consumers to keep clothing within the loop for longer, key to creating a circular fashion system. Resale has seen a growth in popularity in recent years with digital thrift store **ThredUp** predicting the online secondhand market will grow 69% between 2019 and 2021. **adidas'** Infinite Play program is one example of how a brand can facilitate reuse. The program allows owners of adidas clothing, shoes and accessories to return them to the brand, where they can be repaired and sold again, or recycled if they are beyond repair. 'When it comes to sustainability and waste, the ability to connect products and then track data around its usage, around where it came from, where it's going and its conditions, can help drive much more efficient and sustainable supply chains,' explains Max Winograd, VP, Connected Products at Avery Dennison Smartrac.

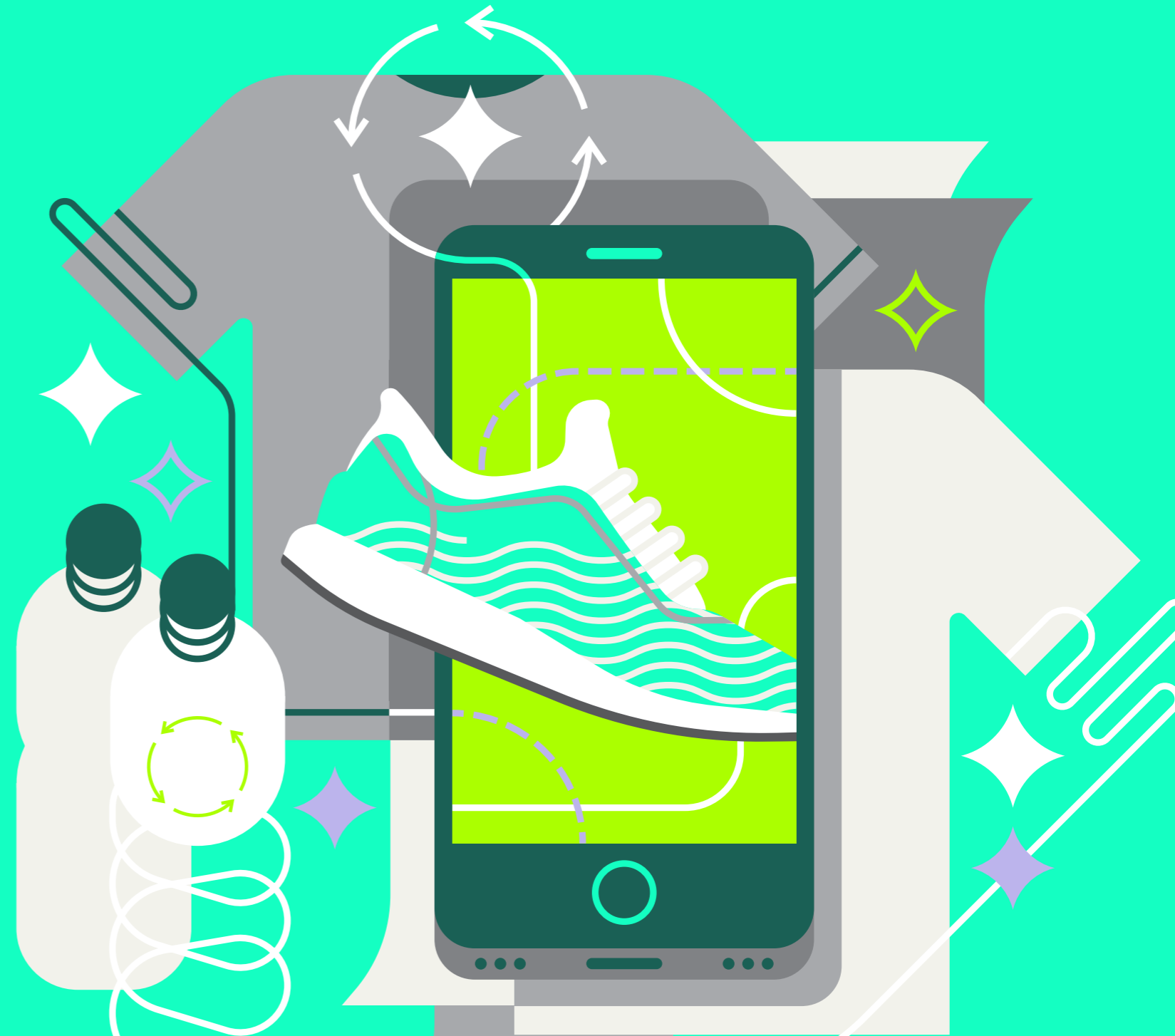


rCollective



Futures

As more governments and businesses commit to a zero waste future, there will be increased investments in novel materials as well as technologies and systems that promise to reduce waste, increase sustainable impact and scale up circularity.



Biomimicry Materials

Achieving zero waste in manufacturing requires multiple approaches. While recycling existing materials is vital, many designers are researching new materials that mimic the cycles of nature, where resources are grown, used and then degrade back into the system to regenerate anew.

Algae is a promising material thanks to the fact that it is biodegradable, edible and available in abundance. As one of the fastest growing organisms in the world, it constantly regenerates in the world's oceans. Takeaway service **Just Eat** is collaborating with packaging startup **Notpla** to find uses for algae in the takeaway experience. In 2019, they piloted a program offering ketchup and mayonnaise in seaweed-based sachets that dissolve in a compost bin. In 2020 they experimented with the Notpla box, the company's takeaway paper box that is lined with a seaweed and plant-based coating to make it water-resistant and greaseproof. The coating makes the box both recyclable and home compostable.

Designers are also experimenting with algae in fashion. New York interdisciplinary designer **Charlotte McCurdy** created a water-resistant jacket made entirely of biopolymers derived from marine algae. She describes the bioplastic material as carbon negative because its material, the algae, naturally sequesters carbon. '[This raincoat] builds a path to where materials can combat climate change,' she says.

Mycelium – the root system of fungi – is another fast-growing material gaining popularity. Material technology company **Bolt Threads** is now working with a consortium of brands including adidas and **Stella McCartney** to bring Mylo, its mycelium-based leather to the masses. One benefit of the vegan leather is that it can be grown and harvested in less than two weeks, before being tanned and embossed to look like leather.

Others are looking to food waste and by-products of the food industry to create new materials. **Tômtex** is a flexible bio-material by Vietnamese designer Uyen Tran that offers a flexible alternative to leather. Made of discarded crustacean shells and coffee grounds, the textile can be embossed and is as durable as real leather while being biodegradable should it end up in a landfill. Similarly, design agency PriestmanGoode envisioned a future of takeaway packaging working with materials designers to create different disposable, durable yet environmentally-friendly offerings. One uses cacao waste from industrial chocolate production, whilst another is made of Piñatex, a material made from pineapple plant's leaf fibers, usually thrown out during pineapple harvesting.

While each of these are experimental, they offer a vision of future materials that mimic the circular rhythm of nature by design.

Design studio PriestmanGoode collaborated with six partners to create bento-style containers from materials that are either biodegradable or re-usable, including Piñatex and cacao by-products



Biotech pioneer Bolt Threads is working with fashion brands to scale up production of Mylo, the mycelium-based leather and alternative to animal skins that it has developed

While recycling existing materials is vital, many designers are researching new materials that mimic the cycles of nature.



Beauty and wellness brand Haeckels has launched zero-waste eye masks that are grown to order from agar that it cultivates in-house

Lifecycle Visibility

In order to reduce waste, we need to know where it is occurring along the supply chain. New digital platforms and technologies are opening up supply chain transparency, which will in turn enable more circular systems. These technologies promise the ability to trace raw materials, prevent waste before it begins, improve post-consumer recycling and create a new value system by which to judge products.

Digital watermarks is one promising technology that aims to minimise waste in packaging. The Holy Grail project by AIM, the European Brands Association, brings together over 85 companies across the packaging supply chain, including Avery Dennison, to use digital watermarks to enable higher recycling rates. One of the biggest problems with post-consumer plastics is ineffective sorting. But digital watermarks, which exist as an invisible (to the human eye) layer on packaging, can be scanned by a camera to turn the package into an intelligent object. 'Watermarks can help recyclers make sure the right things go in the right place' explains Peña Herron. This means the right type of polymers will be recycled together, increasing the quality of the material that gets recycled.

The ability to trace plastics and sort more efficiently is one route to reducing waste, but by turning products into digital entities, waste can actually be eliminated from the start through more accurate inventory management. In the beauty industry, where expiration dates and complex packaging can result in excess waste, using RFID technology to create digital identities for products can offer visibility and new efficiencies for an industry that produces more than 120 billion units of packaging globally each year.

Avery Dennison's experience working with the beauty industry found that overproduction is a serious issue when it comes to managing waste. In one instance between 20-30% of a beauty retailer's inventory was either out of season or past expiry date, making them unsellable. Eye makeup such as mascara, has a limited shelf life (as little as three months in some cases after opening), making its disposal more complex. Overproduction can also occur due to beauty products getting lost in the supply chain and ending up on the grey market. Using digital IDs allows brands to keep track of their products throughout the supply chain, preventing diversion into the grey market and unnecessary production.

Having lifecycle visibility means companies could not only trace products, but raw materials as well, building a more holistic picture of their business's waste footprint. Connected product cloud [atma.io](#)'s ability to trace raw materials (alongside products) allows both brands and consumers alike to understand a product's impact on the environment and can encourage more sustainable supply chains and consumption. Indeed, if consumers can see the entire lifecycle of a product, it might change their purchase decision around it. 'It can help empower consumers to make more ecologically-conscious decisions around which products to buy based on its carbon-footprint for instance,' says Winograd. 'It's about creating that visibility and intelligence at the item level.'

By turning products into digital entities, waste can be eliminated from the start through more accurate inventory management

Circular Ecosystems

In order to achieve circularity at scale, there needs to be buy-in and collaboration from multiple stakeholders all along the supply chain – from product design, packaging and production to consumers to end-of-life disposal. In the apparel industry, new consortiums and collaborations are offering a blueprint for how to close the loop on production.

Swedish company **Renewcell** has announced that vintage store chain **Beyond Retro** will act as a supplier for the company's future recycling plant in Sweden. Beyond Retro will supply 30,000 metric tonnes of old jeans and cotton that could not be sold secondhand. Renewcell will then use its proprietary technology to create Circulose, a new textile made from recycled cotton. Circulose is a virgin-grade textile that is already being used by brands such as Levi's and H&M in their existing manufacturing ecosystems, but currently in a limited-edition capacity. This new partnership with Beyond Retro will enable Renewcell to offer textile-to-textile recycling on an industrial level.

Taking collaboration one step further is The New Cotton Project, an EU-funded consortium that seeks to prove circular fashion is possible at scale. The consortium brings together a group of 12 brands, academics, manufacturers, textile recycling and waste processing companies. During the three year project, Finnish biotech company **Infinited Fibre** will provide its chemically recycled cellulose fibres to the H&M Group and adidas for use in their clothing lines. Despite the fact that the two brands are competitors in the marketplace, the decision to work together to invest in new innovation represents how circularity can occur on a wider level. 'What we have noticed is, in order to get something like chemical recycling off the ground, more than one brand is needed,' says Kathleen Rademan, of Fashion for Good.

While these examples are specifically in the fashion world, they are representative of the movement occurring across industries, which are tackling the dizzying amount of waste created by mass consumption. A cross-industry, collaborative approach to innovation and creating new partnerships to build circular ecosystems will be key to the future of zero waste. 'We all need to collaborate,' affirms Avery Dennison's Groen in 't Wout. '[Waste] is not a problem of Avery Dennison or a problem of brand owners. It is everybody's problem, and we need to solve it collectively. This is absolutely crucial.'



H&M's transparent Loop store allows outsiders to watch garments being recycled, repositioning the store environment as a theatrical, service-led space

Key Takeouts

Creating a world where waste is both lessened and prevented will require different approaches to different issues. 'There is no one-size-fits-all solution out there,' says Tyler Chaffo, Manager of Global Sustainability, at Avery Dennison. Instead, each sector will have to create calculations around the materials they use, their environmental impact, where waste occurs on the supply chain and where it can be eliminated for the most sustainable outcome.

In order to build a zero waste future, businesses must consider:

- **Eco-design is essential to eliminating waste from the outset. This means taking into account not only the environmental impact of a product or packaging, but its economic and social impact as well.**
- **Waste does not have to be negative. Can we create a world without waste by reframing it as a valuable resource to create new products and avoid extracting virgin materials from the earth?**
- **Recycling remains a crucial lynchpin of any waste reduction strategy. Businesses should invest in increasing the recyclability of their products but also in educating consumers on how to recycle effectively.**
- **The legislative tide against waste will continue to swell. If your business isn't already determining how to eliminate unnecessary waste and create solutions for end-of-life products, you risk being caught out in the near future.**
- **Waste reduction requires a joint effort from brands, suppliers, manufacturers and consumers. No single entity will be able to solve the problem on their own, so investing in innovation with competitors in your industry can propel systemic change.**
- **In the future, products will be valued based on their entire lifecycle analysis, from the materials that are used to their full recyclability.**
- **Technologies such as digital IDs and intelligent labels will enable a level of supply chain visibility that we've never had before. Tracing raw materials and inventory allows businesses to create more efficient production decisions and track any unavoidable waste so that it can be embedded back in the system – fostering a truly circular economy.**

Food and Drink

- Food waste offers one of the best opportunities for circularity. The by-products of food production can be used not only within the food industry to create new products, but also as materials source for other industries.
- There is a need to balance decisions around packaging for food and drink products, weighing out durability and longevity with its recyclability and sustainability. Companies must consider whether the materials, adhesives and films used in their packaging complement one another during the recycling process.
- Consumers are seeking to make more environmentally friendly choices. Carbon labelling allows brands to create food and drink products with lower impact, while also giving consumers the chance to understand the environmental consequence of wasted food.





Burberry collaborated with WeChat to launch a social retail shopping concept in Shenzhen that integrates gaming, social media and e-commerce into a bricks-and-mortar environment

Apparel

- New models of circularity are gaining steam among consumers, especially when it comes to clothing. The popularity of resale and second-hand clothing gives an opportunity to extend the lifespan of apparel and keep it in the loop for longer.
- Digital IDs embedded in clothing labels offer an educational touchpoint between customers and brands. Brands can use the labels to not only offer traceability and stories of provenance, but also to provide guidance on how to care for garments and recycle them responsibly, while also being one of the fastest growing models in the apparel industry.
- The apparel industry's collective search for textile-to-textile recycling solutions offers a blueprint for scaling circularity. Joining together to invest in material innovation is one way to build new circular ecosystems.

Beauty

- Beauty products' limited shelf-life and the problematic grey market make it even more important to have oversight of the entire supply chain. The ability to track and trace beauty inventory will enable brands to limit waste from the offset as well as prevent diversion and any waste that occurs as a result.
- Beauty products' multi-layered packaging needs complicates recyclability. Creating refillable packaging, returnable loops or packaging from more easily recycled mono-materials all offer more sustainable routes forward.
- If packaging cannot be refillable, can it be carbon neutral or even carbon positive? Increasingly, consumers will be using their carbon footprint as a purchasing decision. Forward-thinking beauty brands are already using carbon as a way to market their sustainability.

Materials

- Plastic has a perception problem. Brands should educate consumers around why the use of plastic or bioplastic might offer the best solution for their packaging. Take Bulldog, for instance, who explains why it uses bioplastic packaging as part of its efforts to reduce emissions.
- The ability to trace raw materials will make recycling more efficient. If we can sort different polymers together, we can increase the quality and durability of recycled materials.
- Future innovation in materials will be inspired by nature's cycles. Can we create materials that are renewable – which can be used and when discarded, feed back into the system to once again re-enter the supply chain?



Avery Dennison

Avery Dennison Corporation (NYSE: AVY) is a global materials science company specializing in the design and manufacture of a wide variety of labeling and functional materials. The company's products, which are used in nearly every major industry, include pressure-sensitive materials for labels and graphic applications; tapes and other bonding solutions for industrial, medical, and retail applications; tags, labels and embellishments for apparel; and radio frequency identification (RFID) solutions serving retail apparel and other markets. Headquartered in Glendale, California, the company employs more than 32,000 employees in more than 50 countries. Reported sales in 2020 were \$7.0 billion. Learn more at [averydennison.com](https://www.averydennison.com).

The Future Laboratory

The Future Laboratory is one of the world's leading strategic foresight consultancies. It exists to help companies make a better future by giving them the confidence to take the decisions today that will create economic, environmental, technological and social growth tomorrow. From its offices in London and Melbourne, The Future Laboratory offers a range of strategic foresight products and services to help its clients harness market trends, adapt to emerging consumer needs, and keep them ahead of their competitors. Stay on top of the latest consumer trends and market shifts by visiting its trends intelligence platform, [lsnglobal.com](https://www.lsnglobal.com), and find out more about its client work at [thefuturelaboratory.com](https://www.thefuturelaboratory.com).

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