CIRCULARITY.ID

The transformation to data-driven circularity in fashion

Imprint

We are grateful to partners across the value chain for their valuable insights into the development of the circularity. ID® Open Data Standard.

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To enable change and accelerate transformation towards a circular economy, leveraging technology and data plays a key role. The circularity.ID® Open Data Standard is intended for use in the fashion industry for the labelling, identification and storing of digital product data to power circular practices. Open industry standards set an example for collaboration and streamlining of efforts to arrive at comprehensive models for holistic, data-driven sustainability impact.

The transformation to data-driven circularity in fashion

Today's fashion industry is primarily characterised by a linear economy of production → consumption → waste, with less than 1% of clothing being recycled into new clothing[1]. Combined with garments being massively under-utilised[2], the environmental consequences are disastrous - harming the health of people and planet.

There is an urgent need for the fashion industry to shift to circular practices. Such a circular fashion economy is a regenerative system in which garments are able to circulate with maximum value retained as long as possible before re-entering the system through reuse or recycling.

The movement towards such circular practices has already begun, and there is a growing momentum for sustainability. In the fashion industry, many important milestones addressing climate change and sparking progress have been achieved in the past years. Amongst them is the release of the 2020 commitment by Global Fashion Agenda, where 90 signatories, representing 12.5% of the global fashion market, committed to embrace circular practices[3]. Additionally, the UNFCCC launched the Fashion Industry Charter for Climate Action featuring 16 commitments to help industry players reduce their environmental impact[4].

[1] Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future, 2017 (http://www.ellenmacarthurfoundation.org/publications)

[2] Environmental Audit Committee, Fixing fashion: clothing consumption and sustainability, 2019 (https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1952/1952.pdf)

[3] 2020 Commitment, Global Fashion Agenda, 2017 (https://www.globalfashionagenda.com/commitment/)

[4] UNFCCC, About the Fashion Industry Charter for Climate Action, 2018 (https://unfccc.int/climate-action/sectoral-engagement/global-climate-action-in-fashion/about-the-fashion-industry-charter-for-climate-action)

Leveraging technology and data to enable circular economy and recyclability in the fashion industry

To enable change and accelerate the transformation towards a circular economy for fashion and textiles, leveraging technology and data plays a key role. By designing garments for circularity from the beginning and providing stakeholders with essential information at each consecutive stage of the product's lifecycle, enormous environmental, financial and creative value can be captured and re-released to the greater benefit of people and planet. A widely adopted data standard that specifies essential product data for aggregation and sharing has the potential to enable both a reverse supply chain and recyclability at scale in the fashion industry.

circular.fashion is a sustainable design agency creating product and system innovation for a circular economy in fashion and textiles. The company develops services and software for circular design and closed loop recycling to enable a transparent flow of information between materi-

al suppliers, fashion brands, consumers and recyclers. At the centre of the circular.fashion system is the circularity. ID, which holds material and product data, along with a product's entire story. This ensures future reuse, reselling and recycling at the highest possible level of sustainability. Through this system, data becomes accessible to stakeholders in the fashion ecosystem at any point in time to assess and handle products in a circular economy.

The rationale for developing the circularity.ID is based on the identification of three main challenges that need to be overcome to realize a circular economy for fashion: (1) fashion needs to be designed for circularity, (2) product life must be extended and consumers need to know where to return clothing for reuse and recycling, and (3) sorting facilities need to identify products and their materials for fibre-to-fibre recycling.

circularity.ID® Open Data Standard

Over six years of research, pilots, and collaboration with stakeholders along the fashion value chain have generated in-depth insights into the needs and requirements of making and managing a circular product. Those insights have been translated into the creation of the first public stable release of the circularity.ID Open Data Standard. With the intent of reaching a wider audience and allowing a larger adoption of this standard, it is being released under an open source license. The standard is under continual development and will be regularly updated as both technological innovation and stakeholders needs and requirements evolve over time.

The circularity.ID Open Data Standard is intended for use in the fashion industry for the labelling, identification and storage of digital product data, optimising products for a circular economy.

In short, the circularity.ID can ensure that:

01 — information on essential material and chemical components is assessed, stored and accessible,

02 — product data is automatically recognised by software at sorting facilities,

03 — products are matched to appropriate recyclers, to be recycled by best knowledge and method according to the current state of technology when the item is scanned at end-of-life,

04 — essential product information is available to consumers to enable longevity and multiple use cycles for a product, e.g through redesign and resell services.

This paper aims to provide insights into the findings and rationale informing the development of the standard along with the connected products and services under development.

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The development process of the circularity.ID®

The circularity.ID Open Data Standard is developed in close cooperation between circular.fashion and stakeholder partners through extensive research and pilot projects. This in-depth exchange has enabled identification of challenges and needs from the material production phase to design, use, and finally sorting and recycling. The mission of development is to standardise information and data exchange formats to make sure that recyclers and sorting facilities have access to necessary data to recycle garments in the most efficient, sustainable, qualitative and economically viable way.
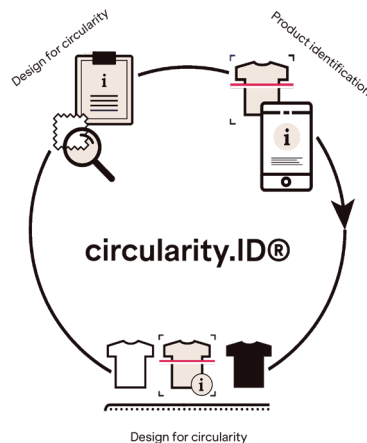
»If we truly want to accomplish positive change in the fashion industry, a big step forward is to open up the ecosystem. The holistic solution from circular.fashion can enable such a systemic change with a global standard that enables brands and stake-holders to publish and share quality information that is accessible to everyone. A great benefit for the entire industry!«

Katrin Ley
Managing Director
Fashion for Good

»Here at the H&M Group Laboratory we are exploring circular business models and solutions that support our mission in being customer centric and also work towards our ambition of 100% leading the change towards a circular future. Digital solutions in our supply chain are a must, and its great to see circular.fashion and other players exploring and developing solutions that correspond with our goals. We are testing various digital product ID services and enablers and its really exciting to see that circular. fashion is now connecting to our brands within circular design to see products circulating more effectively in the near future. Product data within the circularity.ID® is urgently needed to enable scalability of recycling, recommerce and other circular business models.«

Laura Coppen
H&M Group, The Laboratory

The need to design for circularity

The process of recycling garments presents several technical and commercial challenges, such as mixed fibre composition, lack of information on the chemical content, and availability of recycling feedstock. Sourcing recycled textile fibres which are competitive in price, availability, and quality is still challenging today due to limited market capacity. Optimising recycling feedstock has the potential to leverage the commercial viability of recycled fibres through efficient systems and economies of scale.

Textile recycling is done either through ...

1) mechanical downcycling, shredding of textile waste into lower value non-woven products such as insulation material,

2) mechanical upcycling; shredding and opening of textile waste into staple fibres and then respinning, often with a high percentage of added virgin fibres to uphold yarn strength. Polyester waste may also be mechanically shredded, melted and extruded back into reconstituted filament,

3) chemical recycling; in the case of polyester, depolymerisation of the polymer chain into original monomers.

For cotton and potentially other cellulosics, breaking down of textile waste into a cellulosic pulp, which is then further processed into staple fibres or filaments following similar methods to conventional viscose production.

To enable fashion brands to create garments that comply with today's recycling technologies, the requirements, limitations, and preferences of recyclers need to be recorded, understood, and translated into tangible material criteria and design advice. Examples of recycling parameters beside the material composition, might include e.g. exclusion of certain dyestuffs or finishes, removal of trims, and preference for specific colours. The parameters have been translated into circular design strategies for fashion brands and designers, serving as guidelines on how to design circular and recyclable products. The strategies consist of tips, inspiration, and know-how on how to assemble a product together to ensure that it, including all its components, is recyclable in the future. Strategies range from material cyclability through mono-material and disassembly to longevity strategies.

»The solution of circular.fashion offers a holistic approach to circularity. Every brand can find everything they need to create a circular product on their website. This and the collaborative impact approach that circular.fashion had in mind when designing their system makes them unique. Partnering with like-minded initiatives like TrusTrace and harmonizing solutions to leverage their impact and providing a system where information can be distributed across various partners of the supply chain is crucial to establish real transparency and circularity. Opening up their circularity.ID® data structure has the potential to significantly improve the level of transparency in the circular supply chain. We are happy to support circular.fashion in their further development to foster a transparent and circular fashion system.«

Salah Said
Corporate Responsibility and Sustainability Manager
Zalando

»Hugo Boss has implemented several circular design trainings in collaboration with circular.fashion, which were a great enrichment in thinking about new design approaches. We aim to be ready for change not only in regards to future product design, but also in regards to transitioning towards a circular economy and respective textile recycling systems. There is a large potential for the industry in collaborating on this journey and exploring holistic solutions like the one that circular.fashion has built around the circularity.ID®. Transparency is core to take informed decisions in design, enable producer responsibility and allow high quality recycling.«

Andreas Streubig
Director Global Sustainability
Hugo Boss

»circular.fashion is actively educating and enabling industry-wide adoption of circular materials. Their platform is the leading resource and point of collaborative discovery for those on the path towards circularity and resource efficiency. Circular Systems is proud to partner with circular.fashion towards the creation of a new global fashion economy - forming the systems, services and materials needed to kickstart the transformation.«

Ricardo I. Garay
Agraloop Project Coordinator
Circular SystemsTM

The need to save crucial product data

If a product holds information in the format of the circularity.ID Open Data Standard this allows to assess recyclability. At circular.fashion recyclability of a product is defined through the process of conducting circular material checks. This means matching each material in a garment with the feedstock requirements of a recycling company that is able and willing to regenerate the textiles into new fibres, if they become available in reasonable volumes. The circular material check can be conducted by circular. fashion at different points in time, both at product creation and at end-of-life when the product is returned to a sorting facility. As recycling technology is ever-evolving and continues to advance, keeping up to date with feedstock requirements is essential to make adequate decisions in the design and material configuration of a garment. A garment that is not recyclable today may be recyclable in the future, which is why it is inherently important that product data is still accessible at end-of-life through a product identifier.

The essential recycling parameters have been identified and translated into the circularity.ID Open Data Standard. This data can be accessed through the circularity.ID and will automatically be processed by circular. fashion's sorting software to identify accurate recycling streams in the sorting process (see case study on pages 7-8).

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            'brand': 'Very Cool Brand',
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            'price_currency': 'eur',
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            'weight_unit': 'kg',
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            'assembly': [
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»We at Recover® aim to receive high volumes of our ideal recycling feedstock materials to provide high quality recycling output for new textiles. The circularity.ID®'s potential of identifying material compositions very accurately, excluding hazardous chemicals and pooling together large volumes of post- consumer textiles for a matched recycler will help us to close the loop on a sustainable and economical level.«

Alfredo Ferre
CEO
Recover®

»To efficiently recycle on a fibre-to-fibre level the need of having more information than what is accessible through a care label today, such as the fibre's composition and its chemical compliance, is large. The potential of the circularity.ID® as digital tag in clothing saving this information is great in making the recycling process way more efficient and improve its commercially viability.«

Harald Cavalli–Björkman
Head of Communications
Re:newcell

»We at Ambercycle are developing next generation textile recycling, using new chemistry to extract polyester from waste clothing. The circularity.ID® is very important. We see a large problem being solved in the circularity.ID® providing data on material composition of products. For us it would be very beneficial to receive a defined and ideal input so we can deliver high quality yarns to the fashion industry.«

Akshay Sethi
CEO
Ambercycle

»We at Worn Again Technologies have developed a pioneering chemical recycling process to enable textile- to-textile circularity of polyester and polycotton blends. To scale up our technology, we recognise the essential need to collaborate with textile collecting and sorting partners who are willing to implement intelligent sorting methods in order to deliver a high volume of suitable feedstock into our recycling process.«

Chiara Galimberti
Business Development Director
Worn Again Technologies

Enable a reverse supply chain for fashion

To enable a reverse supply chain for fashion and textiles, sorting companies play a key role. The majority of collected post- consumer waste is processed by sorting companies deciding if a garment can be resold or recycled, and subsequently to whom to deliver the customised feedstock. The process of sorting is primarily manual today, based on a sorter's optical impression and sense of touch and smell. The specific feedstock requirements of innovative fibre-to-fibre recyclers bring current sorting processes to their limit as many requirements are not recognizable in a manual decision process. ID-based sorting of post-consumer garments has the potential to optimise the process, reaching a higher-quality level output to serve fibre-to-fibre recyclers and make the operations commercially viable. To ensure that the circularity.ID aligns with the requirements of the sorting partners, circular.fashion is collaborating closely with the largest and most innovative actors in the sorting industry. The following questions have been elaborated and tested with sorting partners to feed into the circularity.ID Open Data Standard:

What information about the incoming textiles are crucial for sorters and recyclersto enable intelligent sorting processes?

Which identification technologies for textiles suit sorters and other stakeholders?

How can ID-based sorting be implemented in existing processes to improve the sorting quality for reuse and fibre-to-fibre recycling?

To begin with, circular.fashion conducted comprehensive research on identification technologies ranging from innovative marking and sensory products, DNA markers, optical codes such as QR or Data Matrix Codes as well as several radio frequency identification tags (RFID). This allowed identification of products suitable for the use case of routing a garment from manufacturing until recycling. As the identification product involves many stakeholders during its life cycle, the requirements of it have been determined on the basis of numerous interviews with fashion brands, retailers, sorters, recyclers and identification experts.

Important parameters for fashion brands and suppliers include ease of implementation, privacy and data protection, cost targets, washability, durability, and wearability. Added value is provided through possible multifunctional use for logistics, brand protection, and material authentication. Readability for consumers is an additional use case which can enable services like informing consumers about return options. For sorters and recyclers it is crucial to get vital product information to improve sorting quality and provide fibre-to-fibre recyclers with suitable feedstock. Therefore, it was concluded that only the identification technologies which are able to store the full product data as defined in the circularity.ID Open Data Standard or are able to enact a lookup of this data from a database are suitable to be used in improving sorting quality. Additionally, the products need to keep sorting processes efficient. Based on this assessment, we chose identification products which have the potential to meet those demands and tested them in relevant industry environments.

Case Study: ID-based sorting test by circular.fashion and Texaid

To test ID-sorting in a relevant environment, circular.fashion developed a working prototype of an intelligent sorting workstation, featuring different scanners mounted below and on a table with a screen above. When moving a garment over the table in the sorter's usual workflow, the screen displays crucial information to support the sorting decision- making, based on possible sorting fractions such as fibre-to-fibre recycling or valuable second-hand fractions. The workstation is able to read and process all products with IDs identified as potentially suitable. On this basis, circular.fashion and TEXAID jointly conducted an ID-based sorting test in TEXAID's sorting facility in Schattdorf (CH). The goal was to find out how sorting with different kinds of IDs would impact the sorting process in terms of operations, time and quality. The joint team prepared a load of garments with optical identification tags (QR 6 codes) on woven labels and different types of RFIDs in form of labels and threads.

The test with RFID showed different results for the processing time for each individual sorter. For some the sorting time was decreasing, others increasing or stayed equal compared to the reference time of sorting without ID. circular.fashion used three different RFID products for the test which all fulfilled the expectations in terms of scanning distance and response time. The test with QR code equipped garments showed that the processing time was slower compared to the reference time. The research showed that on-screen information is beneficial for sorting decisions. It supported decision-making of second-hand fractions and especially recycling fractions, as many relevant attributes are not perceivable by human senses. The findings of this first on-site test were promising, but to receive more resilient results about the impact on the sorting quality and process time it will need further testing in different sorting stages and over a longer time period. Close collaboration with sorters have not only demonstrated the need for a standardised format of product data, but also the high feasibility for the use of this standardised data. Additionally, through this groundwork circular.fashion has further researched the necessary fields needed in the data format to ensure actual and efficient recycling.

Engage consumers to prolong garment life

Fashion is a massively under-utilised product and research shows that garments are used half as long before being disposed of today compared to 15 years ago5. Keeping garments in use for longer is the most direct way to cut waste and minimize the environmental impact of the fashion industry.

The circularity.ID Open Data Standard defines which information about a product to store, with the objective to prolong the use and provide transparency and traceability of a garment - from insights on material components, origin, and manufacturing to care instructions and services for repair, redesign, reuse, recommerce and recycling. This information can be presented on a corresponding digital product site accessible by consumers through scanning the circularity.ID's product identifier.

Being presented with such information can have a trickle down effect on sustainable consumer behaviours, such as building competencies for repairing and using a product for longer.

»New innovative recycling technologies offer very sustainable opportunities but bring up new requirements which are difficult to meet with the current manual sorting processes. We collaborated with circular.fashion and supported the development with industry know-how and conducted a sorting test.«

Martin Böschen
CEO
TEXAID Textilverwertungs AG

»We as I:CO saw that continuously growing amounts of collected clothing in combination with a lack of material information on these is a challenge for the whole sorting and recycling industry. We are always looking for forward thinking solutions that can help to overcome these challenges. Therefore, we awarded the concept of circular.fashion with the I:CO Award already in 2016 as it is a very promising approach to innovate the industry. We did support the developments with our know-how since then and are happy to see the progress to this day.«

Lydia Schmidt
Head of I:CO Circularity
I:CO

10 — Engage consumers to prolong garment life

There are plenty of options on where and how to return clothing today, along with mixed information about what happens to a garment after return or donation. Giving consumers easily accessible information on how to return clothing when no longer in use, together with transparency of what will happen to it, has the potential to increase the number of garments returned.

Through close collaboration with fashion brands, the circularity.ID's consumer-facing services has been piloted with several brands over the past three years. Corresponding product sites have been piloted with 1300+ products from brands including Jan'n June, Silfir, Myrka Studios and Vretena. The Circular T-Shirt is an example of a pilot product designed by circular.fashion, and verified for recyclability by Re:newcell. This product was developed to validate the product data of the standard, conduct market research and test-drive connected software applications.
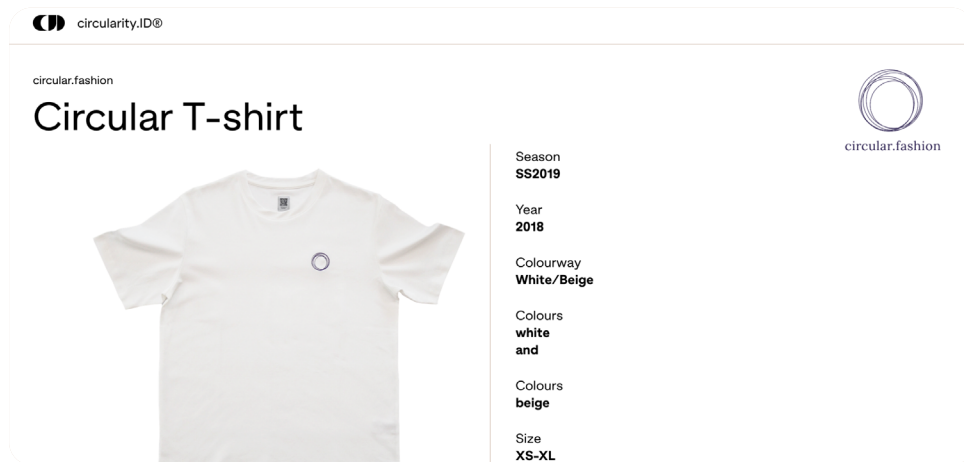
»The reverse supply chain for textiles is facing huge challenges which question the current business model of sorting companies. While quantities are rising every year, the quality decreases and global second-hand markets are saturated. We need much more accurate labeling of the product ingredients so that products can be used for high quality recycling. The circularity.ID® of circular.fashion is a very promising and holistic solution since it connects all relevant stakeholders and holds the crucial data to make a circular economy a reality. As part of their advisory board, we have collaborated closely in this development since the beginning and with my 20 years of working experience in the sorting industry I shared relevant insight to make sure the solution will be easily implementable in the current sorting businesses. I am very optimistic that this solution will become a great benefit for sorting businesses who want to take the chance of adapting their business model to capture the fast approaching market potential of the circular economy.«

Katrin Ley
Managing Director
Fashion for Good

»With our know-how of the complete value chain, from collecting plastic waste to creating innovative fabrics and textile products, we provide businesses a service to become more circular and sustainable. With the collaboration with circular.fashion we want to become part of a network in which we can close the loop and offer the opportunity to recycle the garments after life.«

Niccy Kol
Brand and Marketing Director
Waste2Wear®

Conclusion

Adopting circularity standards for product data holds benefits for all stakeholders along the fashion value chain. It helps material suppliers to identify recycling opportunities for their materials and connect textiles to a predetermined recycling stream from the very beginning and eventually buy back recycled fibres as raw material. Additionally, it guides material innovation towards optimisation for one or more recycling technologies.

For fashion brands, it eliminates the guesswork at the material selection and configuration phase, and ensures the garment is designed with the highest intent to be recyclable at the end of life. It enables accurate and efficient decision-making for sorting companies when sorting for optimised recycling and reuse streams.

For recyclers, optimising feedstock has the potential to leverage the commercial viability of recycled fibres through efficient systems and economies of scale. Consumers can be presented with vital product data to engage in sustainable practices and prolong the life of a garment. The circularity. ID Open Data Standard connects the stakeholders of the full product lifecycle, facilitating efficient data transfers, exchange and a common language of understanding. Open industry standards set an example for collaboration and streamlining of efforts to arrive at comprehensive models for a holistic, data-driven sustainability impact.

The circularity.ID®
Open Data Standard

The circularity.ID Open Data Standard allows fashion brands to publish their product data in a format that can be utilised by a variety of software applications along the product lifecycle. circularity.ID ODS is split into an XML component that contains immutable product data including material and chemical components, and a mutable set of data that contains product information such as product images, description, sustainability consumer information and service offers. The circularity.ID standard accompanying products will be launched in January 2020 including a Circular Material Library, Digital Product Sites and Full Cycle Service. For more information, see https://circularity.id

»When circular.fashion approached us 2015 with the opportunity to create a fully recyclable collection and integrate the circularity.ID® to power a reverse supply chain network for high quality recycling we jumped directly on board because it totally fit to our vision and brand DNA. Ina supported us to create a collection with different circular design approaches, mono- material design as well as design for disassembly including new material innovations like: one of the first recycled fibres from Re:newcell and a cradle-to- cradle certified material with a soluble textile screw to separate biodegradable fibres from recyclable fibres. Each product held an individual circularity.ID® with its own product website. We are proud that we joined this innovation so early on the journey and are amazed by the potential that the circularity.ID® holds for the industry creating full product transparency for a true circular economy. From our perspective the unique point regarding the circular.fashion offer is that they combine circular design expertise with both the relevant partnerships and technical innovations to empower the reverse supply chain for fibre recycling.«

Juliana Holtzheimer
Co-Founder
JAN 'N JUNE

»We are pleased to be a stable partner of circular.fashion. We are actually in a new fashion era. Sustainability, traceability, transparency and circular economy are the new imperatives for the fashion industry. For this reason, Canclini started a sustainable path. The essence of our sustainable journey is the extreme interest in traceable and certified raw materials, in order to create sustainable and circular textiles. Our commitment focuses on the supply chain too, by choosing to analyse and measure our environmental footprint and through the use of natural resources, in order to be more conscious of our needs and try to become less dependent on the demand of natural resources and materials. We are proud to be part of this sustainable fashion industry, giving our support to innovative organizations and projects that could nurture and prosper the actual circular fashion scenario. Thanks to the stable collaboration with circular.fashion, our Canclini Rigenerato Fabric obtained more visibility and interest, supporting an even more transparent fashion supply chain. The true transparency, interconnection and collaboration is what we are interested in, we are doing it with circular.fashion.«

Germana Fossati
Sustainability Manager
Canclini

»For us it's very valuable to be in a partnership with circular.fashion as we love to be connected to partners that not only understand the urgency of changing the textile industry, but are also willing to act and make efforts in order to bring about change. [...] Being able to reintroduce used materials back into the production stream, where new fabrics can then be developed, allows true circularity for WRSD products, something we are proud to be able to say! By including our brand as an example in circularity.ID database, designers and product developers not only have ease of accessibility to WRSD products, but they also have the ability to make better decisions in the design and development phase by choosing to act sustainably from the very beginning.«

Beatrice Fernqvist
Sustainable Product Specialist and Developer
We aRe SpinDye®

»We strive for fashion sustainability and circularity. So, there is no question about using the circularity.ID® to tag each of our pieces. Since day one, it has been a main component of our products. circularity.ID® is an outstanding example for hands-on innovation that helps us to collaborate, learn and produce sustainable quality products with proven cyclability. It makes it easy for our customers to see the story of each piece, learn and actively support the longevity and recycling of the garments. It is the key for driving transparency for us and for our customers."«

Vretena®

About circular.fashion

circular.fashion is a sustainable design agency creating product and system innovation for a circular economy in fashion and textiles. circular.fashion is developing services for circular design and closed- loop recycling. With the sleek traceability solution of the circularity.ID®, a transparent flow of information between material suppliers, fashion brands, consumers and recyclers is enabled. This allows them to collaboratively realise a circular economy for fashion and textiles. In addition, circular.fashion offers consultancy, training and hands- on support to encourage fashion brands to integrate circular design principles, strategies and circular materials into the core of their business, in order to optimise products for future recyclability.

circular.fashion was initially founded as 'Design for Circularity' by Ina Budde in Berlin 2012 with the mission to drive sustainable change in the fashion industry and support fashion brands in their transition towards a circular economy. In 2017, Mario Malzacher joined as co-founder and the company was rebranded to circular.fashion with further development of tech and software tools taking place. Today, the team consists of 11 people with interdisciplinary backgrounds in sustainable fashion design, circular business models, design thinking, process management, textile engineering and software development. As a social business, the team shares the vision of a circular future of fashion and aims to research, develop and spread solutions that accelerate the transition towards such a future.

circular.fashion is based in Berlin with global cooperation partners and clients.

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