EON™

The Connected Products Economy – Powering Fashion and Retail's Circular Future

How CircularID™ Connected Products will unlock new forms of value and create systems to power a circular economy.

Introduced by Eon and Members of the CircularID™ Initiative

EXECUTIVE SUMMARY

The Connected Products Economy Report puts forth a vision of a Connected Products Economy – one where the Internet of Things (IoT) connects the physical and digital worlds, unlocking value and catalyzing innovation at the intersection of people, products, and systems. To achieve this vision, the report presents an ambitious plan for how industry can embed circular economy principles in connected products – to power circular business models, global transparency and new economic incentives to change patterns of production and consumption.

The Connected Products Economy Report brings together perspectives from across the industry—including fashion and retail industry leaders and partners from circular businesses, technology, policy, and academia. Together, industry leaders address the challenges related to operationalizing and scaling circular business models (e.g. resale and rental) and material regeneration processes (e.g. disassembly, recycling). These challenges point to the clear and pressing need for connected products, where a product's digital profile is enriched with the data necessary to identify products and materials in a circular economy.

The Connected Products Economy Report outlines the need for extending digital identification of products beyond point-of-sale and adopting a shared language for connected products to aid communication across the value chain. To create a shared language for connected products, the CircularID™ Initiative develops and advances the CircularID™ Protocol—the global protocol for digital identification of products in a circular economy. This report provides an overview of the CircularID™ Protocol and outlines how Eon and the CircularID™ Initiative make these tools available to industry.

Presenting the challenges and economic opportunities, as well as practical revenue drivers and benefits for business, the opportunities for innovation and policy, and concrete actionable solutions under development, the Connected Products Economy Report introduces the roadmap for end-to-end digital transformation to develop a global fashion, apparel and retail system for the 21st Century.

Defining the Connected Products Economy

The Connected Products Economy is an economic model where all products are digitally identified and connected to the Internet of Things, enabling value chain stakeholders to access data essential for managing and maximizing product value in the circular economy—resulting in the creation of new systems that unlock transformative benefits to our society, economy and environment.

A Connected Products Economy is built on three principles:

- Power circular business models by selling services instead of products
- Unlock data essential for creating new systems for managing and maximizing value and recovery of products and materials
- Bring transparency and measurement to products and materials in circular economy and accountability to natural resource consumption

In our current linear model of take-make-waste, products are not digitally identified or connected to the Internet of Things—preventing the maximum value of products and materials from being managed, monetized and recaptured. Products in the linear model are lost. Without a way to capture value from products and materials, industry relies on ever increasing production and consumption of resources to sustain growth. In a Connected Products Economy, products are no longer lost. Products are identified and connected to systems—enabling industry to capitalize on the continuous use and reuse of products and materials.

ACKNOWLEDGEMENTS

CircularID™ Initiative Leadership

The CircularID™ Initiative is introduced by Eon, and brings together a group of fashion and retail industry leaders and partners from circular business, technology, policy and academia.

Chair

Members

Philanthropic Partner

Technology Members

Knowledge Contributors

System Members

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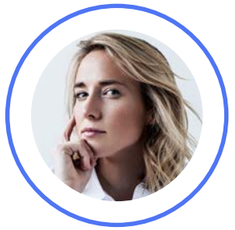
Disclaimer: A team from Eon produced this report in collaboration with Members of the CircularID™ Initiative. Eon takes full responsibility for the report's content and conclusions. While the contributors listed in the acknowledgements provided significant input for the development of this report, their participation does not necessarily equate to endorsement of the report's full content and conclusions.

PREFACE



Natasha Franck
CEO and Founder, Eon

Welcome to the Connected Products Economy, where the rise of the Internet of Things (IoT) will connect the physical and digital worlds, unlocking value and catalyzing innovation at the intersection of people, products and systems. A Connected Products Economy powers the scaled implementation of a circular economy, making it possible to maximize product and material value to the benefit of the customer, society, environment and economy.

In the past decade, the digital revolution has had a transformative impact on all aspects of our society. We have used technology to build intelligence and efficiencies into our linear model of take-make-waste. In the fashion industry alone, businesses produce, manage and track hundreds of billions of garments in their supply chains, offering customers minute-by-minute updates to track products from the moment they are purchased, until they arrive at their front doors. But once these products are sold and delivered, all intelligence comes to an end.

In the linear economy, products are lost. There is no system to identify these products beyond point-of-sale, making it is impossible to maximize product value and material recovery, which are essential for our transition to the circular economy.

> In a Connected Products Economy, it is possible to monetize product and material value across the circular lifecycle.

According to the Ellen MacArthur Foundation and the World Economic Forum, IoT is among the most powerful enabling technologies for circular economy.[1] For IoT to enable circular economy, circular economy principles must be embedded into connected products. This is the vision of a Connected Products Economy.

In a Connected Products Economy, all products are digitally identified and connected to the IoT beyond point-of-sale, making data available that is essential for managing and authenticating products across the circular lifecycle—through production, use, care, return, resale, repair and recycling. In a Connected Products Economy, it is possible to monetize product and material value across the circular lifecycle — customers buy experiences and services, and business success is defined not by the number of products sold, but the value of the service delivered.

In the next few years, there is projected to be massive investment into IoT across the fashion industry – with 70% of retailers investing in IoT.[2] The fashion industry demands reinvention. It is one of the world's most wasteful industries, responsible for 10% of our global carbon emissions today, and that could increase to over 25% by 2050.[3] The Connected Products Economy Report brings forth a vision for marrying the power of IoT with the circular economy to unlock the intelligence, incentives and transparency to make a sweeping global transformation toward a circular model.

IN SUPPORT

Mats Linder
Ellen MacArthur Foundation
"Connected assets with the principles of circular economy lead to new ways to create value."

Caroline Brown
Managing Director, Closed Loop Partners
"When products become intelligent, brands no longer lose sight, connectivity and relationship to the products they create or the customer who purchases them. The opportunities to generate revenue are no longer solely at the first point-of-purchase but rather available throughout an ongoing relationship of value delivered from the product to the customer."

Douwe Jan Joustra
Head of Circular Transformation, C&A Foundation
"In a Connected Products Economy, rather than a focus on one-off sales, products are transformed into assets to maintain and the retailer shifts from being a point of sale to a service provider. As service providers, brands can monetize the value of the product across the lifecycle – not just the moment it is sold."

Dr. Kevin Dooley
Professor of Supply Chain Management, W.P. Carey School of Business, Arizona State University
"Connected products can unlock usage data that could be combined with sales and social media data to improve demand forecasting for new clothes, helping optimize production quantities, inventory locations and sales forecasts."

Yorke E. Rhodes III
Principal Program Manager, Azure Blockchain Engineering, Microsoft Corporation
"Achieving circularity requires a combination of characteristics across several seemingly disconnected elements in a product's life. To achieve the valued outcomes desired of a circular economy, we must break down these characteristics into relevant foundational components that enable the building blocks of the technical stack."

Hannah Kamaie
Managing Director, C Space New York
"In connecting all the dots and gathering information at every stage, we move beyond the simplified, siloed notion of business intelligence into a realm altogether more holistic and impactful. In making the case for connectivity it is imperative to consider not only all the touchpoints in the product lifecycle but also all the active players – consumer, business stakeholders, circular economy partners, and the product itself. Business intelligence can only be fully enlightened when intimately tied to consumer intelligence, product intelligence and crucially, the interaction between all three."

"CircularID™ Connected Products can forge a new cog in the circular economy wheel by creating new solutions for managing textile waste in a manner that extends the life of textiles and significantly decreases the use of virgin materials in textile production. It is a disruptive and scalable innovation that could create more accelerated impactful solutions and change than the traditional and current options for managing used textiles."

Raymond Randall
Managing Principal,
Waste Management
Sustainability Services

Jill Standish
Senior Managing Director & Head of Global Retail, Accenture
"The shift to circular economy and responsible retail is a monumental one for fashion. While there is no silver bullet for getting from here to there, enablers are emerging that can accelerate circular progress. Digital identity is one of them and it could even be a game changer in the journey to circularity in fashion."

"As brands and retailers look to move to a circular economy, they will need to focus on preparing product data for a longer lifespan, beyond the point-of-sale and into circular economy. How that data is set up, maintained, and shared is critical for a company looking to make meaningful connections with consumers and earn their trust in the digital age. For global and circular supply chains to work, they must be nimble and rich with universally understandable end-to-end product and transaction data. Together, GS1 Standards and CircularID™ Protocol create a foundation for the connected and circular future of commerce."

Reid Jackson
Senior Director, Corporate Development, GS1 US

Annie Gullingsrud
Chief Strategy Officer, Eon
"Connecting digitally identified garments to a shared digital system through the IoT will allow them to speak to the value chain and to customers, letting us know what they are made of, where they've come from, who designed them, who has worn them and how to care for them. With a flourishing Connected Products Economy, we can bring circular business models to scale and fulfill the circular design intention of billions of products at a time."

Chris Grantham
Circular Economy , Executive Director, IDEO
"Digital identity for apparel will unlock a historic shift in the industry from the throughput-driven growth (in a linear model) to growth through new data-driven fashion services – these developments will shift attitudes from fashion as 'disposable' to more of an 'investment' mindset, a key step on our road to a circular future."

Jennifer Gilbert
Chief Marketing Officer, I:Collect, I:CO
"I:CO strongly supports the creation of a CircularID™ Connected Products. It will allow garments to speak to us for the first time and bring increased efficiency in directing them to their next best use, and provide the necessary data for sorting and managing every item. Simply put, CircularID™ Connected Products will provide priceless knowledge that will inspire action and the promise of future industry breakthroughs to create a thriving, powerfully beneficial and connected world."

Lindsay Clinton
Executive Vice President, NYCEDC Initiatives
New York City's 8.5 million residents produce 14 million tons of trash annually, of which 200,000 tons are clothing and textiles. NYCEDC's sustainability initiatives and the city's OneNYC strategic plan highlight the opportunity to transition to a circular economy and to achieve zero waste by 2030 and carbon neutrality by 2050. To achieve these goals, product and material identification is essential. Infrastructure, like CircularID™, is integral to material suppliers, factories, and brands in a path to become circular. This game-changing technology is precisely the tool needed to enable cities and businesses at scale to become circular.

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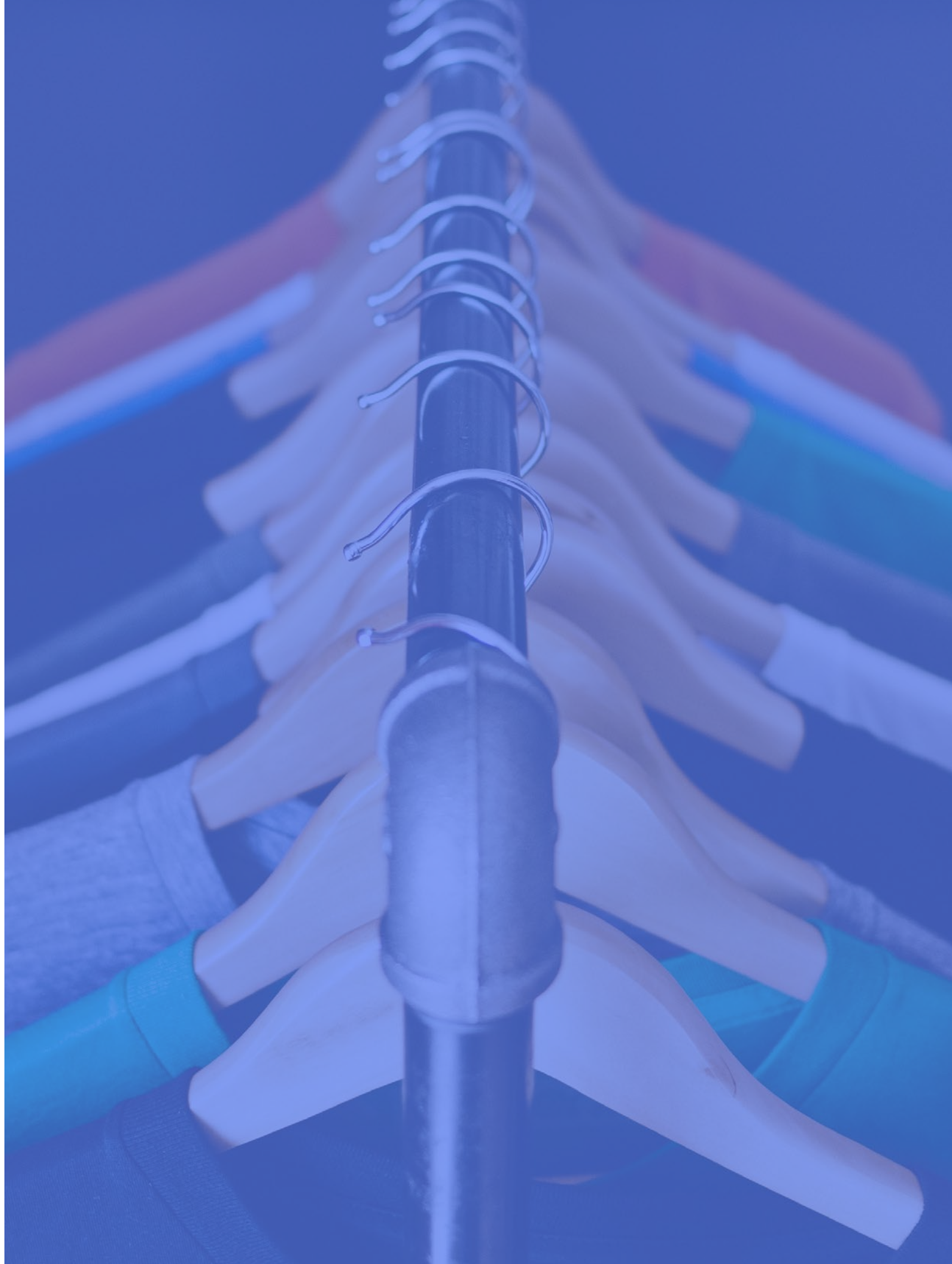


FOREWORD

Caroline Brown
Managing Director, Closed Loop Partners

Every once in a while, we witness the transformation of a major industry. Driven by the development of smart technologies and changing attitudes, these moments present a meaningful opportunity for brands and consumers alike. Today, the fashion industry faces such an opportunity as it rethinks the linear model and looks to a more efficient, sustainable and circular model for the future.

Let's imagine the economic benefits of a model which, instead of disposing raw materials, allows for their recapture. A model that promotes an ongoing dialogue with customers, keeps them close to the brand and creates an opportunity to not only sell but also rent, repair and resell again. Such a circular model would deliver the positive economic value of material reused, rather than the cost associated with materials lost. It would allow for greater margins on the resale of a product that does not require a new production cost. All of these are meaningful financial metrics and inherent in circular business models alongside environmental and societal benefits.

This model, enabled by visibility, aligns with the growing consumer demand for transparency. Intelligent products, embedded with smart technologies that carry knowledge and digital capacity to create a connected system, unlock the valuable economic incentives resulting from increased transparency and power our capacity for such a transition. When products become intelligent, brands no longer lose sight, connectivity and relationship to the products they create or the customer who purchases them. The opportunities to generate revenue are no longer solely at the first point-of-purchase but rather available throughout an ongoing relationship of value delivered from the product to the customer. Every day there is a new brand or retailer launching a resale, repair, rental, or recycling program, demonstrating the value of establishing an ongoing relationship between the customer and brand through products. As these programs become increasingly common, products need to become intelligent by adding a new digital layer that will underpin and transform this ongoing relationship between the brand, product and customer.

> **Let's imagine the economic benefits of a model which, instead of disposing raw materials, allows for their recapture.**

Brands that miss out on building circular models will also miss the opportunity to capitalize on their benefits. The current linear model simply requires growth by selling more – more production and more consumption, no matter the cost, is the measure of success. But in the future with intelligent products, the brand that is able to create one jacket, and sell that one jacket three times through recapture of its product, materials and customer relationships will undoubtedly win.

INTRODUCTION

What is IoT and why does it hold such promise and potential for powering our transition to a circular economy?

First, let's define circular economy

Each year, billions of clothing items are produced. At the same time, over 11,000 tons of textile waste is landfilled each year in the United States alone. This "take-make-waste" approach characterized by poor lifecycle management continues to deplete the world's natural resources, produce waste and greenhouse gas emissions and limit innovation in business.

In contrast, the circular economy is defined by its ability to separate resource consumption from economic growth, which becomes possible when extending a product's lifecycle. It introduces an economic model based on the continuous reuse of materials and designs waste out of the system. A model essential to creating a future that is viable for our ecosystems, environment and economy. But, to ensure the global transition to a circular economy, we must first address several important factors: operational complexity, new financial incentives, new business models, policy and legislation that is enabled by—and in turn enables—transparency, measurement, and accountability.

> **Without identification of products, materials and their resources, it is impossible to manage them intelligently across the lifecycle and keep them at their highest and best use.**

Why IoT and circular economy?

Circular business models and material regeneration processes of today are often unsuccessful because key stakeholders are forced to retroactively identify products and materials. So, for resellers, it takes lengthy periods of time to identity products for resale. For recyclers, sorting and identifying materials and components is a manual process and often impossible. For rental businesses and peer-to-peer platforms, complex reverse logistics and high-friction customer experiences prove inefficient and prevent ease of use.

Without identification of products, materials and their resources, it is impossible to manage them intelligently across their lifecycles and keep them at their highest and best use. Circular economy business models require products to be systematically identified. Similarly, material regeneration processes require detailed understanding of a product's material components to separate, process and regenerate.

The retroactive identification and management of products and materials not only prevents the intelligence essential for operationalizing the circular economy – it also fails to solve the lack of incentives and transparency essential for fundamental systems change across business, consumer behavior and policy.

It requires an intelligent product system where products, materials and resources can be continuously identified, managed, monetized and accounted for across the entire product lifecycle.

Powering a circular system

By connecting products to IoT, we give them a digital identity – a unique web location complete with information about that product.

A product's digital profile must include data and information essential for not only identifying the product, but also understanding its use, brand, commercial value and materials. Complete with all the essential information, digital identity allows for a product to move through circular business models and material regeneration processes.

Circular design intent vs. circular product

A product that is designed to be a circular product can only be circular when it can maintain its maximum and intended circular materials and design set forth by its designer. Once a product leaves the hands of a brand or retailer and is into the hands of a customer, or a second-hand or third-hand customer, or into the hands of a material recycler, there is no automated way to identify and ensure the circular product's intention for circulation or material regeneration has been met. It simply joins into a stream with the billions of other fashion apparel items, with no succinct and efficient identification. Resellers are hard-pressed to resell at highest cost; material regenerators are hard-pressed to identify the materials to understand if they are a good match for the system. In our current system, intent does not ensure circularity.

A shared language for connected products in circular economy

For a product and its materials to be able to flow effectively in the system, the products and materials must be easily identifiable. By today's standards, fashion and apparel products are being identified through a tag attached to the garment. That tag carries an iota of the amount of product and material level data that is essential for circular economy stakeholders to pass the product through the system. With the billions of fashion apparel items being produced every year, from a wide range of fashion brands and retailers, speed and efficiency of identification is essential (because manually reading a small-print tag takes time).

To ensure effective communication across internal and external stakeholders who are processing garments for a circular economy, it is equally essential that we "speak the same language" – product and material-level information must be communicated in a consistent way, otherwise we continue to be stuck in a linear, non-communicative, non-collaborative system where it is difficult and often impossible to access information and data about products essential for a circular economy.

What will be the most essential product and material-level information about a product for product circulators and material recyclers? How will we efficiently identify and authenticate products for resale, repair and reuse? How will we support the reverse logistics of business model innovation, like rental and sharing? How will we measure the circular economy, and create new policy and economic incentives? The CircularID™ Protocol has been designed to do just that.

> **By marrying digital identity with products that are designed for circularity, through a connected system of active participants that can identify product, it's possible to move beyond designing intent toward a scaled circular system where products and materials can be efficiently identified to find the best match of reuse or regeneration in the system.**

CircularID™ Initiative

The global collaboration to establish a shared language for connected products in circular economy

The CircularID™ Initiative presents an ambitious plan for industry to advance systems-change for circular economy through connected products. By embedding data essential for the circular economy in connected products, brands can power new circular business models, transparency across the entire product lifecycle, and unlock new business incentives to the benefit of our economy, ecosystem and environment.

To learn more about CircularID™ Protocol, visit page 66

Who is involved?

The CircularID™ Initiative, introduced by Eon, brings together a group of fashion and retail industry leaders and partners from circular businesses, technology, policy, and academia.

What the initiative does

The CircularID™ Initiative advances the role of connected products in circular economy, enabling brands and retailers to shift to circular economy business models. To enable connected products to communicate in the circular economy, the CircularID™ Initiative champions adoption of the CircularID™ Protocol, the shared open industry-wide protocol for digital identification of products in the circular economy.

CircularID™ Protocol explained

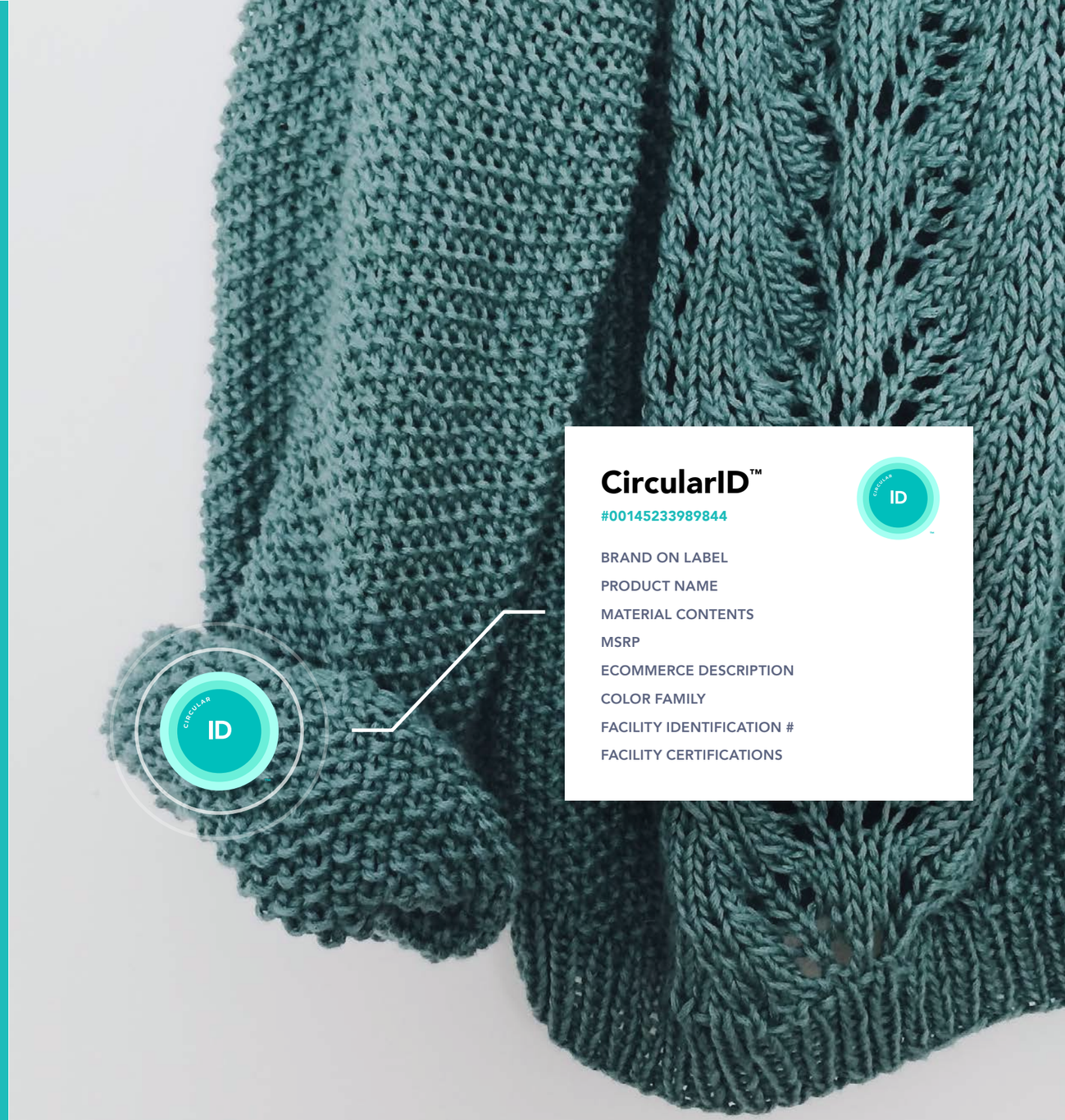
CircularID™ is the global protocol for digital identification of products in the circular economy. CircularID™ establishes the essential product and material data critical for identification and management of products in the circular economy, known in CircularID™ as Product ID and Material ID. CircularID™ Protocol introduces a consistent format of these data fields so brands can exchange and access data across the lifecycle and have visibility and connectivity with products after point-of-sale.

How to create CircularID™ Connected Products

When a product is digitized in alignment with the CircularID™ Protocol, we call it a CircularID™ Connected Product.

The CircularID™ Protocol Pilot Version launches in January 2020. Throughout 2020, Eon will be implementing the CircularID™ Protocol Pilot Version with CircularID™ Initiative members and leaders in the apparel industry to launch the first CircularID™ Connected Products.

In January 2021, the CircularID™ Protocol Version 1.0 will launch to industry.



THE BUSINESS IMPERATIVE FOR DIGITAL IDENTIFICATION

Making the invisible, visible, how digital identity supports circular fashion across the value chain

Jill Standish
Senior Managing Director & Head of Global Retail, Accenture

Behind its famed catwalks, iconic magazine covers and chic styles, the fashion industry has a big problem. Fashion as it operates today is unsustainable, and urgent transformation across the value chain is needed. Could digital identity be the secret to unlocking circularity, delighting customers and uncovering insights across the entire fashion industry?

Waste: a growing problem in fashion

Consumers are buying more clothing and keeping it for shorter periods of time. So it's not a surprise that fashion is one of the world's most wasteful industries, responsible for 10% of our global carbon emissions today,[4] and that could increase to over 25% by 2050.[5] Amid the fast-fashion boom, garment production has doubled in the last fifteen years.[6] Each year, the industry produces 150 billion garments, and 2.5 billion pounds of used clothing ends up in landfills.[7]

With its linear production models, the fashion industry creates a massive resource strain. From toxic chemicals in fabric dyes to water-intensive production and finishing processes to microplastics, fashion is having an irrefutable negative impact on the environment. There is also a toll on human resources. The push for margins and speed to market has led to exploitative labor practices and unjust supply chains. These are existential issues that put the fashion industry's license to operate at risk – and consumers have taken notice.

A more mindful consumer

More and more, consumers are drawn to sustainable fashion brands with environmentally and ethically sound practices. In the United States, sustainable product sales have grown by 20% in the last five years, and the market for sustainable goods is expected to grow to $150 billion by 2021.[8] Around 66% of global consumers - and even higher for millennials at 73% - would pay more for a sustainable brand.[9] This emphasis on sustainability is evolving consumption models as fashionistas put purpose before products.

To meet these consumer demands, both fashion incumbents and new entrants have doubled down on innovation. They have developed new business models, introduced radically transparent brands and scaled end-of-use solutions. And governmental policies are supporting these changes.

Tomorrow's fashion leaders must go further, fundamentally redesigning their businesses to a responsible retail model. This is going beyond traditional metrics like year-over-year sales to design the enterprise around responsible initiatives that create value for the planet, the business, the workforce and the consumer.

By decoupling growth from the use of finite resources, the circular economy could unlock $4.5 trillion of new value.[10]

Push to circularity

The use of circular economy practices is a key part of responsible retail. There is a clear opportunity for the fashion industry to replace linear "take-make-waste" models with more resource-efficient and consumer-centric ones. Already, 12% of fashion brands have committed to circularity by signing the Global Fashion Agenda 2020 Commitment.[11]

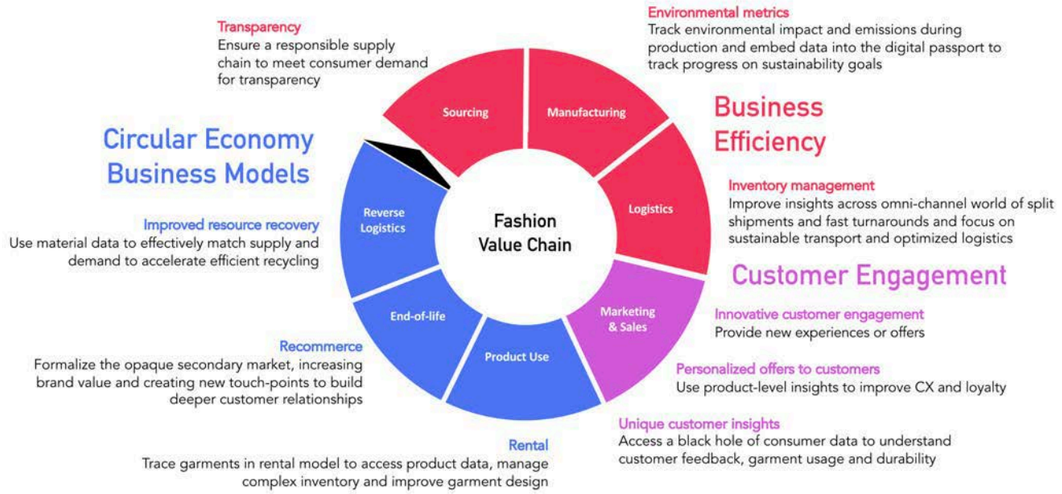
As promising as circularity is for the environment, consumers, business and for society as a whole fashion is struggling to harness its potential. The industry has yet to develop solutions at scale to manage a garment throughout its lifecycle with transparency on sourcing, authenticity, materials, product use beyond point-of-sale and end-of-use solutions. The lack of take-back infrastructure, recycling technology and market development are also barriers to progress. As such, despite good intentions and some initial circular transformation, less than 1% of clothing is recycled back into garments today.[12]

Reflaunt helps fashion brands capture the secondary market by tracking garments after purchase and allowing their customers to resell purchases right from the brand's website.[18]

Changing the game with digital identity

There is no denying that the shift to circular economy and responsible retail is a monumental one for fashion. While there is no silver bullet for getting from here to there, enablers are emerging that can accelerate circular progress. Digital identity is one of them and it could even be a game changer in the journey to circularity in fashion.

Digital Identification Supports Circular Practices Across Fashion Value Chain



Digital identity creates a digital twin for a real-life-garment by using technology, such as RFID, to pair the physical and virtual worlds. With digital identity, every garment has a "virtual birth certificate" and "virtual passport" along with a physical identifier.[13] This creates a breakthrough opportunity for the industry to share granular, product-level data across the value chain and to create new product data and insights that have never been available before. And with the costs of digital technologies decreasing rapidly, the economics of digital identity are becoming increasingly attractive.

Put simply, digital identity makes the invisible, visible. It can help fashion move past longstanding barriers, such as traceability and material identification, and shift to a more sustainable, circular system. While the opportunities are massive, there are three areas where the use of digital identity is especially promising: circular economy business models, customer engagement and business efficiency.

Linear to circular business models

1. Fuelling disruptive circular economy business models

Accenture analysis has identified five circular business models that can help companies optimize resource use while creating new business advantages.[14] Digital identity is a powerful enabler of three of these models in fashion.

First, take rental, a product-as-a-service alternative to "buy and own" models. With $500 billion of value lost annually due to clothing underutilization,[15] there is a strong business case for rental. Traditional players like Banana

Republic, Ann, Inc. American Eagle Outfitters, and Urban Outfitters have recently joined pioneer Rent the Runway[16] in the global online clothing rental market set to grow at 11% CAGR through 2023.[17] The reality is that rental fashion is a complex logistical business model that requires strong inventory management capabilities to fulfil orders and deep knowledge of garment durability to enhance profitability. Digital identity can help brands manage this complexity by providing unprecedented, garment-level insights.

There is also a role for digital identity in recommerce, which extends the lifespan of garments through repair, upgrade and resale. Over the past three years, the global recommerce market has grown just over 20 times faster than the retail market.[19] There is a lot of innovation in this second-hand market today. Even so, it remains difficult for brands to fully capture resale value – in both financial returns and customer engagement. Digital identity can transform this dynamic with new visibility for brands. The more that brands understand product use and customer behaviour after purchase, the more effective they are at reselling their products.

Finally, consider the role of digital identity in improved resource recovery, a business model that is difficult in fashion due to complex design limitations from blended materials and poor recycling technologies. Digital identity can clearly track material composition, and in doing so, enable cost-effective reuse and recycling at scale. This improves the transparency of the process and makes for better collection, sorting, reuse and recycling of garments at end of use. It also fuels circular supply and return chains by incorporating used fabrics back into new products.

> “Digital identity can remove the data blind spots that plague fashion brands.

Delighting and engaging customers

2. Unleashing ingenious new ways to engage customers

New consumer values and purchasing behaviors are reshaping fashion. And in a landscape crowded with competitors and choices, it is more important than ever for brands to create meaningful relationships that seed customer loyalty.

While feedback fuels these relationships, fashion brands are at a disadvantage here. In fashion, there is a black hole of data beyond the point of sale. Brands have little to no visibility into customers’ use of garments after purchase or what they think about wear and durability. Digital identity can change this by telling “the rest of the story.” How does a raincoat perform in a spring with record rainfall? Or how long is the useful lifespan of a pair of jeans for teens? Where do trousers wear out fastest? Such insights can inform future design and material composition selection or repair services. They also create fresh customer engagement touchpoints – such as garment care guidance, styling tips or return options – that can ultimately encourage brand loyalty and repeat purchasing.

Personalization is essential to meaningful customer relationships – and a key currency of competitive advantage. Case in point: retailers that continuously adapt to the evolving customer needs and market conditions at speed and scale are almost 2.5 times more likely to achieve above-average profit growth.[20] Using digital identity, fashion brands can scale an entirely new level of personalization. Imagine the possibilities if consumers could scan a garment tag with their smartphones for reviews, ratings, tips on styling or even get relevant offers for future purchases.

Beyond this, the industry can use digital identity to curate transformative personalized experiences that extend well past purchasing the garment. In this way, the garment is just the starting point of immersive brand experiences that are finely-tuned to customers’ specific likes and lifestyles. For example, a garment’s digital identifier could unlock access to exclusive content and retail gifts, loyalty rewards or special events. This is a whole new kind of customer engagement.

> “Using digital identity, fashion brands can scale an entirely new level of personalization.

From data to business insights

3. Creating visibility to improve business efficiency and insights

Efficiency and insights are essential to how fashion brands run their businesses in today’s complex world of omnichannel retail, split shipments, hassle-free returns and same-day delivery. Yet many fashion brands are limited by data opacity.

Digital identity can remove the data blind spots that plague fashion brands. Inventory management is a prime example. With digitally-tagged garments, brands can improve supply chain visibility, increasing receiving accuracy and reducing out-of-stock levels. In fact, RFID is already going mainstream for this use. Not only have most retailers (69%) adopted RFID, those that have done so fully have achieved 9.2% ROI.[21] In addition to inventory accuracy, digital identity enables and enhances omnichannel fulfillment, by streamlining order fulfillment from warehouses, stores, drop-ship vendors and ecosystem partners.

The business can also use digital identity for real-time insights to track environmental metrics, which is critical to achieving broader sustainability goals. Many fashion brands face increasing scrutiny to demonstrate progress against commitments to improve their environmental footprints and advance the United Nations 2030 Sustainable Development Goals. As a virtual birth certificate and passport, digital identity can store and track data on a garment’s chemical composition, as well as the water use and carbon dioxide emissions associated with its production. Tailored dashboards – which can be accessed internally, or in the right cases, by consumers as well – can make it easy to monitor key metrics across the value chain.

Transparency is not just essential for business intelligence. Consumers demand it too. The need for transparency is especially acute in fashion in light of growing scrutiny around fair labor and supply chain practices. In fact,

Accenture helped create a circular supply chain app that empowers consumers to reward the sustainable practices of small-scale growers and suppliers. Using blockchain, digital identity and payments technologies, the app closes the gap between suppliers and consumers with end-to-end transparency.[22]

78% of consumers say it is important for a company to be transparent.[23] The good news is that digital identity is a boon for transparency. It creates a digital link to the factory or farm from the first to the last mile. Having an open record of a product’s provenance and journey encourages fashion brands to build and draw insights from a powerful knowledge capability and communicate it consistently to consumers. This is the essence of transparency.

> 78% OF CONSUMERS SAY IT IS IMPORTANT FOR A COMPANY TO BE TRANSPARENT.

Start changing the game

Existing and emerging fashion brands have many opportunities to leverage digital identity to drive circular, customer and business benefits. The technology continues to mature every day, and its applications continue to impress. But a word of caution. While digital identity is a game changer for fashion and a driver of its evolution to responsible retail technology, it is a means to an end. Results come from how people use the technology. The informed decisions they make. The bold actions they take. The purpose underlying their objectives.

This is why achieving outcomes with digital identity in fashion will require strong leadership commitment and thoughtful adoption at scale. Leaders who start small and scale fast, by launching pilots and quickly refining and pursuing the most promising use cases across the business, will have the advantage. They are the ones who will change the game in fashion. A more sustainable future awaits.

CIRCULARITY MEETS CONNECTIVITY

Creating value by embedding connected assets with circular economy principles

Mats Linder
Consultant, Ellen MacArthur Foundation

The circular economy is designed to benefit businesses, society and the environment. It presents unique opportunities to transform the way products and materials are designed in ways that tackle waste, pollution, resource scarcity, and biodiversity loss. In contrast to the "take, make, waste" linear model, a circular economy gradually decouples growth from the consumption of finite resources. Underpinned by a transition to renewable energy, the circular economy is built on three principles: design out waste and pollution; keep products and materials in use; and regenerate natural systems.

Circular Economy Principles

Numerous studies have shown that employing these principles can unlock value to businesses and societies worth trillions of dollars, while leading to positive impacts on human health and the environment.[24]

While the rationale for a transition to a circular economy is strong, putting it into practice is a challenging task. Keeping products in high value use, maintaining and repairing them, and making sure they are retrieved afterwards to be refurbished or recycled all require far more oversight and control of the flows of assets and materials.

The Ellen MacArthur Foundation identified early the potential of digitisation and IoT to be used to service an environmentally positive function – to enable the circular economy. Exploring how to harness the transformative potential of billions of connected devices to build a regenerative, resilient economy was the main driver for writing the *Intelligent Assets* report.[25]

> **Applying IoT solutions to garments is much-needed to help address waste generation that's driven by fast seasonal turnover and falling clothing utility rates.**

The report found that such technological innovation can play a major role in bringing the circular economy vision to life, going beyond realising incremental efficiency gains. It outlined the many ways in which combining knowledge of the location, condition, and availability of connected assets with the principles of the circular economy lead to new ways to create value.

Since the publication of the report, more and more industry leaders are gearing up to become circular, reinforced by changing consumer trends and supportive regulations. Indeed, numerous examples show that IoT systems are already being employed to enable circularity. Intelligent assets are enabling distributed energy systems, particularly in developing markets, and are supporting the wider use of performance contracts and predictive maintenance in buildings.

Implementing these solutions in fashion will be instrumental to creating a circular economy for fashion – one in which our clothes are used more, are made from safe and renewable materials, and are made to be remade when we are finished wearing them. Our Make Fashion Circular initiative is working with businesses and organisations in the fashion industry to create unstoppable momentum towards this vision, laid out in our *New Textiles Economy report*.[26]

The CircularID™ Initiative is therefore timely. It opens the door to circular business models, provides greater transparency, enables new pricing approaches, and gives a high degree of certainty about what circular materials are, where they have been, and what they can be used for next time.

Applying IoT solutions to garments is much-needed to help address waste generation that's driven by fast seasonal turnover and falling clothing utility rates. These technological innovations will be of great use to businesses wanting to rethink how we make clothes, as well as how they are sold and worn.

Fundamental business model transformation, calling for brave individuals

Douwe Jan Joustra
Head of Circular Transformation, C&A Foundation

For many executives and policymakers, circular business models have become the default response to balancing corporate social responsibility with business growth. Indeed, the circular economy offers a compelling perspective that gains a lot of public and media attention.

And yet, the action on the ground does not go far enough. Often, initiatives like collection and recycling strategies take a shallow approach and fail to explore a deeper interpretation of the circular economy as a total transformation of business models. This contributes to the debate about whether the circular economy is the 'new sustainability greenwashing'.

At C&A Foundation, we believe the fashion industry can be a force for good and we believe the circular economy can be a critical enabler. But only if there are bolder steps towards disruptive business models.

The circular economy: a new economic model

To create systems-change, companies must be bolder, more disruptive and invest in the radical innovation needed for an economy that operates within planetary boundaries.

In a circular economy, we can reverse the one-way flow of materials and protect the value of all manufacturing inputs – leading the shift away from wealth generation (based on 'take-make-waste') towards smarter product design, more efficient production processes and new business models.

This means, similarly to natural ecosystems, that the embedded value of a manufactured product is optimal and there is no loss of resources.

> "As service providers, brands can monetise the value of the product across the lifecycle – not just the moment it is sold.

Shifting toward service-based business models

The shift in ownership from the end-user to the service provider is fundamental to fostering a transition to a circular economy. The shift means that consumers are no longer 'owners' but 'users' of a product, with companies taking on the role of 'owner' by being responsible for its embedded value.

Rather than a focus on sales, products are transformed into assets to be maintained, and the retailer shifts from being the point-of-sale to being a service provider. As service providers, brands can monetise the value of the product across the lifecycle – not just the moment it is sold. The potential for ongoing revenue streams from products fundamentally changes the incentive structure, driving investment toward higher quality, longer lasting products and materials or towards new logistics models that ensure the product can be reused, repaired or materials that can be quickly recaptured. In a service-based business model, the product becomes an asset; the result is product longevity and value-add.

Transforming business with digital intelligence

Transparency through standardized, accessible, information is key. In a circular economy, assets need to be intelligent, that is to say they need to carry with them the information, history and data needed to turn fashion into a service.

Service-based business models can be delivered through vertically integrated supply chains or multiple supply chain partnerships. To operationalise service models and manage the complex process of reverse logistics, which includes identification and management of products, detailed information is necessary. In this case, companies not only require the information but also an efficient way to access it.

This is where the CircularID™ Initiative is leading the way. The initiative's pioneering and early efforts to create a product identification protocol are crucial to enabling a circular economy transformation for the fashion sector.

Raise the ambition level

The fashion industry is in the early stages of experimentation with circular business models. What is needed now, however, is to create systems change by embedding circular business models that will reverse one-way material flow while promoting social equity and protecting natural resources. Efforts need to be connected and collaborative. Industry-leading collaborations like Fashion for Good and the CircularID™ Initiative are creating the platform for exchange of knowledge, experience, and scaling of innovation and solutions.

> "The CircularID™ Initiative's pioneering and early efforts to create a product identification protocol are crucial to enabling a circular economy transformation for the fashion sector.

Transformation impact is often championed by brave individuals

It is not enough to design the solutions for our connected and circular future – implementation and wide-scale adoption by industry and business is essential for impact. I encourage all of us to raise the level of impact – and start implementing change. Entrepreneurial spirit is needed, often based on initiatives by brave individuals!

A designer's perspective: how connectivity turns circular design intentions into circular products

Billions of apparel products are produced every year. To ensure circular design intention is carried through the value chain, we must create a digital system and infrastructure that can support the management and efficient processing of each of these unique garments.

Annie Gullingsrud

Chief Strategy Officer, Eon

Annie is the Chief Strategy Officer at Eon and has spent her career helping businesses and non-profits advance toward circular fashion—an effort she believes brings balance back to the planet. She has worked as sustainability director, strategist, educator, consultant and designer, for companies and NGOs such as the Cradle to Cradle Products Innovation Institute, Gap Inc., Pratibha Syntex, California College of the Arts. She worked with global brands H&M, G-Star, Eileen Fisher, Stella McCartney, Gap Inc., Marks & Spencer and Mara Hoffman as the Executive Director of Cradle to Cradle's Fashion Positive, an initiative driving innovative circular materials for fashion. In addition, Annie serves on the Board of Directors of Goodwill San Francisco area and is an advisor to Pangaia. Annie is the author of the book, Fashion Fibers: Designing for Sustainability, released in early 2017 by Bloomsbury New York.

As a designer, I am invigorated by the opportunity to change the system with design and experimentation in order to ensure that a garment and its materials can effectively re-enter the system, and not be sent to landfill. From 2014 I started to support fashion designers and brands in the development of Cradle to Cradle Certified products and materials –one of the most rigorous and holistic environmental product certifications. We created beautiful materials and products that I am proud of, all certified at the highest level of Cradle to Cradle Certified.

There's a rich story behind every material; from the sheep that provided the wool, to the mills that produced the fabric, and the team that stewarded their evolution. We put in years of effort, investment, support and passion to ensure that these materials would do no harm and would help the planet flourish.

Through my practice, I began to wonder what would happen to these garments and materials after they were sold and then hopefully resold to customers – how would their story continue to be told after it was in the customer's hands? I began to worry that the embedded quality and embodied energy, not to mention all the time, effort, cost and good intentions that went into creating the garment, would disappear after it was in the customer's hands. If I couldn't tell that story – who would?

> **The solution is leveraging the power of IoT for good purpose — connecting digitally identified garments to a shared digital system, allowing them to "speak" to the circular value chain and to customers.**

Moving beyond intention and into practice

I had my first tour through Goodwill in 2010 and many eye-opening visits to various collection/sorting/resell companies since. I watched as the employees sorted with quick, swift hands for quality and the brand labels that would demand the highest price point.

It was only after I joined the Board of Goodwill San Francisco and began working with Goodwill International, that I was enlightened to the fact that circular design intention was just that – intention. Brands and designers were designing for disassembly, recyclability and biodegradability, but never once did I see anyone disassembling, sorting, separating out for biodegradation, or receiving the rich story of the inception of the products and materials of these garments.

Despite all the effort designers and brands put into redesigning these products for recapture, they were simply lost in the system, unable to be identified or set aside to ensure these products went where they were intended to go. We are in the same position we had always been in – left with products and materials we couldn't identify, sometimes without a tag, unable to tell the story of their inception. Design intention turned unintentional waste of resources.

I began to see similar challenges with recyclers and innovative start-up chemical recyclers after launching the industry's first working group in 2015 dedicated to researching and piloting chemical recycling technologies for post-consumer textile waste. Forming close relationships with global chemical recycler start-ups who were developing technologies to allow for a more flexible system of recycling back to virgin quality, we learned they faced similar obstacles as collectors, sorters and resellers. For them, too, it is difficult to sufficiently and efficiently identify the incoming materials. This would be essential to scale their technologies. The garment's tag, if present at all, often did not provide the information needed to distinguish if the garment itself was a good match for their technology.

In 2014, over 100 billion garments were produced with the expectation that this number will continue to increase each year.[27] Billions of fashion apparel items are being produced every year, from a wide range of fashion brands and retailers, and flow into a stream together at end of use—a combination of multiple brands, years of production, seasons, colors, styles, fibers, etc. How can we create a system and infrastructure that can manage the diversion and efficient processing of billions of apparel garments at a time?

The solution is leveraging the power of IoT for good purpose – connecting digitally identified garments to a shared digital system, allowing them to "speak" to the circular value chain and to customers, letting us know what they are made of, where they've come from, who designed them, who has worn them and how to care for them. With a flourishing Connected Products Economy, we can bring circular business models to scale and sufficiently fulfill the circular design intention of billions of products at a time.

THE DIGITAL FOUNDATION FOR A CIRCULAR ECONOMY

The foundation for responsive enterprise—powering a fully functioning digital ecosystem

Yuan Ma
Director of Engineering, Eon

Luke Connolly
Director of Product, Eon

A set of standard, interoperable data formats is the final requirement to support modern business models, derive maximum value from the products we create, and foster economically and environmentally-sustainable growth.

Our world is being transformed by physical products connected via the internet. Across the globe, 5G and other wireless networks are being deployed to support an increasing number of connected phones, vehicles, digital assistants, computers, tablets, household appliances and other devices. The reach and performance of these networks, alongside decreasing costs for the components that connect to them, is compounding this rapid growth.

Major fashion and apparel brands have taken steps to modernize their supply chains to capitalize on the efficiency and visibility provided by modern networks. Unfortunately, product data is stored in proprietary systems and identified by removable tags, which are discarded by customers after point-of-sale. This prevents products from connecting to the marketplaces, retailers, and partners that handle and process them, especially after purchase. Product data is inaccessible to these partners or lost altogether due to lack of on-product identification methods. In order to capitalize on the opportunities provided by modern connectivity, product data must be accessible via the physical product for the duration of its lifecycle in a standardized, interoperable format.

For brands, connected products open the way for testing and operationalizing new business models such as subscription, rental, and second-market offerings. Connected products also offer brands a channel to connect with customers, providing messaging and transparency directly through the products they sell. Customers will benefit from increased transparency, authenticity verification, and modern functionality such as smart mirrors, digital wardrobes, and more. Perhaps most importantly, embedded product data will allow resellers and refurbishers to efficiently keep products in circulation, and will provide materials details that are critical for recyclers to recapture raw materials when the item can no longer be used.

Our networks can support this wide-scale product digitization, and the cost of product identifiers is steadily declining. A set of standard, interoperable data formats is the final requirement to support modern business models, derive maximum value from the products we create, and foster economically and environmentally-sustainable growth. Eon's vision is to facilitate collaboration between industry participants to create a fully-functioning digital ecosystem that will allow for seamless data exchange so critical to the efficient management of our products and raw materials.

> **Interoperability between IoT systems is critical. Of the total potential economic value the IoT enables, interoperability is required for 40 percent on average and for nearly 60 percent in some settings.**
>
> McKinsey Global Institute, The Internet of Things: Mapping the Value Behind the Hype

The importance of standards

Reid Jackson
Senior Director, Corporate Development, GS1 US

As brands and retailers look to move to a circular economy, they will need to focus on preparing product data for a longer lifespan, beyond the point of sale and into the circular economy. How that data is set up, maintained, and shared is critical for a company looking to make meaningful connections with consumers and earn their trust in the digital age. For global and circular supply chains to work, they must be nimble and rich with universally understandable end-to-end product and transaction data. It's time to supplement supply chain business processes to handle these new demands and realize the benefits of providing consumers with rich data as their preferences and attitude rapidly evolve. The common solution is an interoperable, standardized data-exchange infrastructure.

The GS1 System of Standards, the most widely used supply chain standards in the world, provides a common language to identify, capture and share data. This is important to ensure information is accessible, accurate and easy to understand.

As a neutral, not-for-profit organization GS1 has facilitated a common language of data that powers our global supply chain. Beginning in 1973, GS1 led the development and adoption of the humble barcode – the first digital identification of products. As industry looks to transition to a circular economy and intelligently manage products and materials across the lifecycle, it will require an extension of GS1 Standards to ensure items, locations, and entities are identified during every step of the way.

> For global and circular supply chains to work, they must be nimble and rich with universally understandable end-to-end product and transaction data.

By leveraging the GS1 Standards, the CircularID™ Protocol is extending the intelligence of our current supply chain – bringing data and information essential for sustainable lifecycle management into the circular economy.

GS1 Standards solve the most fundamental challenges related to managing products in a circular economy. Let's take product identification. GS1 has built a standard for product identification– the Global Trade Item Number (GTIN) – making it possible for every product in the supply chain to have a globally unique identification number. By extending the GTIN beyond the traditionally linear supply chain, we can also extend the overall life of a product.

A new standard, GS1 Digital Link, takes unique identification a step further by making it possible for every product to have a unique digital profile. Through GS1 Digital Link, any product can be automatically connected to the internet and represented in a clear, accurate, consistent format that promotes brand, retailer, and consumer interaction. It also makes it possible to create an address similar to a URL (Uniform Resource Locator) for a product. When combined with a data carrier – QR codes, RFID, or Bluetooth tag – the GS1 Digital Link protocol enables a company and/or customer to connect directly to the product and access the product's unique digital profile.

While standards like GS1 Digital Link help streamline the delivery of the product information, the actual collection of product information and proof of its existence is greatly assisted by distributed ledger technologies, including blockchain. Coupling GS1 Digital Link with blockchain in a decentralized approach, the data recorded can travel faster without human intervention. Now, a company can prove the origins of a cotton t-shirt labeled as organic cotton, and leverage the trail of information that was recorded on a blockchain in their online product descriptions. A standards-based framework supports blockchain's success by providing uniformity and structure to the data transmitted. Standards also create the systems interoperability that is fundamental to the blockchain ecosystem.

As CircularID™ Connected Products advance to record interactions across the product's lifecycle, in other words its passport function, GS1 Standards Electronic Product Code Information Services (EPCIS) will inform this next frontier. EPCIS can help a company record granular information about a product's transformation and journey from its source to the consumer with validity. EPCIS has already been embedded into some blockchain applications and has been successfully leveraged in the pharmaceutical industry to authenticate product and help reduce the amount of counterfeit drugs in circulation.

Together, GS1 Standards and CircularID™ Protocol create a foundation for the connected and the circular future of commerce. A network of connected transactions keeps the flow of information moving between trading partners, from the point of a product's origin to the consumer's doorstep—and beyond that point into the secondary marketplace and finally to the point of material reclamation through recycling. Standards provide a foundation upon which all those transactions and events can be communicated. They are both behind-the-scenes and a part of our everyday lives. Now is the time to take advantage of the global opportunity to align on a common platform for future innovation and growth.

> Together, GS1 Standards and CircularID™ Protocol create a foundation for the connected and the circular future of commerce.

Digital identity meets blockchain

Yorke E. Rhodes III
Co-founder Blockchain @Microsoft, Microsoft Corporation

Achieving circularity requires a combination of characteristics across several seemingly disconnected elements in a product's life. In fact, these elements are systemically linked in a circular economy. Opening the opportunity for a circular economy requires unique identification of the goods, ensuring those goods are authentic, and tracking the custody and condition of those goods as they move through their usable life and into reclamation, reuse and recycling. In its most idyllic realization, the custodians and other actors touching the goods are identified uniquely, creating new opportunities to validate participants in the circular ecosystem, and enabling new business models in the circular economy.

To achieve the valued outcomes desired of a circular economy, we must break down these characteristics into relevant foundational components that enable the building blocks of the technical stack. This is where digital identity meets blockchain and AI. We won't address AI here as it is simply a beneficiary of new data that it can take advantage of to perform predictive analysis about supply chain and product lifecycle concerns.

Let's break down how digital identity and blockchain are intertwined and can help to achieve a product's interoperability within the circular economy.

A unique identifier that works across an ecosystem to track goods requires a system that works equally well for products, people and institutions. Importantly, it must transcend enterprise boundaries and function throughout the entire value chain of a global ecosystem. And in order to achieve the appropriate level of openness that ensures interoperability, a set of standards must be established, adopted and consistently followed.

Fortunately, new technical standards support this goal while complying with existing data format standards for goods tracking systems such as electronic data interchange (EDI) formats and GS1 product identifiers that are already in use. These systems must operate across institutional boundaries in a global ecosystem, and logically speaking no single party should control or own the identifiers used to monitor the history of the product or goods. Fortunately, we have systems now that allow us to establish self-owned identities which can be authorized by various parties regardless of who created the original product identifier.

A utility for hosting such identifiers must be based on a set of standards such that the identities can work across the disparate enterprise systems and be easily understood and interpreted by consumers and their applications. It must work up and down the value chain of the goods supporting large enterprise retailers, brands, recyclers and source-material smallholder farmers.

Such a system could be implemented on a private utility or a public utility. In the private case, that could mean a private blockchain with various stakeholders in a supply chain. The public case could involve something like Libra, the new initiative led by Facebook that promotes a controlled public chain with 30-100 participating (and validating) institutions. In its most publicly distributed form, a utility like this is possible using public blockchain systems like Ethereum or Bitcoin. Fortunately, a few years of self-owned identity work are well under way with the World Wide Web Consortium (W3C) recently publishing a draft specification in this area.[29]

Blockchain has been proven to be the foundation for creating globally unique identifiers in a distributed fashion. Parties are not required to coordinate with each other to create root keys in a blockchain. Each root key can represent a unique identity, and even value, for a good, just as it holds other data about its owner and current condition. Each of these identifiers can represent goods at all levels in a global supply chain; individual items, parcels, pallets, and the institutions and participants touching those goods. This enables the possibility to establish a circular economy driving value by uniquely identifying the goods in a global value chain.

A blockchain-based identifier can bring together many systems. The definition of the data fields associated with these identifiers is determined by a flexible framework with a minimum set of required fields that can also support GS1, EDI, or X12 standards. The ability to find these identifiers using metadata, regardless of the registering entity or system they are stored in, has come to be known as a resolver, similar to Domain Name System (DNS), a global standard for finding websites based on a name, for example Microsoft.com. The standards have been established across a number of technical bodies including the Decentralized Identity Foundation (DIF), Verifiable Claims Working Group (VCWG), and others in the W3C.

Blockchain is just one type of data carrier for registering unique identifiers associated with goods, institutions and participants in a value chain. While there are multiple systems that could comply with the standards, blockchain has a number of differentiating factors that enhance its value proposition as an identity registrant and data carrier. First, the potential to have fully controlled identifiers associated with the goods, people or institutions helps to avoid the "your data, my data" problem that is rampant today. Second, an item's data is self-defining. This means it contains a set of data about its own state, condition and custody as it moves across a value chain transcending institutional boundaries. Third, is the possibility of the identifier to also carry an item's value, and history of transactions as it changes hands.

> **Systems must operate across institutional boundaries in a global ecosystem, and logically speaking no single party should control or own the identifiers used to monitor the history of the product or goods.**

After several years of building siloed systems that end at the boundary of institutions, we haven't been able to effectively solve the global challenges associated with tracking goods in a complex supply chain; from source materials to recycling and through its entire journey and effective life. While EDI was designed to address this problem, it is so highly complex and costly to implement that it is widely regarded as a failure beyond its data formats.

Blockchain is a perfect match for solving these problems as it holds the keys for members of civil society to establish circularity across global ecosystems that solve global challenges in our massively inefficient supply chains. Importantly, it does this while avoiding single institutional ownership, and therefore questions about the veracity of data.

A retail executive's perspective: maintaining competitive advantage requires the digital foundation for adaptive and responsive business operations

Hannah Kamaie

Managing Director, C Space

Hannah leads C Space New York, a management consultancy which helps businesses achieve sustained growth by solving challenges through the lens of the customer. Prior to this role she led two successful careers, first as an international M&A attorney in Europe and Asia, and then as a global fashion retail executive, leading companies across the fashion spectrum from the fast fashion giant Zara, to a high-growth apparel start-up. In addition, she is a non-profit board member, advisor to early stage tech companies and mentor to participants in several global accelerator programs.

Let's consider what the smartest, most successful businesses have in common. Is it operational prowess or a clear brand purpose? Perhaps it's an integrated supply chain or a deeply engaged consumer base?

The paths to success are many and varied, but a consistent thread that unites successful modern businesses is the ability to effectively access and utilize data. Better data means better business intelligence and better business intelligence means better strategic decision making. Enhancing this process is the case for connectivity.

In the apparel sector, some companies have made great headway into collecting product data to help grow their business and remain relevant. The application of radio-frequency identification (RFID) is a prime example of how precise inventory visibility and data has unlocked a range of benefits from distribution center to shop floor. This technology has improved allocation and accuracy, has reduced shrinkage, simplified daily retail operations, increased revenue, facilitated omnichannel offerings and armed teams with an incredible customer support tool.

However, these benefits capture just a fraction of the entire value chain, leaving huge chunks of data, and therefore opportunity, unused. Not only are the data trigger points limited, the type of data is siloed, introspective and constrained by the four walls of the business. Consider then a future in which we can connect all the dots throughout the entire lifecycle of a product, from materials provenance to end of product life. A world where products no longer move inertly through the supply chain triggering isolated points of data capture, rather they enter into an integrated space where products interact with systems and their consumers to provide much richer 360-view of data. Suddenly the notion of business intelligence looks extremely different and helps to facilitate and inspire innovation across industries.

Complete visibility and traceability of connected products within the supply chain not only supports genuine Corporate Social Responsibility (CSR) initiatives but allows for a flexible and responsive distribution model. Thanks to real-time data which shows demand in any given market, products can be shipped directly to where they need to go in the quantity required, eliminating the need for intermediary holding centers. By more accurately matching supply with demand, inventory excess is reduced, margin is improved and revenue inevitably increases.

Furthermore, a deeper understanding of how products live in the world post-sale, their durability and lifespan, and even the way they are worn and paired with other items will help to drive product innovation and in turn sustainable manufacturing, commercially viable line extensions and merchandising strategies. Connected products unleash an opportunity to interact with the wearer after their sale through seamless and personalized marketing strategies, leading to higher loan-to-value (LTV) ratio, stronger brand loyalty and opportunities to preempt consumer product needs and capture increased revenue. Connected products also diversify revenue streams by facilitating opportunities in peer-to-peer lending, long term rentals and clothing as a service. The result is a reduction in risk to businesses, meeting consumer demand and greater end-of-use opportunities.

In connecting all the dots and gathering information at every stage, we move beyond the simplified, siloed notion of business intelligence into a realm altogether more holistic and impactful. In making the case for connectivity it is imperative to consider not only all the touchpoints in the product lifecycle but also all the active players – consumers, business stakeholders, circular economy partners, and the product itself. Business intelligence can only be fully enlightened when intimately tied to consumer intelligence, product intelligence and crucially, the interaction between all three.

PRIVACY, SECURITY, & ETHICS

Trust and privacy in a connected world

Miguel Sciancalepore
Corporate Counsel, Microsoft Corporation

Technology has been an engine of change in our world. With every new technology comes new challenges and opportunities. With the rise of the IoT, connectivity is moving into the physical world bringing new opportunities to leverage these tools to improve our society, environment and industry. Ubiquitous connectivity also invites many new challenges, complexities, and concerns: How do we bring trust to the way technology is designed and used? And how do we ensure privacy and security?

We must build technologies that customers and society can trust. The ability to establish a trust relationship with customers and society requires protecting users' privacy and establishing on-going trust to maintain that relationship.

Privacy by design

To enable compliance in technology development, privacy must be by design. Privacy by design means proactively incorporating privacy by default into the design and operation of the technology. IoT technology should be built incorporating security, privacy and control, transparency and compliance throughout the whole engineering process.[28]

IoT challenges to be addressed related to privacy and trust

As IoT is at the intersection of the physical and the digital, IoT requires trust not only in the device, but also the network of devices, and the platform under which they will operate.[29] Translating these goals into concrete steps should also allow some flexibility to avoid impairing IoT functionality.

- **Security:** Companies must implement reasonable and appropriate measures to protect data.
- **Transparency:** Companies should make consumers aware of what the device is for, what data it collected and how it can and cannot be used.
- **Privacy and Control:** Companies will need to determine who owns the data and provide the necessary tools to control both the privacy and administrative aspects of data. Trusted devices need to be configurable for users and be visible with a clear explanation of implications.
- **Visibility and Discoverability:** Companies have a responsibility to make users aware if a technology is invisible.

What Data and Why

What type of data is being collected and for what purpose is crucial to determine the application of certain regulations. For example, "product data" which includes any information that identifies a product (color, size, material content) is distinct from "personal data" which includes any information relating to an identified or identifiable individual.

As physical products become connected to the IoT, this brings new challenges as the intersection of product data and personal data.[30] How do we protect consumer privacy, and ensure customer's identity is not improperly linked? With connected products, the type of data collected, and the purpose of the data is crucial. When introducing connected products, companies should explain the benefits of the new technology to consumers and ask what data is being associated with a consumer and why. If the data is only material content and the purpose of data is to enable recycling of a product, this will bring trust and value for many customers.

What is Personal Data?

Personal data is very broadly defined in modern regulations. For example, under the General Data Protection Regulations (GDPR),[31] personal data is defined as any data that relates to an identified or identifiable natural person. Thus, it is not just the personal data that you normally think about such as name and social security number; it is also online identifiers, sales data, biometrics and voice, as well as any data that can be linked together or combined to identify a person.

When it comes to personal data, companies should limit collection and obtain it by lawful and fair means and, if applicable, with the knowledge or consent of the data subject. It is wise to identify the purposes for which personal data is collected and its use should be limited to that purpose, or such others as are not incompatible. Personal data should not be disclosed, or used for purposes other than those specified, and it should be protected by reasonable security safeguards.[32]

"We must build technologies that customers and society can trust. The ability to establish a trust relationship with customers and society requires protecting users' privacy and establishing ongoing trust to maintain that relationship.

Compliance with key privacy regulations

Regulations have different requirements depending on if you are a controller or a processor of personal data. The GDPR contains many requirements about how companies collect, store, and use personal information. How you detect and report personal data breaches, and how you train personnel. The GDPR gives individuals rights, including the right to correct errors to their personal data and the right to erasure.

The GDPR includes detailed rules on what an organization must tell individuals about its data processing. This includes: information about why the personal data is being processed, how long the data will be stored, with whom the personal data will be shared, and whether the personal data will be transferred outside the European Economic Area. This information must be presented clearly and be easily accessible.[33]

In the United States, the Federal Trade Commission pursues privacy cases to protect consumers and regulations at state level are gaining momentum.[11] For example, the California Consumer Privacy Act (CCPA) provides privacy rights to California consumers. Businesses regulated by the CCPA will have a number of obligations to those consumers, including disclosures, GDPR-like consumer data subject rights, an "opt-out" for certain data transfers, and an "opt-in" requirement for minors. The law contains transparency/disclosure obligations and consumer rights to access, delete, and receive a copy of data.

Conclusion

We have a massive opportunity and responsibility to leverage technology to the benefit of our environment, ecosystem and society. As we look to leverage IoT in designing a circular economy, we should work to design this technology involving adequate security, privacy, control, transparency, and compliance. Also, even great technologies can have unintended consequences, so it is important to design technology with ethical principles.[34] Consumers will only use technology that they can trust; applying privacy, security and ethical principles when designing technology is good business and the right thing to do.

Disclaimer: This chapter is a commentary on privacy laws and the GDPR, as interpreted, as of the date of this document. The application of privacy regulations and the GDPR is highly fact-specific, and not all aspects and interpretations are well-settled. As a result, this information is provided for informational purposes only and should not be relied upon as legal advice or to determine how privacy laws or GDPR might apply to you and your organization. We encourage you to work with a legally qualified professional to discuss how privacy laws and GDPR apply specifically to your organization, and how best to ensure compliance. MICROSOFT MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, AS TO THE INFORMATION IN THIS DOCUMENT. This information is provided "as-is." Information and views expressed may change without notice.

DELIVERING CUSTOMER VALUE

Digital identity empowers the customer

Chris Grantham
Executive Director, Circular Economy, IDEO

A pivotal moment for the fashion industry

Through our work on design and implementation of circular economy ventures in fashion, we have identified areas of missing infrastructure that are key to scaling the circular economy in apparel – this missing piece is digital identity.

Digital identity is the cornerstone for circular business models

For example, it supports systems capable of better aligning supply and demand to reduce unsold stock and waste in the supply chain, circular packaging and logistics systems, and a digital wardrobe experience enabled by digital ID for apparel.

Digital identity: the cornerstone for circular fashion

Digital identity for apparel will have a significant ability to drive a more sustainable fashion industry by enabling the shift from its dependency on a "take -make-waste" model for revenue, to an industry that provides fashion consumers and service providers with more value in terms of style, lifestyle, resources management, and ultimately earns from apparel data and services. This goes hand-in-hand with the digital wardrobe; a place where users, their apparel, and fashion services can interact online.

Digital identity and the digital wardrobe will encourage more circular behaviors in people and the fashion industry. These include:

- Releasing the value of garments and allowing for their place in resale marketplaces
- Visibility of outfits that combine the new with the old
- Identifying damage and connecting with a network of local repairers willing to bid for that job
- More easily swapping and exchanging garments in peer-to-peer (P2P) networks
- More tailored fashion services based on consumer insights and data about what they own and how they use it, and then offering more circular ways to access fashion (such as rental)
- Integration into circular logistics and packaging platforms.

How might we rapidly prove the value of digital identity today, while creating the conditions for a more circular tomorrow?

The CircularID™ Initiative is ambitiously pursuing a common standard for the digital identity of apparel. In order to scale digital identity globally, the next stage will involve building the right infrastructure in order to connect products. This requires investment incentives as well as the communication of operational benefits to businesses and value for early adopter apparel users.

Data on apparel usage, based on service providers blending digital identity with contextual information about the user and usage occasion, is a tantalizing prospect for fashion and market insight providers who don't typically collect much data once the items leave the store.

During the spring and summer of 2019, IDEO CoLab conducted multiple design sprints with a variety of potential users and industry experts to understand the critical use cases that could drive adoption of the digital identity and the digital wardrobe it supports. The team's conversations with big fashion companies reaffirmed that usage data would offer them operational benefits. For example, they could measure claims around durability and other aspects of product performance, helping to make more informed design or procurement decisions. Usage data combined with information on what is trending could also help reduce unsold inventory by offering a better understanding of trend lifecycles by geography.

Apparel usage data will provide the basis for more tailored shopping/outfit planning services, effectively incentivizing customers to share their data. By choosing to submit their wardrobe and apparel usage data – overlaid with personal data collected via a personal data account – users can have more personalized shopping and planning experiences. This would include recommendations of new items to match with unworn garments, and options of renting, swapping or buying reconditioned items with a relatively high cost per wear. They could also opt to repair a loved item no longer in use, or decide to release funds to buy something new by re-selling an old item.

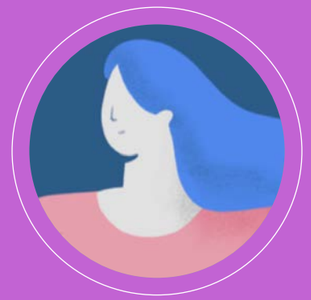
These are what we refer to as fashion fitness services that address a variety of pain points by offering alternative benefits for people. The result? Consumers can stay fashionable, maximise resources, and do so in a guilt-free way. There is a huge opportunity to implement and scale digital infrastructure by driving this two-sided marketplace for fashion fitness services, with digital ID and usage data at its heart. It's exciting to imagine how this kind of system would create new intrinsic value in the apparel itself post-sale, as it serves as a new dynamic channel for marketing, R&D, and even new customer acquisition. Digital identity for apparel will unlock a historic shift in the industry from throughput-driven growth (in a linear model) to growth through new data-driven fashion services. Usage feedback loops will also enable providers to target circular services and reduce waste inventory by developing more resourceful operations. In the world of the apparel user, these developments will shift attitudes from fashion as 'disposable' to more of an 'investment' mindset, a key step on our road to a circular fashion future.

Future fashion users

MEET OMAR

Omar Howard, upcycler and re-designer, 43 years old

Omar works as an upcycler and clothing re-designer. He is a master of visible repair and re-design and uses digital identity to create new garments from old by identifying compatible materials.



MEET CARRIE

Carrie Wilson, fashion nomad, 35 years old

Carrie loves fashion. Known for her unique style, she's always on the front foot when it comes to what's trending. But Carrie doesn't own any of her clothes. As a member of Wanderobe, she can preview and access the latest fashion picks currently available in her extended, shared and part digital wardrobe at purpose-built hubs around New York.

MEET SAKKY

Sakky Kotto, changer/reseller, 23 years old

As a 'changer' Sakky spends a lot of her time buying and selling clothes. She believes that the life of a garment never really comes to an end, but rather people's tastes change. She sees herself less as the reseller of clothing and more as the thread between people and their next great outfit. Digital identity helps her assess a garments value and authenticity.

Potential user exploring IDEO's Aray prototype. Aray is a multi-sided digital wardrobe platform that provides fashion usage data to enhance business planning and the targeting of resale, rental and shopping services specifically aimed at increasing the utilization of apparel.

Capturing value and insights from customer utilization data with digital identification

Dr. Kevin Dooley
The Sustainability Consortium and Arizona State University, Project WearEver

We understand much about the environmental and social impacts associated with the production of clothing, and we know that most garments end up in a landfill after their first life.[35] We know precious little, however, about what happens to clothing during its actual use. While some studies have used traditional market research methods to estimate how often a garment is used, laundered, or how long it is owned,[36] these studies are costly to execute on an on-going basis.

This is changing; the broad availability and lowering cost of digital technology will enable new systems to be developed that will efficiently track clothing utilization and next-life. These systems have the potential to create significant value for consumers, retailers and clothing manufacturers.

There are three main drivers behind the increased interest in tracking clothing use, and thus measuring clothing utilization. First, investment in IoT is increasing and expected to be $1.2T globally by 2022.[37] Continued IoT investments will improve quality and functionality and will reduce the cost of IoT products and services, making the business case for their adoption more attractive.

> **There is already broad adoption of digital tracking technologies within the clothing supply chain and the business case from an inventory management perspective is well-developed. Extending inventory tracking to use and end-of-life is the logical next step.**

Second, there is already broad adoption of digital tracking technologies within the clothing supply chain and the business case from an inventory management perspective is well-developed.[38] Extending inventory tracking to use and end-of-life is the logical next step. A persistent digital identity can enable transparency across the value chain.

Third, IoT provides a means by which retailers and brands can have continued conversations with the consumer post-sale, something that is difficult to do now, as well as richer consumer-to-consumer interactions. Tomorrow's peer-to-peer engagement involves cell phones and social media interacting with IoT. Digital garments also will allow us to measure their use and gain insight from it.

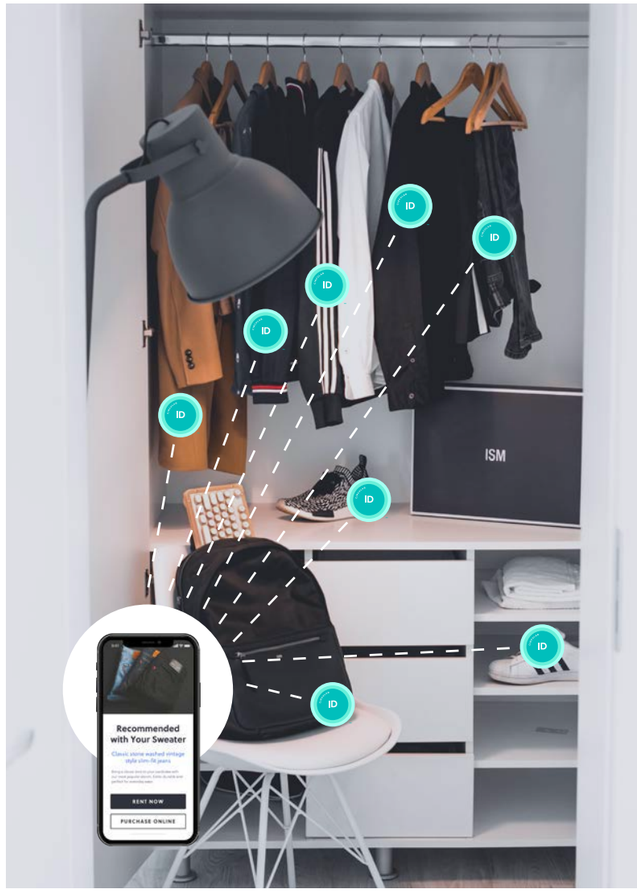
But what business value can be created through measuring clothing usage? Accurately measuring clothing longevity and a garment's physical integrity during use will allow us to understand how garment design, production and use attributes impact garment longevity, and enable valid and believable benchmarking and product claims concerning garment durability and longevity. We will be able to analyze garment usage patterns (including laundering) and measure garment-to-garment and wardrobe-level patterns.

These analytics will allow brands to improve garment design and customize communications with consumers via the observed use patterns. For example, use of a garment may prompt marketing messages about other garments that the brand sells or when a garment is observed to be dormant for a long time, a message regarding its resale or donation could be sent. Such a system can inform the consumer on correct garment laundering and maintenance, and eventually detect whether the garment is being laundered correctly. Usage data could be combined with sales and social media data to improve demand forecasting for new clothes, helping optimize production quantities, inventory locations and sales forecasts.

Project WearEver was initiated by The Sustainability Consortium, in collaboration with the Ellen MacArthur Foundation, to demonstrate how digital technologies can measure clothing use. We are collaborating with many of the retailers, brands and technology providers that are driving progress around this opportunity. Our goal is to be a champion of these efforts through demonstration of the use case, and to help industry develop common measurement guidance and standards so that different brands and technology solutions can share valid and comparable data to their downstream retailers and consumers.

In summary, Project WearEver will help lead industry solutions where:

- Consumers and retailers get valid information that helps them choose clothing brands that are more durable. Some customers will find data about their own usage patterns valuable.
- Retailers and brands get information on how their clothing products are being used, allowing them to understand the elements that drive clothes to be used more often, for longer and then re-used.
- Brands can rely on a trustworthy and efficient way to benchmark their product use quality against others and make public claims. They also get empirical data on longevity that helps them validate and create better clothing design criteria.



Unlocking the data and insights to reduce waste and power circular business models

Peter Akbar
Global VP and Chief Customer Officer Fashion, SAP

The past 15 years have been marked by an unrelenting and disruptive consumer revolution. Retailers have launched initiatives to meet consumer demands for convenience, price, and a seamless, rewarding shopping experience.

Through all these evolving preferences, sustainability is surfacing as a key priority for consumers. In fact, they seem to be demanding sustainable products: Business of Fashion's State of Fashion Report 2020 showed online searches for "sustainable fashion" tripled between 2016 and 2019.[39]

The task to keep up with changing demands is only going to get more challenging. As more commerce moves online and the smartphone solidifies its role as the primary purchase platform, retailers will need to understand consumers better and evolve their strategies further to give them what they want. Retailers will need to use emerging technologies to squeeze more insights out of the data they have – that's a given. They'll also have to come up with new, creative ways to enable customer feedback to drive everything from sales to product designs. More insights help fashion brands design more strategically, which can lead to less waste.

> As retailers forge closer ties with consumers, they'll develop an ability to create more personalized, immersive experiences.

Some of these new age customer experience initiatives are gaining traction today. A good example is how technology-savvy brands are using technology to gather instant feedback on the looks displayed in major fashion shows. The Runway by SAP app removes the post-show scramble for feedback, giving consumers a new level of control, enabling them to interact with a new collection as they see it on the runway in real time. Powered by the Internet of Things, beacon technology and machine learning algorithms, the smart technology recognizes the apparel looks as models take them down the runway. Users can "like" or "love" certain looks, access detailed information, add and subtract items from a wish list, take photos and preorder specific items – transferring data directly to sales teams and designers. These insights help designers prioritize the styles that perform well and avoid overproducing those that don't – ultimately reducing waste that could have been generated by manufacturing unpopular designs.

Other experience management projects are emerging as we speak. A broad-based plan by Eon and the CircularID™ Initiative sketches out a vision for a "Connected Products Economy" for the fashion industry. The ambitious plan creates mechanisms to operationalize and scale circular business models (i.e., resale, rental) and material regeneration processes (i.e., disassembly, recycling). At its heart is an effort to enrich products with identifying information that can, among other things, drive important advances in customer experience.

Giving fashion products a digital identity throughout their lifecycle gives the fashion industry a critical tool for developing new products that consumers will prefer to buy. Traditionally, retailers and designers collected troves of information about products right up through the point-of-sale. But once the product was sold off the shelves or shipped to a consumer, the information flow stopped. Unless a consumer responded to a survey or complained about a jacket's zipper malfunctioning, insights fell into a black hole.

Now consumers and retailers will be privy to a whole new world of data. Smart technologies enabled by digital identities will track wear and tear, fading of colors, general functionality and performance in hot or cold environments. Sensors and connectors can provide valuable pointers for designers in the future, letting them know which styles retain popularity and which functions need altering. Digital identity capabilities also create the potential for new communication touchpoints, allowing consumers to access detailed, updated product information or garment care tips.

As retailers forge closer ties with consumers, they'll develop an ability to create more personalized, immersive experiences. Picture a future scenario where a runner has integrated sensors in his shoes continually streaming use and fitness data. The runner and manufacturer will share continuous, automated updates on the product's use and degradation, along with the owner's running patterns. When a shoe nears its end of life, an automated notification pings the consumer. The runner clicks their smartphone, places an order and gets a personalized set of shoes shipped to their door. That's because marketing intelligence already knows the individual consumer needs based on product use, customer profile, peer groups, trends, and social media inputs using machine learning.

One thing's for certain: Retailers will continue to face challenges meeting consumer demands. But emerging technologies are giving retailers more tools to use to both understand consumers better and provide the experiences they're looking for – all while reducing waste and following a circular economy model.

CIRCULARID™ IN PRACTICE

Jennifer Gilbert
Chief Marketing Officer, I:Collect (I:CO®)

Powering collection, sorting and recycling with CircularID™

I:CO, short for I:Collect, is a leading expert specializing in global solutions for the collection, sorting, reuse, and recycling of unwanted apparel, footwear and other textiles. We are committed to combating the growing challenge of textile waste worldwide and empowering the future of circular fashion.

Through our consulting and other service offerings, we help fashion brands and retailers embrace product end-of-use responsibility and make it convenient and rewarding for their customers to give unwanted clothing and shoes a new life. With our innovative retail take back system and infrastructure in more than 60 countries, we aim to keep our partners' customer collected goods in a continuous closed-loop production cycle where they can be reprocessed and reused again and again, enabling and accelerating a circular economy for the textile and fashion industry.

A key for I:CO in achieving this currently is through the critical effort of processing each item by hand in up to 400 categories in our sorting partner plants to determine its next best use. Wearable items are reused and find new homes as second-hand goods. Unwearable items are recycled into raw materials for new products. Together with our fashion brand partners, I:CO has successfully realized the first post-consumer closed loop projects within the denim sector, and has been able to create new footwear soles from recycled rubber. Our closets are the raw textile material banks of the future. I:CO taps into this and helps enable the transition towards a more circular fashion industry that reutilizes resources, increases consumer engagement, and captures economic value.

There are links in the circular fashion system that are starting to work – more brands and retailers are using recycled materials as well as collecting products at the end of their use. But there are great challenges and missing links in the industry that need to be addressed to fully close the loop at a local and global industry-wide scale.

One such challenge is the technological innovation progress in product and material recognition and sorting.

> **Billions of pounds of clothing, shoes and other textiles end up in landfills or incineration each year around the globe, and the volume is rising dramatically.**

Currently, sorters rely on manually touching each item and looking at the label to determine whether it is re-wearable, reusable or recyclable which is time consuming and thus an expensive process. They have limited insight on the specifications of a product. All the information may not be on the item's printed label, it may be inaccurate or the label may no longer be attached. With increasing collection volumes to be processed and the necessity to know the correct fiber content to successfully break down unwearable products, we need better scalable recognition technology to move goods through the system faster with more efficiency and clarity, resulting in consistent supply flow and a product of highest value.

Another key challenge regarding textile-to-textile recycling is the issue that most garments produced today are a blend of natural fiber such as cotton and synthetic fiber like polyester and elastane. These mixed fiber fabrics are difficult to mechanically recycle. Therefore, it is necessary to further chemical recycling innovations. Some promising solutions exist at various development stages and have the potential to disrupt the material economy, however, they also need defined material input which again stresses the necessity of automated material recognition processes and more time is needed to see if they can be fully scaled.

> **The CircularID™ Protocol parameters will provide necessary specifications for every individual item, validating its true content and aiding the sorting process by quickly recognizing the product category and material content of collected textiles.**

We are confident that these technological advances will be commercialized in the coming years. This will increase the demand for well-defined post-consumer textile waste as feedstock. In order to align the textile recycling industry to help achieve circularity locally and globally, it will be important for the technologies to be affordable, accessible, easy to install and use at sorting and recycling facilities of all sizes around the world.

As a Knowledge Partner with the CircularID™ Initiative, I:CO strongly supports the creation of a digital CircularID™ system. It will allow garments to speak to us for the first time and bring increased efficiency in directing them to their next best use.

The CircularID™ Protocol parameters will provide necessary specifications for every individual item, validating its true content and aiding the sorting process by quickly recognizing the product category and material content of collected textiles. CircularID™ will help speed up the handling and allow for higher garment utilization and more accurately targeted inputs for reuse, mechanical and chemical textile-to-textile recycling. This will lead to increased profitability as more products will be accessed and directed correctly, allowing for the flow of increased volumes and output to handle the future demand of recycled fibers.

The data feedback from a CircularID™ Protocol will help I:CO gain deeper insight into our collected goods and further strategic partnerships inside and outside our network of partners. The increased intelligence could aid in preparing product that obtains higher profit and cross-industry collaborations that could create innovative new business models.

The Standard will allow for more transparency and efficiency to transform our partners' fashion supply chains for a digital future and extend their vision to include product end of use and beyond. It will bring together processes, data and people and help us further unlock the value of textile waste. Simply put, CircularID™ Connected Products will provide priceless knowledge that will inspire action and the promise of future industry breakthroughs to create a thriving, powerfully beneficial connected world.

Nicole Bassett
Co-founder, The Renewal Workshop

Powering resale and repair with CircularID™

The Renewal Workshop is the leading provider of circular solutions for apparel and textile brands. We are helping brands reduce their negative environmental impacts and expand their businesses by adopting circular practices. We offer apparel and textile renewal, sales channel management for renewed products, circular mapping, data collection and textile recycling R&D.

Our proprietary renewal system takes discarded apparel and textiles and turns them into renewed products, upcycling materials or feedstock for recycling. We track data on everything that flows through the system offering comprehensive insights never before available on product's lifetime value and impact. The Renewal Workshop operates a zero-waste circular system that recovers value out of what has already been created as a way of serving customers, partners and the planet.

> **We track data on everything that flows through the system offering comprehensive insights never before available on product's lifetime value and impact.**

The renewal system is the proprietary process we developed to bridge gaps, connect systems, and mobilize leadership to transform the existing linear manufacturing practice into a circular one. At its heart, it is a collaborative process that relies on progressive brand partners committed to sustainability.

Brands and retailers lack systems to maximize the full value of a product over its whole lifetime. This means the creative, physical, natural and financial resources that have been invested in products are lost when value still exists. This leads to massive waste problems with negative environmental impacts and significant financial losses.

The renewal system maximizes the lifetime value of every product created. It takes apparel and textiles and turns them into renewed products, upcycling materials or recycled fiber.

> **By controlling access to their products and other data via CircularID™ Connected Products, brands will be able to control the resale of their own items.**

The necessity in product identification and product data for the renewal system:

- The Renewal Workshop has been serving apparel and textile brands for the past three years. Over this time, we have seen first-hand the challenges that brands face to take products designed in a linear business model and get them ready for circular next phases like resale or recycling. These new stages in a product's life require accessing information that was never designed to be accessed in the linear model.
- In order to resell a product online, there is digital information about that product that is not visible or accessible from the product itself. Take for example, a jacket that has been used and washed by an individual, is then returned to a brand for resale but does not have its product name, the original selling price or features and benefits about the product located on it. These are critical pieces of information required by the resale customer. We have seen an increase in sales conversion when more information is provided about an item in its resale channel. To help overcome this, it is important to ensure the product comes with the digital twin of its physical manifestation.
- Another challenge in the transition from a linear model to a circular one is the information provided on the garment for recycling. Currently brands are required by law to label the primary fibers that make up the garment. This however does not include the trims or threads that are also used. These details are important to recycling the product; recyclers are looking for the specific inputs of the post-consumer materials and having more detail allows for a pure feedstock for recycling.

CircularID™ would not only increase the efficiency and accuracy of processing garments into a resale platform, it would also lower the costs of making a product available for resale. Currently manual steps of adding color, size and content take time and have potential for errors. Using CircularID™, the product style number is linked to product data exported from the brand's various systems and organized in a new way to present forward for resale.

By controlling access to their products and other data via the CircularID™, brands will be able to control the resale of their own items. This means they can offer customers the best resale experience in the future because other third party sites would not have access to this product data.

Access to the accurate digital information of a garment would also allow for an efficient and trustworthy process to get that garment to the right recycler and access to new fibers on the other end.

In nature everything within a biosystem is integrated; communicating and working together for the health of the whole system. In today's linear apparel and textile industry, there is limited communication between people, products and technology in a way that allows for the fluid flow of information. CircularID™ offers that connectivity to allow products to speak for themselves and move through geographies and businesses in a way that ensures their highest value throughout the entire product lifecycle.

Powering product-as-a-service with CircularID™

Kristy Caylor
Co founder & CEO, For Days

FOR DAYS

For Days is a closed-loop clothing company that produces great basics on a join and swap program. Customers buy in once and can then swap old items for new ones anytime for any reason. All returned products are upcycled into new materials that go into future products.

Our members select their initial items which activates their membership. Membership means they can then swap old items for new ones. They swap by ordering something new, putting the old items back in the same bag, and dropping the return in the mail. For Days handles all outbound and reverse logistics and tracks all returns and upcycling quantities.

Tracking and recording swaps present a unique challenge for our business as all products being returned either go into inventory or into a recycling queue. Understanding what the customer intends to do and then following products through the entire lifecycle is unique.

With CircularID™, swapping could be automated and therefore easier for the customer and easier for the company. We could track inventory at the individual item level with fewer human interactions and could also track the product after it is returned. We would have faster data on swap behavior and recycling activities, which would in turn, help us communicate with our customers in a more personalized way. We believe the future of commerce is circular and creating a connected ecosystem is essential to realising this.

> Tracking and recording swaps present a unique challenge for our business as all products being returned either go into inventory or into a recycling queue.

Powering reverse logistics, recycling and sorting with CircularID™

Raymond Randall
Managing Principal, Waste Management

WM WASTE MANAGEMENT

As North America's largest recycler, Waste Management has been a leader for more than three decades in the ever-growing and dynamic recycling industry. We work closely with our 20+ million customers to identify trends and technologies to create new opportunities to manage materials in the best manner possible.

Strategically, creating a portfolio of solutions allows us to solve challenges specific to certain materials, geographic areas, or industries. But central to everything we do is the need for a viable market for the materials we can collect and process; if there is no demand for the materials processed at our recycling facilities, it does not matter if we can collect the materials. And for recycling to have the greatest environmental impact, it needs to ultimately reduce the use of virgin materials. Therefore, collaborating to build supply chains that create markets for materials and reduce the use of virgin materials are key markers for success in our business.

Textile waste is the fastest growing component in our waste stream when compared to traditional components such as paper, glass, plastics, metals, glass and organics. While traditional recyclables have largely been recycled into a variety of new products ranging from new bottles and cans to building materials, options for managing post-consumer textiles are also starting to grow rapidly. This increase in textile waste has also led to advancements in technologies and industries that create new opportunities to manage textile waste more effectively.

Efficiently, accurately and effectively identifying which solution is right for each garment passing through a sorting facility, especially a facility designed for scale and volume, is extremely challenging. This is where CircularID™ fills a need in the marketplace because it can help identify the best use of old and used clothing by evaluating its embedded data against varying sets of criteria.

> Textile waste is the fastest growing component in our waste stream when compared to traditional components such as paper, glass, plastics, metals, glass and organics.

For example, if a brand wanted their own garments back, the sorting equipment could identify those garments and separate them for return to the manufacturer. Or if a textile recycler can only accept garments made from certain fibers, or without certain accessories like buttons or zippers, the sorting equipment could read the CircularID™ digital birth certificate and more quickly identify compatible garments, as well as those which should be directed to a different solution.

The data contained in the CircularID™ can forge a new cog in the circular economy wheel by creating new solutions for managing textile waste in a manner that extends the life of textiles and significantly decreases the use of virgin materials in textile production. It is a disruptive and scalable innovation that could create more accelerated impactful solutions and change than the traditional and current options for managing used textiles.

CIRCULARID™ PROTOCOL OVERVIEW

CircularID™

#00145233989844

BRAND ON LABEL

PRODUCT NAME

MATERIAL CONTENTS

MSRP

ECOMMERCE DESCRIPTION

COLOR FAMILY

FACILITY IDENTIFICATION #

FACILITY CERTIFICATIONS

CircularID™ is the global protocol for digital identification of products in the circular economy. The CircularID™ Protocol introduces a consistent format of these data-fields so brands can exchange and access data across the lifecycle and have visibility and connectivity with products after point-of-sale.

CircularID™ Connected Products

Through adoption of the CircularID™ Protocol, brands can create CircularID™ Connected Products and drive the shift to circular and connected business models – connecting with products, customers, and partners across the lifecycle. When a product is digitized in alignment with the CircularID™ Protocol, it is called a CircularID™ Connected Product. A CircularID™ Connected Product is one that is digitally identified, with data essential for the circular economy, and connected to the Internet of Things. The essential data is then made accessible to identified value chain partners.

CircularID™ Protocol Pilot Version and CircularID™ Connected Products

Throughout 2020, Eon will be implementing the CircularID™ Protocol Pilot Version with CircularID™ Initiative members and leaders in the apparel industry to launch the first CircularID™ Connected Products. Through these pilots, fashion and apparel products will be digitized in alignment with the CircularID™ Protocol Pilot Version. The pilots will be used to evaluate and improve the CircularID™ Protocol before launching CircularID™ Protocol Version 1.0 publicly in 2021.

If your company is interested to pilot the CircularID™ Protocol Pilot Version, contact connect@eongroup.co to learn more.

To download the CircularID™ Protocol Pilot Version, or to learn more about CircularID™ Connected Product Pilots and CircularID™ Initiative Membership, visit eongroup.co or contact us at connect@eongroup.co.

Benefits of CircularID™ Connected Products

For brands and retailers
With CircularID™ Connected Products, brands and retailers are able to:
- Connect with customers and partners through product and across product lifecycle
- Monetize products through circular business models (i.e. resale, rental, service)
- Share, exchange and access data with circular economy partners (reseller, recyclers, etc.)
- Unlock transparency across the product lifecycle
- Access customer and product insights beyond point-of-sale to inform business decisions
- Measure and demonstrate success in achieving circular economy goals

For the customer
With CircularID™ Connected Products, it's possible for the customer to:
- Engage with brands and access information through the physical garment (e.g. tap with mobile phone and access unique web experiences)
- Access directions for care, and instructions for sustainable next-life management at end of use (e.g. send-back to brand, send to specific reseller, etc.)
- Connect with brands after purchase to build a more meaningful connection
- Upload products to digital wardrobe applications (e.g. smart closet mobile application)
- Instantly provide feedback with brands about products, through the product itself
- Post, share and engage in peer-to-peer models by easily accessing and posting information about products

For circular economy stakeholders:
With CircularID™ Connected Products, circular economy stakeholders are able to:
- Identify products to facilitate circular business models on behalf of brand partners (e.g. resale, rental, etc.)
- Identify products and materials for reverse logistics, collections and sorting
- Access data about materials to inform disassembly and recycling
- Engage with customers and bring efficiencies for customer to service-models
- Unlock transparency across the product lifecycle

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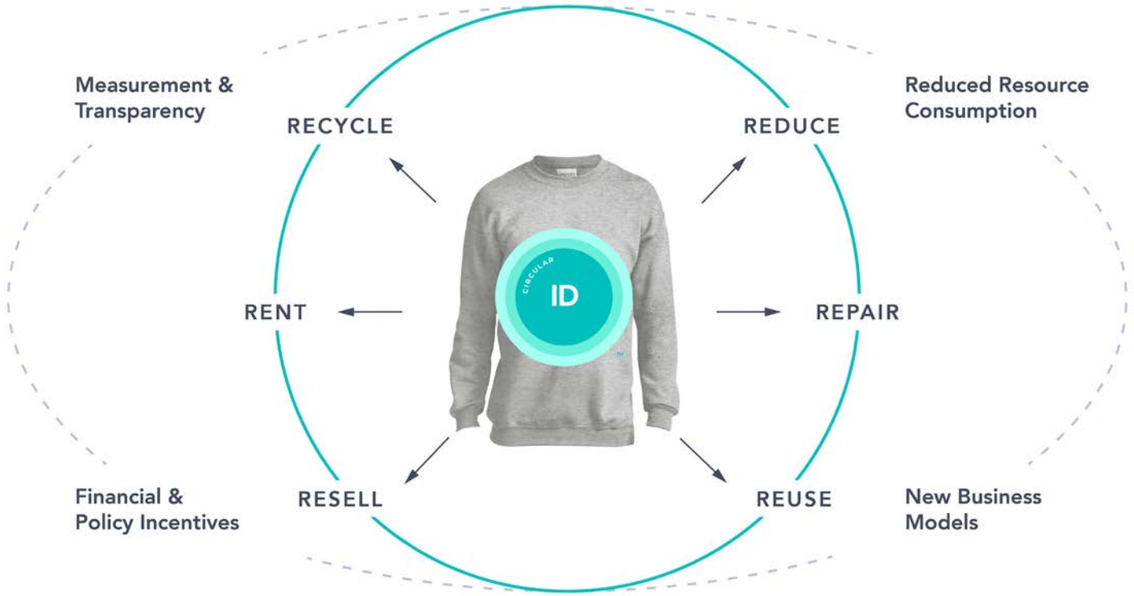

Implementing CircularID™ Protocol in CircularID™ Connected Products

How it works

When a product is digitized in alignment with the CircularID™ Protocol, it is called a CircularID™ Connected Product. A CircularID™ Connected Product is one that is digitally identified, with data essential for the circular economy, and connected to the Internet of Things. The essential data is then made accessible to identified value chain partners.

To link the physical product to the IoT requires that a digital identifier (e.g. RFID, QR Code, NFC) be attached to the physical product. Through interactions (e.g. scan, tap, or photograph) with the digital identifier, access to the product's digital profile can be provided.

Aligning the data fields of the digital identity with the CircularID™ Protocol ensures all data essential for managing products and materials in circular economy is consistently included and structured.

A CircularID™ Connected Product has the following components:

1 Digital Birth Certificate
A CircularID™ Connected Product has a Digital Birth Certificate. The data fields of the Digital Birth Certificate are the defined data-fields of the CircularID™ Protocol. A Digital Birth Certificate is created for a finished product. Examples of CircularID™ data-fields include product name, brand, color, factory identification number, and material content, among others.

2 Digital Passport
A CircularID™ Connected Product has a Digital Passport. The Digital Passport includes the record of interactions with a product throughout its lifecycle. An interaction occurs whenever the product's digital identifier engages through a scanning a QR code or tapping a products NFC chip, for example. These interactions are recorded into a product's Digital Passport, adding visibility into the product's real-world utility and value.

The interactions in the product's Digital Passport provide unprecedented insight and measurability into the lifetime economic value of a product. Through data built within digital passports, brands and industry stakeholders gain invaluable insights into product usage, durability, and movement in the value chain, incentivizing products to be designed and built for maximum lifetime value. Records of interaction data must maintain consumer privacy and confidentiality through rigorous security and data governance.

3 Identifier
In order to associate a physical asset with its digital profile, it needs a physical identifier that must remain attached or embedded within the asset for the entirety of its lifecycle.

An identifier that is permanently attached to the product allows product data to be efficiently accessed, verified, and expanded across the product's lifecycle. Examples of identifiers include RFID, NFC, QR Code, UPC barcode, and others, provided they are designed to remain intact for the full lifetime of the product.

Interacting with the identifier is what allows data to be accessed from (and added to) the product's digital profile. Without it, there is no way to associate item-specific data with an individual physical item.

To download the CircularID™ Protocol Pilot Version, or to learn more about CircularID™ Connected Product Pilots and CircularID™ Initiative Membership, visit eongroup.co or contact us at connect@eongroup.co.

CircularID™ Protocol

Development

To develop and champion adoption of the CircularID™ Protocol, the CircularID™ Initiative was established by Eon in 2019. The CircularID™ Initiative brings together retail industry leaders, and partners from circular businesses, technology, policy, and academia—representing key value chain stakeholders critical to informing the development of the CircularID™ Protocol.

Developed in alignment with the ISEAL Code of Good Practice for Setting Social and Environmental Standards
The CircularID™ Protocol Pilot Version has been developed in alignment with the ISEAL Code of Good Practice for Setting Social and Environmental Standards, which provides a clear framework for the development of standards, defining how a standard should be developed, structured and revised.

Two open industry-wide peer review Public Comment Periods
In addition to development, research and consultation with CircularID™ Initiative members, leading organizations and standards, the CircularID™ Protocol process included two rigorous and open industry-wide peer review Public Comment Periods where comments and recommendations were collected from fashion and retail industry leaders and partners from circular businesses, brands, retailers technology, policy, subject matter experts, NGOs, standards organizations and academia.

Aligns with GS1 System of Standards
The CircularID™ Protocol leverages and aligns with GS1 System of Standards, which provides a common language to identify, capture and share product data and is the most widely used global supply chain standard.

Governance

The CircularID™ Protocol is owned by Eon and is managed and released by the designated Voting Members of the CircularID™ Initiative. Throughout 2020, the Members of the CircularID™ Initiative will evaluate and improve the CircularID™ Protocol before launching the CircularID™ Protocol Version 1.0 publicly in 2021. Following the release of Version 1.0 in 2021, the the Voting Members of the CircularID™ Initiative will maintain the CircularID™ Protocol until the time of the next revision.

Join us in powering our connected and circular future. For more information, including joining a pilot, contact us at connect@eongroup.co.

Primary functions enabled by the CircularID™ Protocol

There are two primary functions that the CircularID™ Protocol supports – the identification of products and identification of materials.

1 **Identification of products – supports continued use/ circulation of products**
The CircularID™ Protocol enables the continued identification and monetization of products through circular business models (e.g. rental, resale) and the management of products through channels for continued use and circulation (e.g. repair, reverse-logistics, peer-to-peer, collections, etc.).

2 **Identification of materials – supports continued use/ regeneration of materials**
The CircularID™ Protocol enables the identification of materials for regeneration, including disassembly and recycling.

The Structure of the CircularID™ Protocol

Aligned with the two primary functions of CircularID™, the CircularID™ Protocol is structured in two parts – each with unique data requirements.

1 **Product ID**
The Product ID includes all information required to enable commercial identification of the product, in order to facilitate the ongoing management and monetization of the asset. Examples of data fields in the Product ID include: brand, size, color and MSRP (manufacturer suggested retail price).

2 **Material ID**
The Material ID includes all information required for the identification of the materials of the product, in order to facilitate management of the product's material components. This information is considered essential for the regeneration of the materials and supports processes such as disassembly and recycling. Examples of data-fields in the Material ID include: material content, dye process and thread type.

Timeline

- **Jan–July 2019**
  CircularID™ Initiative internal development of the CircularID™ Protocol
- **July 2019**
  CircularID™ Initiative completion of the CircularID™ Protocol draft for Public Comment review
- **July 29–October 30, 2019**
  60 day Public Comment Period #1 to collect feedback through public commenting platform
- **October 14–November 14, 2019**
  Updated draft launched for 30 day Public Comment Period #2 to collect feedback through public commenting platform
- **January–December, 2020**
  The CircularID™ Protocol Pilot Version to be implemented in pilots with CircularID™ Initiative Members
- **January 2021**
  The CircularID™ Protocol Version 1.0 and Implementation Guidelines launch to industry

GLOSSARY

Circular Economy
A circular economy is an industrial system that is restorative or regenerative by intention and design.[44] Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: 1. Design out waste and pollution 2. Keep products and materials in use, and 3. Regenerate natural systems.[45]

CircularID™ Connected Products
When a product is digitized in alignment with the CircularID™ Protocol, it is called a CircularID™ Connected Product. A CircularID™ Connected Product is one that is digitally identified, with data essential for the circular economy, and connected to the Internet of Things. The essential data is then made accessible to identified value chain partners.

CircularID™ Protocol
CircularID™ is the global protocol for digital identification of products in circular economy. CircularID™ establishes the essential product and material data critical for identification and management of products in circular economy, known in CircularID™ as Product ID and Material ID. CircularID™ introduces a consistent format of these data-fields so brands can exchange and access data across the lifecycle and have visibility and connectivity with products after point-of-sale.

Connected Products (also known as Intelligent Assets)
Physical objects that are able to record, communicate and/or sense information about themselves and/or their surroundings. This definition incorporates IoT objects but also includes assets that are not continuously transmitting information, and things that do not feature wireless communication.[46]

Connected Products Economy
The Connected Products Economy is an economic model where all products are digitally identified and connected to the Internet of Things, enabling value chain stakeholders to access data essential for managing and maximizing product value in the circular economy, resulting in the creation of new systems that unlock transformative benefit to our society, economy and environment. A Connected Products Economy is built on three principles: 1. Power circular business models by selling services instead of products, 2. Unlock data essential for creating new systems for managing and maximizing value and recovery of products and materials, and 3. Bring transparency and measurement to products and materials in the circular economy and accountability to natural resource consumption.

Digital Birth Certificate
A CircularID™ Connected Product has a Digital Birth Certificate. The data fields of the Digital Birth Certificate are the defined data-fields of the CircularID™ Protocol, and include information about the Product and Materials. A Digital Birth Certificate is created for a finished product.

Digital Identity (Digital Twin)
A digitized product has a digital twin, also known as a digital identity. A digital identity is a virtual replica of a physical product. Digital identity makes it possible to connect a product to the Internet of Things (IoT), and exchange information about the product via the internet.

Digital Passport
A CircularID™ Connected Product has a Digital Passport. The Digital Passport includes the record of interactions with a product throughout its lifecycle. An interaction occurs whenever the product's digital identifier engages through a scan, tap, etc.

End-to-End
Across the entire fashion value chain, from sourcing, manufacturing, logistics, marketing, sales, product use, and reverse logistics.

Interaction
The interactions in the product's Digital Passport provide unprecedented insight and measurability into the lifetime economic value of a product. Through data built within digital passports, brands and industry stakeholders gain invaluable insights into product usage, durability, and movement, incentivizing products to be designed and built for maximum lifetime value. Records of interaction data must maintain consumer privacy and confidentiality through rigorous security and data governance.

Internet of Things (IoT)
The networked connection of physical objects, such as apparel, to the internet. Companies hope to analyze the data generated by those devices to boost efficiency and, in some cases, generate new lines of revenue.[48]

Interoperability
The ability for different IoT systems to communicate.

Linear Economy
A linear model of resource consumption that follows a 'take-make-dispose' pattern. Companies harvest and extract materials, use them to manufacture a product, and sell the product to a consumer, who then discards it when it no longer serves its purpose.[47]

Lost Product
In our current linear model of take-make-waste, products are not digitally identified or connected to the Internet of Things, preventing the maximum value of products and materials from being managed, monetized and recaptured. Products in the linear model are lost. Without a way to capture value from products and materials, industry relies on ever increasing production and consumption of resources to sustain growth. In a Connected Products Economy, products are no longer lost. Products are identified and connected to systems; enabling industry to capitalize on the continuous use and reuse of products and materials.

Material ID (Component of CircularID™ Protocol)
The Material ID is one of two parts comprising CircularID™ Protocol that includes all information required for the identification of the materials of the product, in order to facilitate management of the product's material components. This information is considered essential for the regeneration of the materials and supports processes such as disassembly and mechanical and chemical recycling. Examples of data-fields in the Material ID include: Material Content, Dye Process, Thread Type, etc.

Physical Identifier
The physical identifier is what is attached to the item to identify the product, connecting the product's unique identification number to a web location. The physical identifier must remain attached or embedded within the asset for the entirety of its lifecycle. An identifier that is permanently attached to the product allows product data to be efficiently accessed, verified, and expanded across the product's lifecycle. Examples of identifiers include RFID, NFC, QR Code, UPC barcode, and others, provided they are designed to remain intact for the full lifetime of the product.

Product ID (Component of CircularID™ Protocol)
The Product ID is one of two parts comprising CircularID™ Protocol that includes all information required to enable commercial identification of the product, in order to facilitate the ongoing management, circulation and monetization of the asset. Examples of data fields in the Product ID include: Brand, Size, Color, MSRP (Manufacturer Suggested Retail Price), etc.

Transparency
Transparency requires that companies know and share who makes their clothes– from who stitched them right through to who dyed the fabric and who farmed the cotton—and under what conditions.[49]

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EON™

Eon is the market-leading digital identity platform—connecting products to the Internet of Things (IoT) to drive intelligence and connectivity across fashion and apparel. The Eon platform powers enterprise intelligence, customer engagement, and new business models. Eon's software-as-a-service platform is the trusted IoT solution for global brands and retailers to create digital profiles, manage product data and introduce intelligence and connectivity to products. Eon's platform is accessible via open APIs, enabling connections to all applications, to power a fully-functioning digital ecosystem.

Eon's mission is to power the shared digital foundation for the circular economy. Powering industry's end-to-end digital transformation, Eon leads the development of the CircularID™ Protocol, the global protocol for digital identification in the circular economy, through a collaboration of industry stakeholders and leaders. Eon digitizes products in alignment with the CircularID™ Protocol—making it possible to share access and generate data from products throughout their lifecycle and to communicate with partners across the value chain.

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