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Design Strategies

05

# Design for Circularity: The Case of *circular.fashion*

*Essi Karell*

What does it mean in practice to design clothes that at their end-of-life could be circulated into new fibers, yarns, fabrics and textile products? This chapter addresses the question through a descriptive case study of a sustainable design consultancy *circular.fashion* which has developed a novel approach to circularity. Multiple challenges and solutions regarding circularity within the company practice are introduced and reflected upon with respect to different phases within the circular textile value chain and previous literature. The chapter contributes to a deeper understanding of required changes in clothing design practices when aiming to accelerate the transition from a linear production–consumption system to a circular alternative.

**Keywords:** Design for circularity, circular fashion, circular design strategies, chemical fiber-to-fiber recycling

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## Introduction

Fundamental problems within the fashion industry originate from the pace of production and consumption, which further brings forth many environmental and societal crises. Fortunately, the problems are being increasingly recognised by various stakeholders throughout the fashion value chain. This can be seen in the growing interest in the circular economy (CE), which has been recognised as a viable concept towards a more sustainable production-consumption system.

CE is an economic model that is restorative and regenerative by design (Ellen MacArthur Foundation 2012). The concept builds on various ideologies and approaches, from which *cradle-to-cradle* by Braungart & McDonough (2002) is probably the most well-known. In the cradle-to-cradle approach, technical and biological materials are viewed as nutrients (excluding harmful chemicals) that can circulate infinitely creating closed material loops in a waste-free system. The closed-loop system provides countless steps to add value to products and materials, upon which the global fashion industry also depends when taking into account the decreasing virgin resources.

When envisioning the future without textile waste, *closed-loop recycling* (CLR) is required. As emphasised by Payne (2015, 111–114), closed-loop recycling in the fashion industry can be defined in many ways. One definition refers to recycling methods, through which the waste textile is reused in the garment production chain (ibid.). It includes, for example, remanufacturing and the mechanical fiber-to-fiber recycling of textiles. Also, the reuse of garments (second-hand market) can be considered an example of closed-loop recycling as the “product may enter a new life cycle within the same production chain” (Payne 2015, 114). Thirdly, and the most radical means of CLR, is linked to the cradle-to-cradle method (Payne 2015). In this approach, infinite material recycling becomes possible through chemical fiber-to-fiber recycling. It indicates processes where textile product can be broken down to a fiber level and reprocessed into a similar or higher quality textile application than before. In this chapter, closed-loop

recycling based on the cradle-to-cradle method has been chosen as the basis of discussion.

When illustrating closed-loop models, the interrelations between different stakeholders within the fashion value chain are easier to perceive than in the current linear value chain. Everything effects everything. This relatedness also obligates designers to participate in the discussion of a circular economy. As reported by Elander and Ljungkvist (2016, 51), fashion companies represent a stakeholder group able to influence most aspects of the circular textile value chain. Hence, approaches to new product design are critical in supporting recyclability (Kant Hvass 2016). But what will this actually imply regarding fashion designers' daily practices? What does it mean today when the ambition to move towards CE is only just emerging?

This chapter presents a case study that provides understanding of the systemic challenges for textile circularity and how they relate to designers' work. Berlin-based sustainable design consultancy, *circular.fashion*, has developed a novel approach to circularity and thus embodies multiple ways to address the barriers to it. A descriptive case study<sup>★</sup> of *circular.fashion* examines the company's philosophy and practices when designing for closed-loops. The case reveals challenges and solutions in circular fashion design practices which are addressed in respect to different phases within the circular textile value chain.

The current study aims to provide solutions to how to contribute to CE through design, and supports the ideation of an alternative design practice. New technologies are constantly emerging, and commitment to CE throughout the industry is increasing. The situation pictured on

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★ The intent of a descriptive case study is to understand a specific issue, problem or concern (Creswell 2013). In the case of *circular.fashion*, the issue at hand is the overall challenge of design for circularity in such a complex system as the clothing industry. *Circular.fashion* can be labeled as an instrumental case as it holds potential to provide insights that can go beyond the case at hand (Lazar et al. 2010).

the following pages is a snapshot of the design consultancy and its practices at a specific time and place.\*\* As Niinimäki (2017) states, examples of real life design are needed to support the change on multiple levels towards CE. With its novel approach, *circular.fashion* can be considered a crucial example.

## Challenges for textile product circularity

There are many challenges in the chemical fiber-to-fiber recycling of post-consumer textiles. Following Elander and Ljungkvist's (2016) expert interview study, some critical aspects are specified below based on four categories: Material input for recycling, markets, information, and technology.

First, however, it is important to picture the state of legislation in textile recycling. As noted by many (e.g. Hvass 2014; Payne 2015; Bouzon & Govindan 2015), legislation is an influential driver regarding the practice of reverse logistics and, consequently, effective recycling systems. For example, in the European Union common legislation for textile waste management is currently lacking, and regulations vary between countries. Yet, in February 2018 the Council of the EU

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\*\* The case study of *circular.fashion* was conducted between January 2018 and March 2018. The data is based on interviews with the company founder Ina Budde. Interviews were conducted by email (23.01.2018) and through Skype conference calls (29.01.2018 & 09.03.2018). The first Skype call interview was transcribed. Emails and the transcription in combination with the company's marketing material were analysed based on open coding (more precisely descriptive, in-vivo and process coding). Codes were categorised thematically and used for researching links between challenges, solutions and future visions. A holistic approach was taken for the analysis, meaning that the case was viewed as a whole rather than as separate units of analysis. Reporting is based on thematic categories.

published a press release about a provisional agreement on the waste package, which was described to “lead to more recycling of waste and contribute to the creation of a circular economy” (The Council of the EU 2018). If the agreement passes it implies that member states will have to set up, by 1st of January 2025, a separate collection for post-consumer textiles (ibid.). How this would ultimately effect the disposal practices of European consumers remains to be seen. At least from the perspective of other stakeholders in the fashion industry, this holds potential to develop functional reverse supply chains and re-arrange industrial operations – at least within the European Union.

### Material input

Regarding materials, the low volume of textiles suitable for recycling is one of the main challenges (Payne 2015), while the functionality of reverse logistics is another. Currently, the collection and sorting of textiles is insufficient (Elander & Ljungkvist 2016) despite being based on multiple collection systems. Increasing amounts of fashion companies are setting up take-back systems, but there the challenges that arise are related to textile volumes as well as quality (Hvass 2014). Consumer awareness of the negative impacts of clothing disposal is a further concern (Elander & Ljungkvist 2016). Because consumers are responsible for the products end-of-life, the functionality of reverse logistics is ultimately dependent on their disposal habits.

The efficiency of textile recycling also depends on the design of easy-to-recycle products (Gulich 2006). A major concern is the complexity of textile products due to the use of material blends, layering of different materials, presence of prints, elastane and trims which include chemicals, colours/dyes, harmful substances etc. (Elander & Ljungkvist 2016; Franco 2017; Niinimäki 2017; Wedin et al. 2017). This implies that very limited amounts of textiles are suitable for chemical fiber-to-fiber recycling.

Increasing the volume of suitable textiles requires the commitment of various stakeholders. Each fashion, sorting and recycling company,

however, has their own demands, which complicate industry-wide collaboration. “As there are no best practices available and no legislation to guide the industry, companies are currently alone in developing a reverse logistics system that matches their needs”, as highlighted by Hvass (2014, 425).

### Market

The complexity of the fashion value chain and the relatedness of different stakeholders within complicates assessing the functionality and economical viability of closed-loop recycling. When it comes to markets, cost is a serious factor. Sorting and recycling costs are high, transportation costs for textile waste are high and, furthermore, the incentives for investment in textile recycling are lacking (Elander & Ljungkvist 2016). This results in the high price of recycled textiles (Franco 2017) that many small brands or design teams in commercial fashion companies (often under extreme price pressure) cannot afford. Meanwhile, fashion companies perceive there is a limited supply of recycled fibers/textiles available for designing new textile products (Elander & Ljungkvist 2016; Franco 2017). On the other hand, suppliers of recycled textile fibers report the lack of demand for recycled textiles amongst fashion companies and textile producers (Elander & Ljungkvist 2016). This aligns with the statement by Gulich (2006), according to which recycled products are hard to market, exacerbated by high prices (Franco 2017).

### Information

In terms of information, fashion companies seem to lack knowledge of collection and recycling aspects of textiles, as well as reverse logistics (Hvass 2014; Elander & Ljungkvist 2016). There is also a lack of information regarding product content (material composition, dyes, chemicals, other substances) (Elander & Ljungkvist 2016, Wedin et al. 2017). Accessing information about the complete chemical content of products is said to be difficult for fashion companies “due to long and

complex supply chains, the discrepancy in national and regional legislation (REACH) and very limited transparency of the chemical industry” (Elander & Ljungkvist 2016). Going further in the textile value chain, the dialogue between sorters and recyclers seems to be missing. Sorters need to know what textiles to sort out in order to match recyclers’ needs and requirements, while recyclers need information about the chemicals used in recyclable textiles in order to regenerate fibers of good quality (Elander & Ljungkvist 2016, Wedin et al. 2017). Moreover, the requirements of both sorters and recyclers would be crucial information for designers in order to effect the sortability and recyclability early on in the design phase.

### Technology

Critical aspects regarding technology relate to the readiness level of different processes. Automated textile sorting technologies that could increase the volumes and purity of textile waste sorted for recycling are under development but currently there is none functioning on an industrial scale (Cura & Heikinheimo 2017; Wedin et al. 2017, Circle Economy & Fibersort). In addition, scaling up chemical fiber-to-fiber recycling technologies is challenging due to the lack of investment in recycling technology (Elander & Ljungkvist 2016). Even though the separation of cotton and polyester fibers (the most common fibers on the market) has been recently proven (H&M & HKRITA 2017; Mistra Future Fashion 2017; Palme et al. 2017; ), the separation of different fiber types and handling impurities in chemical recycling processes remains challenging.

## The case of *circular.fashion*

**Company:** *Circular.fashion*

**Registered office:** Berlin, Germany

**Established in:** 2015

**Main service:** Design consulting, online tool *Circular.fashion System*

**Main product:** *Circular.fashion.ID*

**Revenue model:** Yearly membership fee, price per product and service

In our current planetary state, the idea of a future without waste appears somewhat impossible to attain. Especially if working in the global fashion industry, the picture of a world without resource scarcity and waste requires plenty of imagination, passion, as well as trust in the human capacity to change and to make changes. Dedicated to this idea is Berlin-based fashion designer *Ina Budde*. As a founder of sustainable design consultancy *circular.fashion*, she believes that if every single product around us could be recycled into a product of the same quality we could eliminate the concept of waste and the need for virgin resources. Inspired by the concepts of cradle-to-cradle and closed-loop ideology, *circular.fashion* provides support for fashion companies in the creation of products and systems suitable for CE. Under the umbrella term design for circularity, the company offers consulting, development of recyclable and biodegradable textiles, products and full collections. Additional services to both academia and industry include workshops and trainings focusing on sustainable fashion, circular retail models and systems. At the core of *circular.fashion* is a novel digital system for textile circularity providing one of the best practices currently operating in the fashion industry.

Today *circular.fashion* employs six people embodying different competencies related to recyclable materials and material research, closed-loop design, consumer demands, sustainable business models, reverse logistics, and software development. Close collaboration with material suppliers, material scientists, textile collectors, sorters and recyclers continuously feeds into the company practices and services.

Customer brands of *circular.fashion* are established and mainly producing in Europe. Today, all the company's operations (collecting, sorting and recycling) are also based in Europe. Regarding sorting, the company is in contact both with global and local actors in order to develop a solution that would be globally possible. Current focus is on developing Berlin-based pilots, which can later be transferred to other situations. The aim is to demonstrate that the concept works in regional loops before expansion is considered.

### Design for circularity

As there are many ways to define closed-loop recycling, there are certainly many ways to approach and define *circularity*. For *circular.fashion* consultancy, circularity in fashion does not only mean recycling of discarded materials and products based on cradle-to-cradle, but also reusing the existing garments to keep them at their highest value. However, when it comes to *designing* for circularity, the base line for each product should be the suitability for chemical fiber-to-fiber recycling.

Currently, two ways to approach material recycling for designers have been identified (Goldsworthy 2012). The first – *re-active approach* – refers to working with existing material and product streams. These can be linked to various business models such as redesign services, second hand and leasing models but also downcycling of materials through remanufacture (ibid.). In *circular.fashion*, the re-active approach is referred to also as a *transitional approach*. Even though the approach can provide enormous business potential and slightly reduces the amount of waste, it will not change the linear system from within (Budde 23.01.2018). In order to change the system, a *pro-active* approach that follows closed-loop ideology should be integrated into product design from the start (Goldsworthy 2012, Budde 23.01.2018). In *circular.fashion* this means focusing on full material recyclability, i.e. the creation of products that have the ability to be regenerated 100%.

As an innovative solution, *circular.fashion* has developed a web-based tool called the *circular.fashion system*. It is an industry-connecting

platform and tool for all stakeholders to create circular products and to keep them in the loop. The tool can be purchased and used as Software as a Service (SaaS). Today, the service is based on three different pricing models depending on the company size. The system includes two parts *Circular Design Software* and *Reverse Supply Chain Intelligence*, described in the following sections.

### Circular Design Software

The *Circular Design Software* is a digital service designed for the pre-consumer phase in the fashion value chain. It assists fashion companies to design circular and sustainable products in a lean and efficient process. The software features three supportive tools starting from *Circular Design Guidelines* that provide hands on descriptions to designers of how to apply various circular design strategies to their products. In the *Circular Material Database*, designers can look for materials that have been approved by the partner network of *circular:fashion*. Designers can contact material suppliers through the software, request for sample swatches and place their orders directly to suppliers. Through the platform, it is also possible to create the final production documents. In the end, *Circularity Check* shows if the designed product is recyclable with the chosen materials. Sometimes, however, it occurs that products such as functional clothing do not fulfill the requirements of any closed-loop recycler. In such cases, *circular:fashion* can link the customer brand with a mechanical recycler, although that is not their first priority.

### Reverse Supply Chain Intelligence

The *Reverse Supply Chain Intelligence* is another part of the service focusing on the post-consumer phase of the product. *Circular:fashion* has allocated a closed-loop recycler for every material in their database. A garment that passes the circularity check receives a unique *Circular:fashion.ID* – a code that guarantees the product is suitable for chemical fiber-to-fiber recycling. The ID is attached to garments as a woven label

and allows tracking of each item. The labels can be purchased individually or from one of the certified suppliers. The ID can be scanned by end consumers as well as by sorting and recycling companies and it leads the user to the *Customer Interface*. Through the interface it is possible to access the full history of a garment (product content, material composition, care instructions and production network). Additionally, options for updating, reusing or recycling of a garment are available. At the point of product disposal, consumers are advised how and where to return the products through a *Sorting Guide* that is part of the *Circularfashion.ID*. It also provides information for sorting companies to identify the predefined textile recycler from the *circular.fashion* network. Budde provides an example (29.01.2018):

*Let's say there's a cellulosic based material and it has a cellulosic recycler allocated. A brand or designer creates shorts. They can decide then which materials they put into the product. For the lining, for the surface material, for the closure. And then the product check will prove if all the different components are possible to go to the same recycler ... If it's not going to the same recycler but they have chosen a design strategy for disassembly – let's say the lining can be detached. Then it's still approved and this information of detaching the lining will be added on to the product info site as well.*

Through this step, chemical fiber-to-fiber recycling becomes possible. In the future, the brands may even order the recycled textiles again for their own production.

## From challenges to solutions

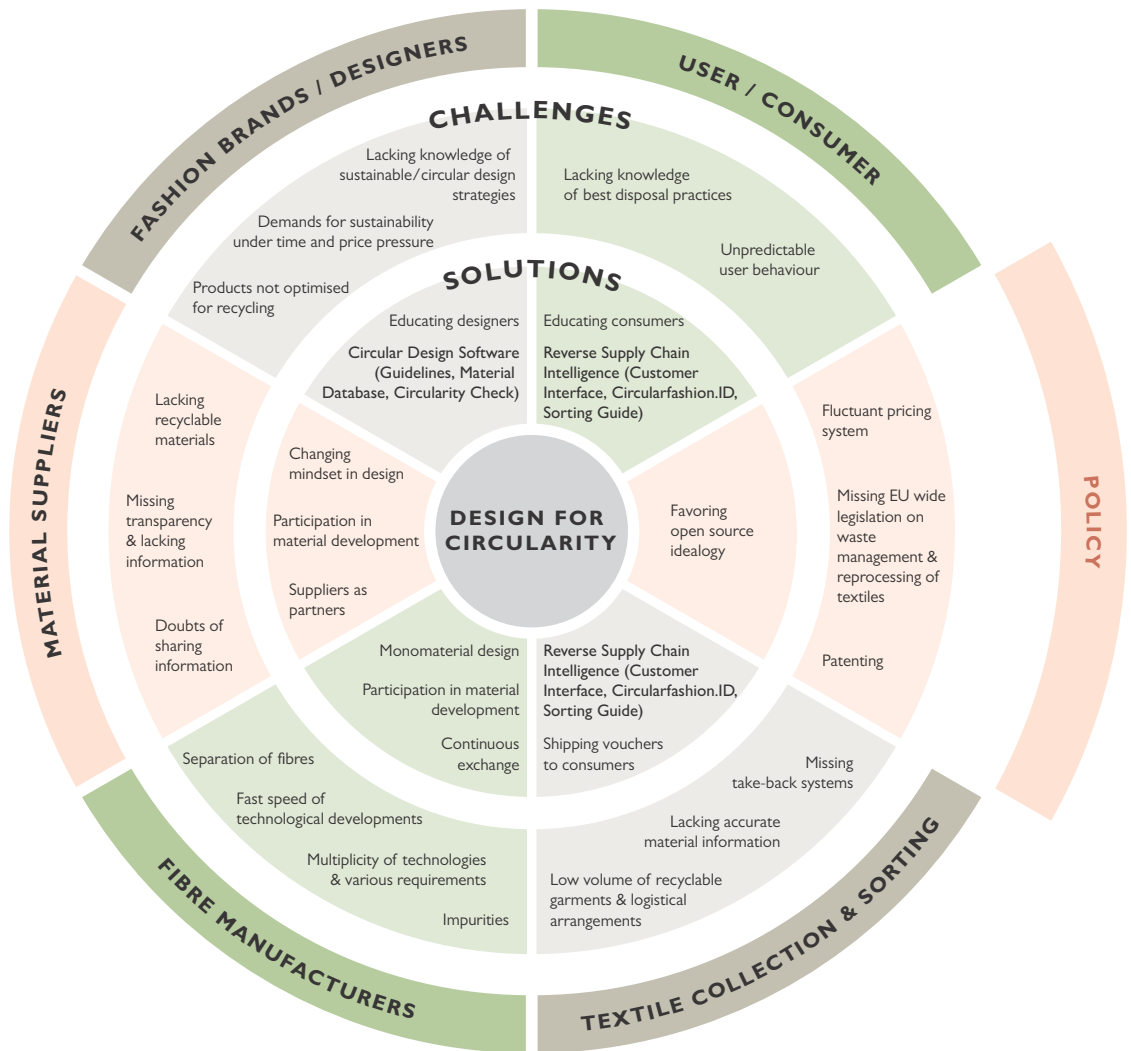
As mentioned in previous literature, there are numerous critical aspects to consider when aiming for circular fashion through chemical fiber-to-fiber recycling. The descriptive case study of *circular.fashion* reveals many similar obstacles based on the company's experiences but also provides some new ones described on the following pages. In addition, their own practical approaches and solutions to overcoming the issues are presented. These are aimed to assist other designers and design teams to reflect on how they could contribute to circularity.

To help the reader to navigate through the findings, Figure 1 provides an overview of the challenges and solutions. The company aim, *design for circularity* (based on chemical fiber-to-fiber recycling), is placed in the centre of the diagram. The outermost circle demonstrates the different phases in the circular textile value chain. Policy is not regarded as a phase per se but an upper-level influencer, especially when it comes to waste management and disposal practices. Hence, it is located between *user/consumer* and *textile collection & sorting* and remains more distant from the center. The challenges and solutions for circularity identified in the practices of *circular.fashion* are placed in between and in relation to the different phases.

### Easing adoption of circular design strategies

A harsh fact is, however, that current products are not optimised for recycling. Apart from those educated in sustainable fashion and textile design programs, general understanding and competence in sustainable design practices seems to be lacking, let alone what it takes to design with a closed-loop mindset. As Budde (23.01.2018) describes:

*Many brands want to create sustainable fashion but lack the knowledge of how to design for longevity, adaptability or material circularity or how to access sustainable materials.*



**Figure 1.** Challenges and solutions identified through the practices of *circular.fashion* when aiming for circular design (illustration by the author).

Meanwhile, design teams working in commercial fashion companies should respond to the pressures of price and production time with sustainable and automated technological manufacturing methods. Calling for sustainability under extreme time and price pressure seems contradictory, but tools like the *circular.fashion system* can supply designers' needs. As part of the *Circular Design Software*, materials and many sustainable design strategies are proposed that enable circular design solutions. Information on the software can be filtered according to designers' interests. For example, designers can choose whether to investigate material cycles such as cellulose, polyester or biodegradable substances. They can also filter materials according to the country of production, characteristics, composition, fabric type, pattern type and color. Regarding strategies, filtering can be done based on material cyclability (e.g. monomaterial design, design for disassembly), material cycle (recyclability or biodegradability), design for adaptability (e.g. modular design, multi-functional design, adjustable sizes), design for longevity (e.g. repairability, aesthetics, emotional durability) and also product types (Budde 29.01.2018.)

After filtering, compatible strategies are displayed. They are further illustrated as design briefings because designers are used to being briefed on what to do (Budde 29.01.2018). Figure 2 illustrates a briefing of emotionally durable design. In other words, each strategy has its own translation. This eases and speeds up the adoption of strategies, but also differentiates *circular.fashion* from other initiators promoting sustainable/circular design strategies. Regarding emotionally durable design for example, it can be hard to imagine what a designer should actually do. Budde (29.01.2018) explains it as follows:

*We always have an example next to the strategy ... a very specific product and how it was solved or what was the idea behind this product.*

**Figure 2.** Briefing of emotionally durable design strategy.  
Design: Jonna Haeggbloom, Photographer: Erik Cronberg.

## Design for Longevity Emotional Durability

### STRATEGY

If functional durability refers to whether a garment by its physical attributes will last, emotional durability refers to whether a user wants to keep and wear a piece. Today's use of clothing is mainly characterized by short-term wear and disposability, where garments generally are replaced due to the fact that a wearer have lost interest, rather than the pieces being broken. To design for emotional durability is about creating pieces that consumers wish to keep and use for longer, resulting in reduced consumption of new pieces and a stronger emotional connection with the pieces one already own. Factors that impact emotional durability are related to how a user feels when wearing a piece and are influenced by when, where and from whom the piece was acquired. Transparency of a garment's production will build on its narrative and strengthen the emotional connection as it reduces the distance between maker and wearer. Increased awareness will likely result in more responsible consumption patterns and a greater willingness to take care of one's clothing and as such improve sustainable behaviour in the use phase. Other factors influencing emotional durability is the comfort, fit and size, how well it emphasizes the users personality and how well it ages over time and use.

### PRODUCT DETAILS



This coat created with a layered modular pattern technique fastened by fabric stripes. This technique gives the wearer the possibility to update and customize the piece by changing colours, materials and weaves of the fabric stripes as well as deciding whether the coat is long, short, sleeveless, with or without a collar.



Designing emotional durability into garments is complex, as what affects emotional connection, naturally, is different for every person and depends on one's own beliefs, memories and ideas. However, a few general guidelines that foster emotional durability:

- Enhance a garment's value and meaning by being transparent of its making and narrative
- Use co-creation and personalisation strategies to customize a garment's function and aesthetics to the actual needs and desires of the wearer
- Keep the interest of the wearer by using techniques for updating possibilities of the piece
- Use materials, coatings and techniques that age beautifully over time or that reveal patterns by use

### MATERIAL PASSPORT



Easing the adoption of circular design strategies and the development of new solutions is an ongoing work for *circular:fashion*. Solutions are also developed according to specific brand environments or products. The whole life cycle of a garment and use scenario is kept in mind. According to the company's consulting framework, it is essential to match a circular strategy with products' functional needs, brand DNA and customer expectations. Hence, product ideas are combined with circular retail models and services. The company also educates designers by organising workshops and training on the issues mentioned above. Budde (29.01.2018) highlights four main categories to keep in mind when designing garments. These include material choice, material combinations, product construction and surface treatments. Furthermore, she shares her own notion of what clever design entails:

*For me when I look at the product it gets just more beautiful if I see that I can disassemble all the different parts again and that I don't need to destroy it if I need a part of it. So for me it's just a notion of this is beautiful because I don't need to destroy it. It gives respect to every single part of this product.*

### Overcoming the lack of information and materials

As earlier stated, the lack of information and materials hinders textile product circularity (e.g. Hvass 2014; Elander & Ljungkvist 2016). Similar obstacles and required activities identified in case of *circular:fashion*, are described below based on three categories. These relate to attitude changes in fashion and supplier companies, as well as exchange about the constantly changing requirements.

#### Change in attitude

Based on *circular:fashion*'s experience with fiber manufacturers and textile sorters, the ideal textile products for fiber-to-fiber recycling would be those made of one single material, i.e. monomaterial products (Budde 23.01.2018), as opposed to the complex material blends and layered structures noted earlier (e.g. Franco 2017; Wedin et al. 2017). However,

challenges arise when thinking of surface design and details. Sourcing of buttons, zippers and other trims that fit certain materials may be difficult to find or are not yet developed in a recyclable way (Franco 2017; Budde 23.01.2018). Hence, there appears to be a clear gap between the requirements of textile recyclers and the current material offering. In addition, surface treatments like prints should be avoided in monomaterial design. These challenges ask for new replacing technologies but also positive attitude and creativity. Budde (23.01.2018) provides an example related to a project made for an urban tech-wear brand Acronym:

*We decided to work with a monomaterial approach in the technical cycle and used a water-resistant membrane that can be regenerated with closed loop polyester recycling. One could assume this might be limiting or restrictive but for us it's much more a driver for innovation and creativity that led us to explore new closure methods or exciting technologies such as laser engraving to work with the material itself instead of adding any impurities like print colors.*

### **Suppliers as Partners**

A further challenge in sourcing relates to transparency. Similar to earlier findings (e.g. Elander & Ljungkvist 2016), *circular.fashion* has also found it difficult to obtain exact information about material content. Budde (29.01.2018) describes the current relationship with material suppliers as follows:

*Some are really open and collaborative but some are ... First they need to understand the sense of why they need to make the effort.*

But without transparency there is no way to assess the recyclability of the materials. This complicates the design process for circularity because many brands don't have their own research and development (R&D) team and are dependent on existing materials. Moreover, missing information is a further obstacle if brands want to make a full Life-Cycle Assessment (LCA) of their products. Doubts about sharing information

must be solved, which asks for trust between stakeholders but also new collaborative attitude. Budde (29.01.2018) gives an example of her own approach:

*For me suppliers are rather partners than just simply suppliers because they need to know that they are kind of part of the system. Because otherwise they maybe don't understand why they should provide so much material information or why we want to check their materials so specifically. So they are partners as well.*

A collaborative attitude builds close partnerships with suppliers, which is of great importance in reuse and recycling initiatives in fashion (Hvass 2016). Today, *circular.fashion* participates actively in the development of recyclable materials with a selection of certified suppliers within their network, which has resulted in new material innovations (Budde 23.01.2018), exemplified by a biodegradable polymer blended with natural fibers. This compostable material blend can be transformed into all kinds of soft and stable elements, such as textiles, buttons, zippers and even elastics. It implies that every part of the product can be made of the same molecular content and therefore the worn-out garment as a whole can safely enter the biological cycle (ibid.). A jacket designed for disassembly is another example which combines material and product level innovation. Budde (23.01.2018) clarifies this as follows:

*The textile is designed to be disassembled into the two layers for separate cycles of composting and recycling. Additionally the sewing yarn is soluble so that the lining can be separated too. This innovation is a game-changing development and enables the benefits of stable synthetic materials combined with the flattering touch of natural fibers.*

Participating in material development enables the company to easily access material information and set new requirements for textiles as other technologies advance. The work supports other fashion companies through the material database in the *Circular Design Software*.

Generally, fashion design teams in commercial companies approach material suppliers with sample references when sourcing new materials for upcoming collections. Newness is usually based on style, quality, comfort, functionality, etc. In design for circularity, however, the “new” indicates also the ability to fit materials to certain recycler, which requires changes in the dialogue and processes between fashion companies and suppliers. In the future, this may imply that fashion companies turn from pure customers to active co-developers, which might also extend the fashion designer’s role and require deeper knowledge of materials and their structures even at the fiber level.

### **Constant exchange with fiber manufacturers**

As earlier mentioned, it is difficult to evaluate which materials could fit chemical fiber-to-fiber recycling due to gaps in material information (Elander & Ljungkvist 2016, Wedin et al. 2017). Developing new materials with suppliers, *circular.fashion* aims to overcome this challenge. However, it is no easier to access the information about the requirements for materials suitable for chemical recycling processes. First of all, each recycling process has its own specific requirements. Budde (29.01.2018) clarifies this with an example regarding the maximum amount of elastane that does not disturb the fiber-to-fiber recycling process:

*I think it's now 2% with one recycler. But I think it's just valid for this one recycler, and there is another one who can not still handle it.*

Secondly, everything is in the movement. Technologies advance so rapidly that it is hard to stay updated. This is good news in respect to the targets of CE but difficult for other stakeholders. As Budde notes (29.01.2018):

*With one recycler, the cellulosic recycler, we are working already for ... I think 3 years now. And their process changed quite a lot. In the beginning we had very harsh requirements for textiles that could get into the process and now it's much easier. But sometimes you don't really find out with the first one.*

*When you maybe schedule a meeting again and you talk through another project and then by chance you realise that things have changed a little bit.*

The way *circular.fashion* takes on the challenge of technological changes is now based on constant exchange with the fiber manufacturers. The company constantly pursue research into and analysis of the requirements of chemical fiber-to-fiber recycling processes. New materials with suppliers are further developed and matched according to those specifications and then evaluated. Materials on the *Circular Material Database* all fit current requirements. In order to share the information more efficiently in the future, Budde suggests the following (29.01.2018):

*Maybe there is actually some easier way to get this information all the time. ... I mean we could implement it (information) on our platform so that they (fiber manufacturers) can post it. But I mean there are so many different companies, so why should they always give you the latest news. It's also hard for them to spread it through their network. But yes, I think the future vision would be to constantly update.*

Until the requirements become more accurate and technologies develop further, monomaterial designs are favored by fiber manufacturers and should be taken into account also in design. However, material recyclability is not the only attribute to consider in circularity. Material selection should not only be weighted according to the preferences of fiber manufacturers, but instead the whole product life cycle including various use scenarios should be taken into account and matched with the material properties of each design. In terms of waste management hierarchy for instance, reusing should always precede recycling. Hence, product longevity (including good quality materials, adjustable fit, etc.) must be considered. Sometimes certain functionalities that further increase longevity may require material blends, maybe even elastane. Then a decision between the product longevity and recyclability may be needed until appropriate technologies are in place.

### Increasing economical viability through *Circularfashion.ID*

Currently, there are very few garments in the market that meet the requirements of the textile recyclers (Budde 29.01.2018). Due to low volumes, textile sorters practically need to set up a room to collect garments separately until they have a volume that is worth sending to a fiber manufacturer (Budde 29.01.2018). Logistical challenges relate to the economical viability of the sorting process (Elander & Ljungkvist 2016). In the near future, however, *circular.fashion* aims to assess the viability of collecting and sorting by providing consumers with shipping vouchers so they can ship the old garments for free to a designated sorter within the *circular.fashion* network (ibid.). The effort should help evaluation of the overall quality of collected textiles.

Also, the lack of precise material information results in low volumes for chemical fiber-to-fiber recycling (e.g. Elander & Ljungkvist 2016). The *Sorting Guide* of the *circular.fashion* system provides a solution for this, enabling textile sorters to assess whether garments are suitable for second hand use. In addition, enables reliable material identification and designated recyclers through *Circularfashion.ID*. It also provides instructions to consumers on how to increase the useful life of products. Scanning the code with a smartphone permits easy access to the customer interface with a full history of the purchased product (Figure 3). Moreover, it allows fashion companies possibilities to increase the rate of customer retention.

Reliability of material identification is a key in building a reverse supply chain. Many different solutions are currently underway, but there is no point in companies developing systems that only match their own needs – as is the situation of today (Hvass 2014). As Budde (29.01.2018) notes:

*No one is setting up a system like us at the moment, but as soon as someone does I think it would be just very useful to join forces because we don't need many different solutions. We need one solution that is used by many people.*



circular.fashion

## ALLISON



**MYRKA**  
studios

### ALLISON

MYRKA studios – Spring 2018  
Size: One Size

The special plush look and the oversized fit transform jacket ALLISON into a real statement piece. It originated from a collaboration between Myrka Studios and circular.fashion and can be lead back into the closed circuit without losing any resources. The main material was a remnant textile and is made of 100% polyester. The silky lining, yarn and labels are made of recycled polyester from PET bottles. For each sold jacket the berlin based label donates 10€ to the «Clean Clothes Campaign Germany», which pleads for better working conditions along the production chain – so that in the future fair productions won't be the exception, but the norm.

## Brand   Material & Care   Production   Circularity Guide

### Main Material



100% Polyester  
#recyclable  
Production Country: Germany  
Recovered Overstock  
[Learn more](#)

### Lining



100% Rec. Polyester  
#recyclable  
Production Country: Turkey  
Certificate (GRS)  
[Learn more](#)

### Yarn and Labels



100% Rec. Polyester  
#recyclable  
Production Country: Netherlands  
[Learn more](#)

### Care Instructions

Oberstoff/Main fabric: 100% Polyester  
Futter/Lining: 100% recycled Polyester



Hergestellt in Deutschland  
Made in Germany

### Building an open source ecosystem

Moving towards CE means taking a systems perspective on fashion that includes all actors (Niinimäki 2017). Building a functional reverse supply chain that brings different stakeholders together has been one of the fundamental aims of *circular.fashion* consultancy. At the time of this case study, the company has managed to build a small ecosystem through which everyone within the circle is connected: the designer, user, retailer, sorter and recycler. Budde (29.01.2018) describes the starting point of building the multidisciplinary network as follows:

*Timewise it would start with the recycling company. So, I started to map out where closed-loop recyclers are popping up, and which of those technologies are actually already in place or what could we work with. Because a lot of them are not really selling yarns yet or can't really take things back. So this was the first thing we researched. And then we looked for material suppliers that could potentially provide textiles that would fit the recyclers' requirements.*

According to Budde (29.01.2018), the process has taken a lot of time in conferences and Skype calls. Having a specific project already in mind when contacting different actors has also been one crucial aspect in building the networks.

*I was inviting these people to be part of the pilot project of building a circular collection and providing the information of how to close the loop for this collection. That was a very good basis to really have something specific to talk about. Like a real case.*

Operating in such a manner has led to proof-of-concepts. One example is a collection 'Curated circularity – designed for Infinity' with a brand JAN'N JUNE (Figure 4), to whom *circular.fashion*, in co-operation with various other partners, managed to set up its own recycling system.

**Figure 3.** Customer Interface showing the full history of a garment. Jacket design by Allison, MYRKA studios.



**Figure 4.** 'Curated circularity – designed for Infinity' collection for JAN 'N JUNE. Photographer: Maximilian Probst.

Due to insufficient legislation, companies are left largely free to decide about their own sustainable practices (Hvass 2016). Hence, real-life cases are crucial for proliferation of sustainable practices, because they hold the potential to embody a proof-of-concept that can later encourage and motivate other stakeholders to take action. Ideally, companies also open their processes aiming for sustainability to other actors in the industry, as in the case of *circular.fashion*. Openness and sharing information are fundamental in order to further accelerate the transition towards CE. However, Hvass (2016) mentions a tendency of companies to develop sustainable solutions only for themselves. Yet, patenting has not (to the author's knowledge) been mentioned as a critical aspect in previous literature. Budde (29.01.2018) mentions patenting as a major concern potentially delaying material circularity. The following notion illustrates the approach of *circular.fashion* related to open source thinking:

*I think this is really important because I think only with such an approach, being more open about it, can you actually accelerate this. Because if you*

*don't allow other people to use the same ideas then it's just one time in the world and then it will never make a change. I believe these ideas should be spread. And patenting in this area should be forbidden. And we should find other business models around it.*

Spreading the word is at the heart of the company's business. Fighting for the same goal and being constantly in contact with different initiators is a daily practice. This can also be seen in the other activities of *circular.fashion*: 'Open Source Circular Economy days,' for instance, is one forum where the company has been active in promoting CE to consumers and other stakeholders.

Openness is also part of the membership strategy. Even though the online tool is currently based on a yearly subscription, a long term aim is to provide all the knowledge for free as soon as enough fashion companies join the platform. In this vision, the company would charge only for *circular.fashion.IDs*, meaning a price per product produced.

## Future vision

Technology evolves at a pace that is sometimes hard to keep up with. Budde (29.01.2018) shares some of her own future visions that could influence designers' work crucially when aiming for textile circularity.

*Obviously in the past blends of fibers were the most difficult. But I believe that in the near future we will be able to handle that as well. The main question will then be if we can handle both components of the blend and recycle both of them to virgin quality. We are aware that the separation of blends is currently possible, but I mean it's not happening at scale yet. Also, often the recyclers can just filter out one part, for example cellulose or polyester, if they don't know the exact composition of the blend. So what I think is that in the future we will be able to handle blends and additional at scale if we declare the exact composition accurately.*

Designers will probably not have such a hard time in the future, Budde (29.01.2018) speculates. For instance, designers may not be obliged to make every closure part detachable when considering design for disassembly. Although, many of the problems within fiber separation could be solved, the information relating to full product content and the way garments are constructed will still be needed according to Budde (Ibid.):

*Regardless if we can use it or not (blends), I think we need to be transparent about it and declare what the products contain. Because most recycling technologies simply work better if they know the content. And still I believe that some – let's say closure parts or blends – should not be used. And so I think there will always be some guidelines for designers about which materials should be used.*

Despite possible technological advancements easing designers' work, fashion companies will need to create products according to many more purposes than selling garments, Budde states (23.01.2018):

*When companies implement Product-Service-Systems to unlock the growth from material throughput, it will be the challenge of the designer to create the garments that are durable, versatile and modular so that the brand can actually max out the business potential of many use cases of one product.*

Moving from products to services will also expand the designer's role. Budde sees designers becoming interdisciplinary translators between consumer demands, product functions (defined by the respective service offer) and requirements for material circularity (ibid.).

*Products responding to those parameters become an inter-connective element that flows in circular ways between people in various relations. This way of thinking breaks up the whole idea of seeing a product as one product and a material as one material. Because a product is only one product in a certain setting with certain people but becomes a different product in another setting.*

## Discussion

When visualising the challenges of chemical fiber-to-fiber recycling (Figure 1), it becomes evident that change has to take place simultaneously throughout the value chain. Technological developments in automated textile sorting and chemical fiber-to-fiber recycling is rapid, which should effect the practices of other stakeholders. If we want to see chemical fiber-to-fiber recycling running at scale in the near future, the practices of designers and other stakeholders must change fast.

In order to set up a functional system, open dialogue is required in terms of the critical aspects mentioned earlier. More specifically, how each stakeholder could take these aspects into account in their own operations. How they deal with the upcoming concerns and possibilities will vary based on companies' own interests as long as the common guidelines are initiated and new legislation commences to oblige industry practitioners. Actors that could facilitate the discussion between stakeholder groups are needed. *Circular.fashion* is already one of the visionaries achieving this and may have the ability to accelerate the change with its exemplary and committed activities.

This study has pictured the state-of-the-art situation at the turn of the year 2017–2018, and for this reason may only hold value for a limited period of time. Further weakness in the study is the focus only on one specific case. The issues reported may only be relevant for the case in question. *Circular.fashion* is a relatively new consultancy and actor within the field of sustainable design. Hence, it remains to be seen how the *Circular Fashion System* will eventually work out. However, the case brings forth many crucial aspects entailed in operating with all stakeholder groups within the circular textile value chain. It provides valuable information for fashion companies on ways to reimagine the role of designers and the organisation of design practices. As such, it provides an excellent reflection point for further studies on challenges and the latest innovations in circular fashion, but also a case by which to compare changes in practices and industry operations more generally.

Based on this study, several future research directions are suggested. Regarding textile volumes and planning the reverse supply chains, research is needed concerning the estimated flows of the newly designed pieces that fit chemical recycling. A further difficulty remains as to how to share the newest information and developments between stakeholders in the circular textile value chain and how to facilitate dialogue between them. In addition, studies on different solutions and proof-of-concepts are constantly needed to spread the information on best practices to each stakeholder group.

## Conclusions

This case study was conducted to research the evident changes in fashion design practice when moving from a linear to a circular economy. Because of its novel approach, *circular.fashion* consultancy was used as a descriptive case to illustrate how to design clothes that at the end-of-life could be circulated into new fibers. Challenges in the circular textile value chain, as identified in the previous literature, provided the basis for reflection when studying the practices of *circular.fashion*. The description of the company's activities revealed many practical solutions and strategies in accordance with each challenge. Solutions depict the changing landscape of fashion designers' daily work, as summarised below:

- Material choice, material combinations, product construction and surface treatments are the most important factors designers have to consider when designing for circularity.
- Online tools such as the *Circular Fashion System* hold potential in educating designers on the subject and easing their work under pressure of time and price.
- A change in attitude is required on many levels:
  - Innovation exists in the challenges, meaning that designers should expand their creativity beyond the contemporary practices.

- Being dependent on the existing materials (not suitable for recycling) can be overcome by partnering with suppliers.
- Due to rapid technological advances, fashion companies need to prepare themselves for constant exchange with textile sorters and fiber manufacturers.
- Economical viability of collecting and sorting textiles requires changes in design practices, which touch upon the choices of materials, structures and surface designs. These have to be aligned with the requirements of recyclers.
- A reliable identification system like *Circularfashion.ID* can ease the sorting process but requires volumes and multiple companies utilising the same coding system.
- In order to accelerate the change, more real life cases are needed.
- Best practices should be shared openly. Patenting may hinder the change and hence should be weighted thoroughly.

In the case of *circular.fashion*, the designer role extends from design to materials, and finally to recycling processes. Even though material knowledge is part of basic fashion design competence, in *design for circularity*, deeper understanding of material and fiber structures may be required – as well as knowledge of chemical processes or at least the basic idea of their possibilities in fiber-to-fiber recycling. This enables designers to expand their skill set from product design to innovative material *development*. In *circular.fashion*, the designer works also as a coordinator and translator between different fields. In individual company cases, the work requires matching between various aspects: user demands, product functionalities, requirements, strategies, materials, brand identity, etc. In this equation, a fashion designer becomes a matchmaker who plays the key role in textile circularity.

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