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Circularity and Fashion

D | Sustainable Fashion in a Circular Economy

Kirsi Niinimäki

This chapter provides an overview of the circular economy in general and specifically linking circular economy to fashion. While the phenomenon, fashion in a circular economy, is new and emerging, this chapter is an initiative to open some of its many layers, while not providing exact scientific knowledge as such. More so, it tries to show the complexity of this term while also providing some opportunities to change our linear way of thinking towards circularity.

Keywords: Circular economy, circularity, sustainable fashion, closed-loop, systems thinking



VERTAISARVIOITU
KOLLEGIALT GRANSKAD
PEER-REVIEWED
www.tsv.fi/tunnus

Introduction to current reality, linear economy

The textile and fashion industry is one of the largest industrial sectors, which uses a lot of resources and causes a lot of environmental problems. To give an example, globally 20% of industrial water pollution is caused because of the dyeing and treatment of textiles (Kant 2012, cited by EMF 2017, 21). In the linear system this industrial sector uses mostly non-renewable resources “– 98 million tons in total per year – including oil to produce synthetic fibers, fertilisers to grow cotton, and chemicals to produce, dye, and finish fibers and textiles” (EMF 2017, 20). While textile and fashion manufacturing has moved to lower-cost countries on the other side of the globe, so also have many environmental problems. The true value of resources used in industrial production are easily forgotten or subsidized (e.g. clean water, energy, pure soil) and the costs of environmental impacts are not included in the end price of the product. In this way low cost garments can have a remarkable environmental impact in the location where they are produced. Textile manufacturing in particular causes a lot of environmental problems, while harmful and toxic chemicals are used and waste is not treated properly. This causes human tragedies for workers and the neighbouring communities and their environment.

In the linear system (design-manufacturing-sale-dispose) we are wasting valuable materials in huge amounts. Not only materials, however, but also many other resources, for example water and energy needed for manufacturing are wasted if the product life-time is very short. It has been estimated that 80% of all products turn into “waste” and are thrown away within the six first months (Baker-Brown 2017, 11). Garments’ life cycles have also drastically shortened. For example, in the UK, WRAP (2012) has studied that the average time of owning a garment is 2,2 years. On the other hand the amount of impulse-purchased garments has increased, and these kinds of garments might never have been worn (Niinimäki 2011). A study from Finland showed that around 30% of garment purchasing was based on impulse shopping

(ibid.). Some consumers actively seek emotional “highs” by constant purchasing, and this emotionally “addictive” search easily leads to impulse shopping, which seems to have become accepted behaviour in today’s fashion consumption (Niinimäki 2018b). The average number of times a garment is worn has decreased by 36% compared to the situation 15 years ago (EMF 2017). Moreover, the vast amount of garment production results in markets being oversaturated, and not all garments produced actually enter the market anymore. There are different figures for unsold garments, but one estimation shows that even 20% of produced garments will be unsold (Ann Runnel 11.10.2017). For example, in the Netherlands it is estimated that 21 million garments were unsold in 2015, meaning 6,5% of garment offerings (Pijpker 5.5.2018).

WRAP (2012) has produced good reports on clothing consumption in the UK. They have reported that 1.14 million tons of clothes are supplied onto the UK market each year and 1.78 million tons of raw materials are needed to produce these items. From this, around one third becomes waste in the production phase (pre-consumer waste), 10 000 tons ends up as waste during the use time (damaged in the maintenance, e.g. during laundering) and 1.13 million tons ends its life either in re-use (540,000 tons, of which 70% goes overseas), recycled (160,000 tons), incinerated (80,000 tons) or goes to landfill (350,000 tons, worth £140 million).

In the linear model, the material throughput in the system is fast (fast design and manufacturing, fast consumption, easy disposal) and this fast tempo is also setting the model for the fashion business and its means of pursuing profit. McAfee et al. (2004) highlight that garments are not made to last for long in the current linear system and most of our garments are designed to be laundered only 10 times. Such is the new “norm” in the fast fashion business. But we also have other problems than waste in the fashion sector. There are consumers who buy new fashion items every week (Morgan & Birtwistle 2009) and fashion has become easy entertainment or a kind of fashion “hunt” for some consumers (see Armstrong et al. 2015, Niinimäki 2018b). Because of this intensive consumption and impulse purchasing our wardrobes

are full, and therefore many garments in our wardrobes are not in active use. Around 30% of clothing in wardrobes have not been worn for at least a year, according to a study by WRAP (2012), and Fletcher (2008) further estimates that up to 70% of our wardrobe content is in inactive use. This ends up as a huge unused resource and wardrobes full of disused garments.

While the linear model results in an oversaturated and oversized fashion system with big environmental impact (Armstrong et al. 2016), it is imperative that we develop better use of resources and change the system. We have to create a better balance and use all resources more wisely. Closing the loop and building a new understanding of how fashion can be redesigned in the context of a circular economy and can be more sustainable is the goal of this chapter.

Circular economy

A Circular Economy (CE) is regenerative by nature, based on principles of closed loops. A Circular Economy CE, is not a new concept. It originates from Walter Stahel's report "The potential for substituting manpower for energy" from 1976, presented to the European Commission (Baker-Brown 2017, 10). It presented the idea of an 'economy in loops', with the positive impact to increase jobs: "economic competitiveness, reduced dependence on natural resources and the prevention of waste" (ibid.). This idea was further developed by McDonough and Braungart in their concept 'Cradle to Cradle' which is a well-known principle for closing the loop in two different cycles; biological or technological (2002). According to this principle, a product is designed to have multiple life cycles or to be biodegradable. Accordingly, after the use phase, the product will continue in technical or biological cycle.

A biological cycle means composting, which, however, is not a realistic option for textiles while only a few fibers can be composted and while textiles include harmful chemicals which should not be released into the soil. Moreover, composting produces methane, which

contributes to greater greenhouse gas emissions and global warming (Niinimäki 2013), and even the nutrient value from textiles to soil is low. Furthermore, textiles, even bio-based, compost too slowly to be suitable in the municipal composting system and therefore should be composted in home-composting units. In the fashion sector, therefore, closing the loop is more likely to happen in a technical cycle (using textile waste to produce new fibers and yarns). Nonetheless, some of the latest experiments reveal the potential for using the biological cycle as one solution in the textile sector. For example, some Cradle to Cradle Certified garments have been developed to be compostable (see EMF 2017). On the other hand, a more interesting option is to combine these two cycles and use biological processes to some extent in order to process textile waste to be suitable for the next round of manufacturing within the technical cycle (producing new yarns). For example, while separating fibers in blended materials, biological composting can help, for example, to destroy bio-based materials from blends, and in this way polyester can be separated and used again in the recycling process (Yao 22.3.2018).

A circular economy approach in fashion aims to develop a more sustainable and closed-loop system where the goal is to extend the use-time of garments and maintain the value of the products and materials as long as possible. This means that all materials will be recycled in several rounds. Products are designed to be included in a system where all aspects support circularity. The original design needs to take account of several lifecycles. Materials need to flow within the system and waste needs to be collected and appreciated as a valuable material for recycling and material recovering. All products need to be collected back after their useful time is over. Policy measures could push the development towards this path by implementing Extended Producer Responsibility EPR principles (e.g. Niinimäki 2013; OECD 2001). Accordingly, moving towards a circular economy means taking a system perspective on fashion, where all actors are included: designers, producers, manufacturers, suppliers, business people and even consumers. A good model for the fashion sector is presented in Figure 1. This model was constructed by RSA (Royal Society for the Encouragement of Arts, Manufactures

and Commerce, “Great Recovery” programme 2013). The model constructs a four level system. The first includes consumer behaviour, and its goal is to extend the product use phase. The second includes companies and new kinds of business models (e.g. Product-Service Systems PSS) to extend or intensify the use of products. The third challenges manufacturers by bringing in new ways to extend the use-time of the product through remanufacturing. The fourth level concentrates on material recovery, using waste to manufacture new fibers and yarns. This is the most interesting level, and a lot of new development work is going on in this sector looking at how to use textile waste as a source for new fiber production. Notably, this model also includes key stakeholders who are needed to enact the transformation towards circularity. New kinds of collaborations are needed to get everyone onboard. Designers, researchers, industry, companies, users and policy makers are all needed to create a new network and a new system.

The next section presents the key concepts for circular economy. The text includes some business examples in parentheses, from businesses which have succeeded in offering some interesting developments relating to a certain aspect of CE.

Focus on use

As Walter Stahel puts it, the optimization of use or utilization of manufactured objects, is at the core of the circular economy, and not the term ‘cycle’ as one might have expected. This distinguishes the circular economy from the linear economy, which optimizes the production of the same objects up to the point of sale” (2017, wiii). Extending and intensifying the use, reusing the same object in a new context, and innovative reuse are some of the ways that shift use to the centre of circular thinking. This is a new challenge for industry, business and designers, but also for consumers, who need to critically consider their own consumption practices. We have to create a new consciousness towards the use of clothing and introduce new practices for using our clothing

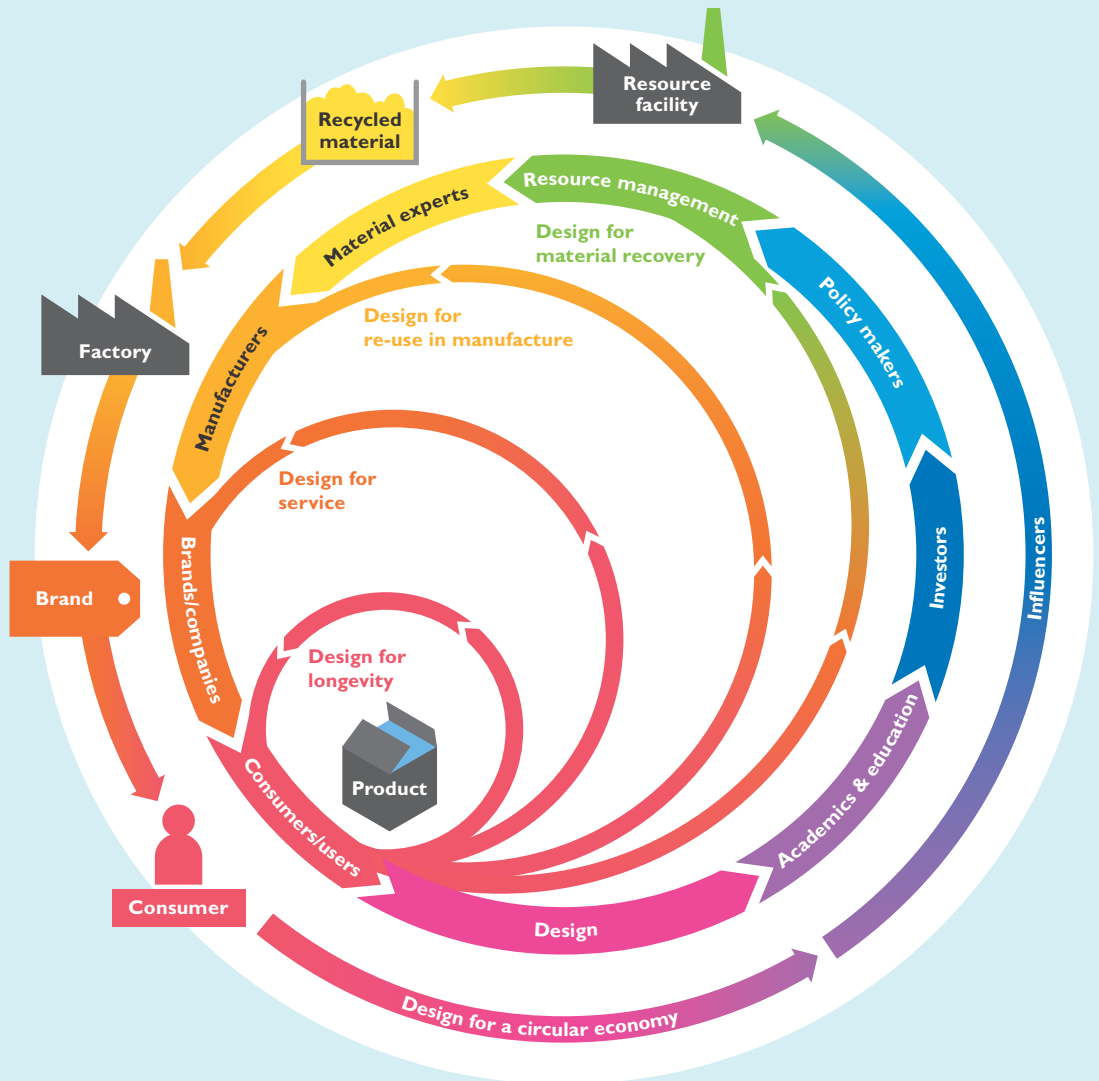


Figure 1. The Four Models of DCE, Design in a Circular Economy (RSA 2016).

longer, maintaining it well, but also investing in a smaller wardrobe with less content. The concept of a curated wardrobe is based on the need for wiser purchase decisions whereby each garment is seen as an investment, and thus wardrobe content is constructed slowly (e.g. Filippa K). The smaller content but smarter collection of clothing choices in a wardrobe provides an alternative approach to fast fashion consumption.

New business thinking

Extending the use of clothes is one key issue in sustainable development. For example, if we can double the use-time of clothing we can halve the resources needed for production and halve the waste rates of consumption (Stahel 2017). This would be an important improvement upon current unsustainable fashion consumption and the early disposal of clothing. Some examples already exist of how garments can be rented or leased (e.g. Mud jeans, Lena fashion library, Vaatepuu) or brands that offer free mending services to extend the use-time of garments and, simultaneously, to emotionally satisfy customers but also to strengthen brand value (e.g. Nudie jeans). Patagonia even offers returns with an ‘Iron Clad Guarantee’, offering a replacement or mending service if a product does not last as long as expected (EMF 2017). Product-Service-System PSS models can provide a new focus for fashion companies. Here, the focus is more on use and product utilization than on selling the product. Such services create the possibility of providing new value propositions for consumers. For example, through a more individual, customized or made-to-measure design service a better fit – for both mind and body – can be provided (e.g. Anna Ruohonen).

Circular economy means adopting a new, more strategic and future-oriented mindset in all aspects of a company’s activity. While in the linear model it is easier to focus on a narrow core, in a circular economy the core has to be in the lifecycle, use, and regeneration of products and closing the material loop:

Sourcing from return chains, growing presence in used product markets, creating value from any waste materials along the value chain and maintaining deep involvement with products in use are just some of the strategic shifts companies make to evolve to a circular model. Companies have to think beyond the traditional core and build an ecosystem of partners that operate and monetize the entire product lifecycle (Lacy & Rutqvist 2015, 149).

Enabling technology and grass root activities

Information technology, IT, provides us with new ways to track the origin and flow of material (Webster 2017). Transparency – the origin of the product – could be increased through the help of new technology. RFID codes (or yarn including the same information) could include information about the fiber content of the garment and could also inform about suitable recycling technology for the garment and its materials (EMF 2017).

Online services can provide possibilities to open out the production path behind the garment towards consumers (e.g. MADE-BY). Cloud services can also help the producer to make the right sustainable choices along the way. For example, *makersite.net* provides tools for teams to work with sustainability issues along the production chain and to calculate the best choices through LCA (life cycle analysis).

Reverse Resources (2017) has constructed a future view for the mass manufacturing garment industry and propose an open data system for all material leftovers. If this is done together with an alternative pricing system, factories could facilitate virtual traceability of material resources and create “virtual interconnections throughout the supply chain. ... This is crucial for building an effective circular economy as well as supporting many digital solutions of industry 4.0 globally (e.g. blockchain-based transparency)” (ibid., 22).

IT also provides new ways to reach the consumer and do business by engaging consumers. Crowdfunding could be one way towards



Figure 2. Swapping events organized by students in Aalto University, Helsinki (posters by Manuel Arias Barrantes).

sustainable fashion. Through crowdfunding, users can invest in a project they want to see implemented and the process aided by social media platforms (Kretschmer 2013, 186). Designers can sell a small collection, for example, specially made from sustainable and high quality, durable materials and produced locally. Through a crowdfunding campaign, a designer can sell the collection before it is produced, thereby avoiding surplus production (Anna Ruohonen has used this strategy). This ensures and stabilises the way of doing business. Crowdfunding also provides a channel for cooperation between designers/companies and users and thus can open “a shorter and more regional value chain” (Kretschmer 2013, 186) within the global and complex fashion system, which is otherwise not easy to control.

As Webster points out (2017, 103), “a circular economy is not primarily about technical materials and recycling/recovering them while moving to renewables. It is a different way to see the economy which includes the material but is not limited by it.” All kinds of activities are welcome in a circular economy and grass root activities can be influential or at least offer alternative business examples. A sharing economy can include activities like cooperation, sharing, flexibility, lending, giving, and gifting. For example, new IT enables services/platforms to be built, which can be used by anyone to provide repair or swapping services. A sharing economy can lead to collaborative consumption enabling consumer-to-consumer activities (see Figure 2 of a swapping event as a student activity in Aalto University). Peer-to-peer-based activities can provide new ways to access goods or services or can offer a platform for a business in second-hand garments, for example. This ‘two-sided market’ between consumers is happening through platforms created and run by third parties (Webster 2017; Hamari et al. 2015). Examples of this are the websites Zadaa and Emmy, where anyone can sell their garments.

Technologies can even create social interaction around these activities. Through the help of IT, a community can be built in which new forms of collaboration can happen, even face-to-face. Good examples of this are mending or knitting clubs. These communities can educate consumers to extend the use time of garments but can also enhance social wellbeing, providing emotional satisfaction which can even replace some of the emotional effects of fast fashion consumption (Hirscher et al. 2018). ICT examples lead to new ways of developing a sharing economy and also demonstrate ways towards a new kind of business thinking. As Webster (2017, 106) highlights: “The IT revolution is enabling circularity and the rethinking of materials, energy and credit flows. It is also one key to rebuilding social capital, social networks.” It also provides opportunities to act and operate on different scales (local, block-based) or combine different actors (e.g. companies and consumers) in a new kind of collaboration showing new alternatives for large business operations.

Dealing with and recovering waste

Lacy and Rutqvist (2015, 119) divide waste into four different categories. The first is **wasted resources**, where all materials and also energy are entirely lost if the product cannot be continually regenerated. The second is **wasted lifecycles**, where products have artificially short lifecycles, and might even be disposed while they are still functional; a phenomenon called early disposal. The third category is **wasted capacity**, where the full potential of the product is not used, seldom use for example. The fourth category is the **wasted embedded values**, where all resources and materials from the disposed product are not recovered and put back into use.

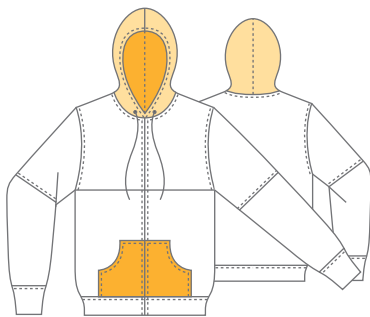
There exists a lot of both pre- and post-consumer textile waste, as explained earlier in this chapter. Reverse Resources (2017) found out that up to 25–30% of textile material is lost from the supply chain during fabric and garment production. This pre-consumer waste is mainly from cutting and mill waste and does not include the larger leftover materials (deadstock) from when the production season is changing. Reverse Resources have created a totally new way of using larger leftover pieces of fabric from the range of 18 inches to 5 yards as well as introducing deadstock fabrics back into mass scale production. This new strategy of using leftovers is a creative example of remanufacturing (the process of using leftover fabrics in mass-production). They approach the problem through three different design strategies. Firstly, **invisible remanufacturing**, where leftover fabrics are placed in internal sections (hidden details). Secondly, **visible remanufacturing**, where leftover fabrics are placed on external sections of a garment (visible details). Thirdly, **design led manufacturing**, where a designer takes into account a specific waste stream and uses that while designing a new garment. Here, the waste fabric has a strong influence on the aesthetic of the new garment (Runnel et al. 2017). This approach does not need big investment in technology but challenges the current way of designing and manufacturing on a mass-industrial scale. As Reverse Resources

highlight (ibid. 2017, 16), “remanufacturing is particularly interesting because it could be the key to creating the economic incentive for transparency. ... But making data on leftovers and creating transparency is the critical key to unlock effective circularity of material flows.”

Post-consumer waste can be recycled using mechanical, thermal or chemical recycling methods (see chapter 9). In mechanical recycling, material is selected, cut, shred, carded and spun into new yarns (e.g. Reblend, Purewaste). With this process, the quality of the yarn is not as high as with virgin materials and very often some virgin materials are added to keep the quality sufficiently high. Through the chemical or thermal recycling process, the material is returned to polymer level by dissolving it, and thereafter the fiber is regenerated (or reproduced). Unfortunately, a lot of recycling is down-cycling, meaning that the value of the material is lost (at least at some level) if the recycled material or

VISIBLE REMANUFACTURING

– using leftover fabrics on external sections of a garment



PRODUCTION OF 10 000 OF THESE HOODIES WOULD:

- Save 2843 yards (17%) of virgin fabrics
- Avoid 0.88 tonnes of fabrics from being spilled
- Saved 7827 kg CO₂

Hoodie specification drawing & marker plan

- Visible remanufactured fabric pieces
- Invisible remanufactured fabric pieces
- Virgin fabric
- Amount of saved virgin fabric

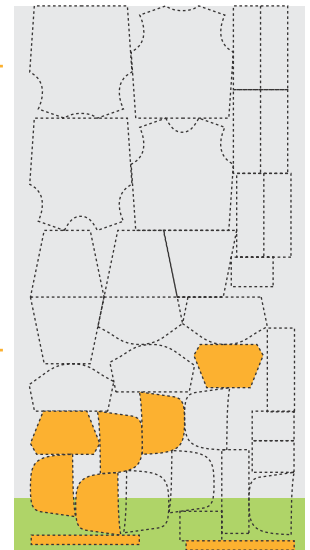
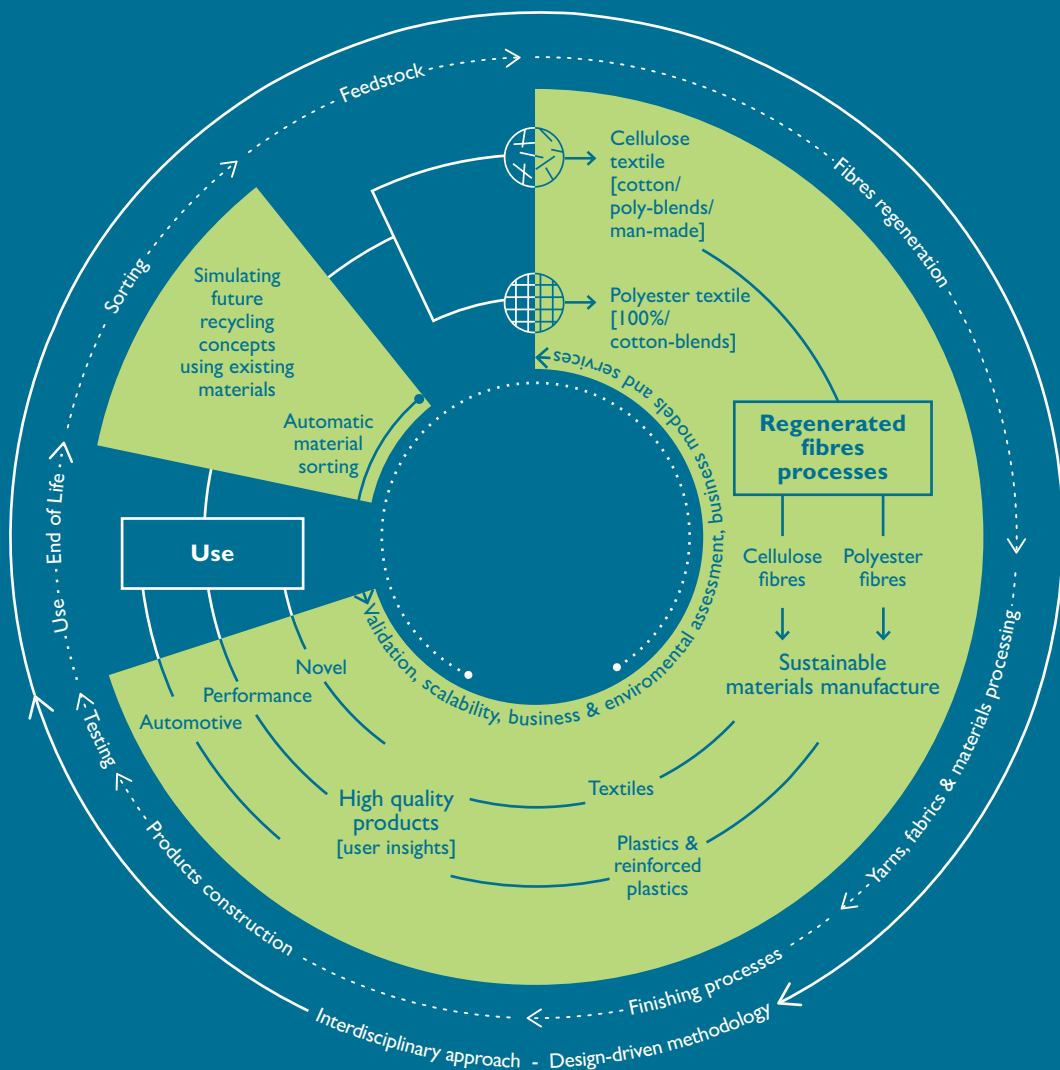


Figure 3. Visible remanufacturing by Reverse Resources (Runnel et al. 2017, 15).

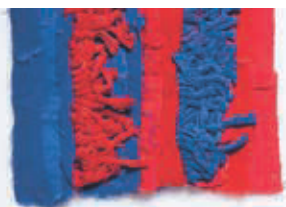
product is of a lower value than the original (every frequently-recycled textile material is down cycled for filling purposes only). Recently, a lot of development work has been done to construct different technologies to be used with different waste fibers in the mechanical or chemical recycling process. New technical and system innovations are needed to use the waste as a valuable resource within manufacturing. New material standards and testing methods are also needed as more and more waste is remanufactured into new fibers, yarns, textiles and clothing. Safety issues are critical when textile waste material includes different kinds of chemicals, some quite harmful. In addition, new inventions are needed to totally close the loop and to recycle not only materials but also the chemicals in the textile materials.

A good example of multi- or even interdisciplinary collaboration is the T2C Trash-to-Cash project, by which new material and product opportunities are developed via creative design from textile waste or process by-products. With collaboration between 18 diverse partners from 10 different countries – from design research, material science, market research, and industry – this Horizon 2020 funded project aims to reduce the utilization of virgin materials, improve material efficiency, decrease landfill volumes and energy consumption, and foster design for recycling with the vision of closing material loops. The waste used in T2C is cotton, polyester, cotton-polyester blends and recycled paper board, and the aim is to develop technical innovations to make use of these waste streams while producing high quality materials and innovative design products. The project is based on wide collaboration between different knowledge areas, and the focus is to challenge the current linear system towards circularity. The project is based on three iterative cycles throughout the 3,5 years and on open knowledge

Figure 4. Closing the material loop. Green lines present the research areas in T2C project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 646226.



TRASH
2
CASH



sharing between disciplines. At the end, product design concepts and prototypes are constructed in a co-design setting and are evaluated through the following aspects: circularity, LCA, and innovation potential (see the results from <https://www.trash2cashproject.eu/>).

One technology used in T2C is Ioncell-F, which is a chemical recycling method for cellulose fibers (Sixta et al. 2015; Aalto University 27.10.2015). The process uses environmentally friendly ionic liquid, which is an alternative to the solvents currently used in man-made cellulosic processes (viscose production). Ioncell-F technology converts wood into textiles or textile waste or paper waste into new fibers. It is an alternative to virgin cotton production or viscose production. In addition, the process has the potential to revolutionize recycling of textile waste, turning waste cotton into upcycled high-quality, high-end fiber.

Aalto ARTS contributes to the project through the development of design methods for interdisciplinary collaboration, defining new material attributes and making the first prototypes with recycled yarns, defining principles for design-for-recycling and constructing a methodology for a design-driven material innovation process. (For interim results, see, Smirnova et al. 2016; Niinimäki, Tanttu, & Kohtala 2017; Niinimäki, Tanttu, & Smirnova 2017; Tanttu, Kohtala, & Niinimäki 2016). The project is multidisciplinary by nature, aiming even for interdisciplinary collaboration and defined as a design-driven process. This chosen strategy means that creative and collaborative methods are used throughout the process. While traditionally, innovation processes are driven by technology initiatives, here the creative aspect of the design is given the role of forerunner within an interdisciplinary collaboration to enhance new perspectives in knowledge sharing. Design methods created the grounding and the “glue” for three different streams within the project: Design Research Stream, Science and Technology Stream, and Manufacturing Stream, in order to work towards the same objective

Figure 5. Eugenia Smirnova's tests on colour recycling from textile waste (photo by Eeva Suorlahti).

and achieve the best results. During the project, creative design methods for interdisciplinary material-based and collaborative research have been developed. A design-driven approach can challenge the traditional technology-driven innovation process by bringing in new, unexpected elements, combining different knowledge flows or challenging the traditional way of realising invention in the material sector (Niinimäki 2018a). A good example of this is fashion designer Eugenia Smirnova's MA thesis (Smirnova 2017), in which she collaborated with material researchers, worked in their lab to get to know the process and began to question, what might happen if colour was recycled and not only fiber. Based on this idea and colour tests she constructed a new concept of a colour library; how designers will work in the future, a future where all fibers are recycled, and colours are kept throughout different lifecycles, while closing the material loop (Smirnova 2017).

New technologies for using textile waste are being developed, creating new challenges to the original garment design while considering the end part of its lifecycle, e.g. the fiber content in the garment. The sorting of different textile waste materials is an important phase while recovering waste. Unfortunately, a lot of fashion items are made from blends, very often from 3–4 different fiber types, and this combination might prevent their recyclability. Also, the information about fiber content is not always correct, which also prevents garments from entering certain recycling processes. Recently, an automatic sorting system using robotics has been tested with textile fibers (e.g. in Trash2Cash project). New kinds of sorting plants for textile waste have also been established, with one new plant planned to be built in Southern Finland in the near future.

More creativity and collaboration are needed

Redesigning materials, systems, and products for circular use is a fundamental requirement of a circular economy and therefore represents a giant opportunity for companies, even in product categories that aren't normally considered innovative (Nguyen, Stuchtey & Zils 2014, 15).

“Design is a key to circular economy” says Ken Webster (2017, 66). He further quotes Nigel Cross, the leading researcher in design thinking, “scientific problem solving is done by analysis, while designers problem solve through synthesis” (ibid. 66) and he links this approach to a wider system perspective. While we need the system approach for CE, designers can help to navigate through “complex interactions, iterations (feedback) and uncertainty” highlights Webster (ibid.). Designers can in fact use their creative skills to enhance collaboration between different knowledge areas (Niinimäki 2018a), to build new networks and connections between different stakeholders and to push the boundaries between different disciplines (Niinimäki, Tanttu & Kohtala 2017). Moreover, the choices made during the initial design phase determinate if the product is possible to recycle and therefore is it suitable for several lifecycles. Moreover, the PSS; Product-Service-System requires a new approach to product design, while here the focus is on utilization and use, focusing on fulfilling users’ needs in more creative ways, not the product design or manufacturing alone.

But not only design creativity is needed to transform existing challenges to opportunities. We need more creative thinking in business, industry and technologies. We need to construct experimentation concerning how different business models could work with services, different profit-making logic, and with new practices at different levels (micro and macro, local and global). Businesses have to think how to best create stronger brand value in the context of sustainability, which could be used even in the second-hand market, how high-quality brand clothes could have another “business cycle” as second-hand clothes

(e.g. Filippa K, Emmy). Business has to think about how to create new profit-making possibilities from services (e.g. Vigga or Mud jeans and leasing cloths), from extended product lifetimes, or from reuse or recycled strategies in fashion. In this regard, a more experimental economy is needed, i.e., an economy which is based on circular experimentations and forerunner companies.

Also, new kinds of networks are needed. Networks which combine different stakeholders, different knowledge areas and which boldly begin to challenge the linear model and think things differently. There already exist good examples of what this kind of networking can best achieve. Furthermore, policy makers are needed for this work to solve the question of what would be the best way to invite (even force) companies, industry and consumers into this transformation process. As Sanders (2015) puts it, collaboration is the key for a successful outcome in complex problem settings. “Collective creativity refers to acts of creativity that are experienced jointly by two or more (and sometimes even crowds of) people” (ibid. 296). Complex sustainable issues like circular systems need to be approached through a collaborative, experimental and creative mindset to be able to find solutions together. “The only way we will be able to address the important challenges we face today is to do so collectively. Collective creativity can lead to relevant and sustainable innovation” (Sanders 2015, 298). In the best creativity can be used to challenge the whole industry, the way we design, manufacture, do business and consume fashion. We have to align creativity and innovative economy in the context of circularity. Here I want to quote Infinited fiber company and their statement of values which they think can help facilitate the BIG change.

Values:

Innovativeness: The more brains the more change

Openness: Together we will find affordable solutions

Solution oriented: We want to put all in

(<http://infinitedfiber.com/strategy-2/>)

Strategic design and innovation in a CE context

As Kretschmer (2014, 181) highlights in the context of sustainable development, design has to move from the “beautification and improvement of products” towards a wider perspective and system thinking, that is, strategic design. Systems approaches do not remain at the product design level only but widen the design aspects towards cultural aspects (cultural transformation process). Understanding sustainable innovation through this way extends the design process from products to “human needs, to ways of satisfying them, and, if appropriate, to transforming them into artefacts. Accordingly, sustainable innovation includes societal system innovation, usage innovation, organizational innovation etc.” (ibid. 182). Kretschmer further argues that product innovation alone might not be the best solution to a certain problem in the context of sustainable development. He further proposes that new knowledge is needed at the front-end stage of innovation to find the right focus for the innovation, which might not in fact be a new product.

In the linear economy, design has been used to keep the consumption rates high. This has to change in the CE context, and material throughput in the system needs to slow down. Even if the waste can be handled differently in the future, a CE approach cannot give permission to maintain unsustainable fashion consumption rates at the current level. Fashion consumption needs to transform. “The commonly accepted role of design as a cheap resource of ideas, as a profession of beautification, and as a powerful marketing ‘tool’ must therefore be questioned seriously and urgently” (Kretschmer 2014, 183). If the industry continues on the traditional design path, it will lose the potential of creative thinking to change its business assets towards a more sustainable future. More creative and strategic design is needed to build a sustainable product culture which takes into account, and more importantly leads towards, sustainable fashion consumption practices even in a CE context.

Design principles in CE

Good stuff is durable, made from locally sourced, sustainable materials, is repairable, fit for purpose and dismantle-able (thus easily up-cycled or recycled). It has a valued purpose (not just a fantasy-advertising-based, flash-fashionable appeal). Let's make stuff remarkable again. Meaningful. Special. (Fletcher 2017, 19)

This quote from Cat Fletcher (2017) highlights the key issues in design for circularity. We have to change our current and familiar design strategies while working in the context of a circular economy. We have to create new strategies for designing with quality and life cycles in mind. We have to be able to design for several life cycles and these different cycles need to be included with the design solution of the original product. We have to focus on creating something more meaningful and special for the end user. Something that they are ready to fall in love with, keep long, cherish and take care of (e.g. Niinimäki & Koskinen 2011; Niinimäki & Armstrong 2013). We should avoid designing disposable products, or alternatively we either have to find ways to effectively produce them from eco-materials or recycle them into new textile materials with low environmental impact. The best new design is included into the new business model which focuses on use and providing value through deep satisfaction in utilization, not only on easy profit via a single sale.

Based on the earlier discussion, the following design guidelines for a circular economy have been constructed in Table 1.

The list starts from the designer's daily practices and more traditional design tasks, such as dealing with style, quality, and the aesthetical aging of materials or styles. Then the list moves to include the users' world, how to trigger the user to extend the lifecycle of the garment, how to intensify the use or how to include the service aspect within the design and business concept. In this way the emphases upon the circular system is included. We need to use recycled materials more and also think about the product's recyclability. The work of designers moves towards the

Table 1. Design guidelines in a CE.

DESIGN	KEY STAKEHOLDER	IMPACT
Design for quality and long-term use	Business, Users	Extending the lifecycles, aesthetical aging, product satisfaction
Emotional Design	Users	Slowing consumption through deep product satisfaction and person-product attachment
Design for easy repair, reuse and redesign	Business, Users	New business models (e.g. services)
Design within new business models (e.g. swapping, second-hand business, PSS, renting, leasing)	Business, Users	Extending or intensifying the use
Design from recycled materials	Industry, Business	Creating demand for recycled materials
Avoid harmful, toxic chemicals and substances	Industry	Supporting CE system
Design for recycling (easy disassembly or made from mono-materials, recycling all materials and chemicals in a closed loop manner)	Industry, Policy	Creating CE system
Design for transformation	All	New paradigm

future and because of that towards more intentional design. “The intentional design space points toward the future. Design embodiments that emerge from an exploration of intentional design space include organizational transformation, behaviour change, and/or social transformation” (Sanders 2015, 298). This aspect creates new challenges for design skills, because we have to design for a larger scale or with a view to a longer future, to construct the transformation towards a circular system as a

whole. Here more strategic thinking is needed and also large-scale collaboration needs to be achieved. In the CE context, including systems thinking and new collaborations, changes fashion design and the role of the designer becomes a knowledge-intensive profession, more so than if it merely emphasized aesthetic or functional outcomes.

Impact

One focus in the circular economy is to support activities in more local and regional contexts than in the linear economy. Waste is best handled locally rather than by being transported long distances to the other side of the globe. Reuse, updating, and modification can be achieved more flexibly within close distance, and in this way such activities support the local economy. The new sharing economy (e.g. swapping) needs local actors and local communities to create a viable new economy, even a block economy.

Investing in and creating local actions intensifies the use of labour. Many of the activities within the circular economy are labour-intensive and can create new boosts in the micro- and also macro-levels of the economy (Stahel 2017). “By rethinking the way we produce, work and buy, we can generate new opportunities and create new jobs”, has been stated in the EU’s Circular Economy Package (EU 2.12.2015), giving positive futures a path to follow. WRAP predicts that change towards

Table 2. The effect of extending the use time of garments (WRAP 2012, 23).

EXTENDING THE USE WITH	CARBON SAVING	WATER SAVING	WASTE SAVING
10% = 3 months	8%	10%	9%
33% = 9 months	27%	33%	22%

circularity could generate up to 3 million new jobs in the EU by 2030 (WRAP 2015).

Circular thinking (extending and intensifying use, reuse, redesign, recovering waste) uses fewer resources, and preserves the water and environment, ending up in low-carbon use, less use of energy and fewer virgin materials, making circularity, therefore, more ecological than industrial processes in the linear model (Stahel 2017). WRAP (2012) has calculated the effect of extending the use time of garments. According to WRAP the average lifetime of a garment in the UK is 2,2 years. From the figures in Table 2, we can see that even a slight change in consumer behaviour can have a big effect. For example, 9% savings in waste means 150 000 tons of waste in the UK alone.

Conclusions

Circular economy is an emerging phenomenon which will totally change the fashion system. Companies and designers at the forefront will be leading the transformation of the fashion industry. On the other hand, individual designers, small companies and even grass root initiatives can show the alternative ways towards more sustainable futures. There already exist examples of how to design, manufacture or do business in the context of CE. Policy and legislation are tightening, at least on the European level, and companies who are prepared for this can lead the way towards the CE business and CE society at large.

When constructing a new understanding of the circular economy, all levels need to take into account; consumption, design, business, industry and waste management. This needs a systemic perspective and tight collaboration between different stakeholders. On the other hand, new understanding and new networks open different business and design opportunities. It can be summed-up that the transformation towards circularity needs creativity, new way of thinking and acting, new networks, large collaboration and brave experimentation.

Companies mentioned in the text

<http://filippakcircle.com/>
<https://global.makersite.net/>
<http://infinitedfiber.com/>
<https://mudjeans.eu/>
<https://store.emmy.fi/>
<https://vaatepuu.wordpress.com/>
<https://vigga.us/in-english>
https://www.annaruohonen.com/fi_FI/
<http://www.lena-library.com/>
<http://www.made-by.org/>
<https://www.nudiejeans.com/>
<http://www.patagonia.com/ironclad-guarantee.html#searchterm=guarantee>
<http://www.purewaste.org/>
<http://www.reblend.fi>
<https://zadaa.co/>

Some interesting information on the web

WRAP Love your clothes -campaign
<https://www.loveyourclothes.org.uk/>
Circular Fashion
<https://circular.fashion/>
Circular Fashion Network
<https://circularfashion.com/>
Cradle to Cradle products
<https://www.c2ccertified.org/>
Fashion positive materials collection
<https://www.c2ccertified.org/fashionpositivematerials/>
Close the loop, a guide towards circular fashion
<https://www.close-the-loop.be/en>
EMF Ellen MacArthur Foundation, *A new textiles economy: Redesigning fashion's future*, https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report.pdf

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