Closing the Loop

Design Guideline for Recycling

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A Pilot Design Guideline on Recycling for

Students and Emerging Designers

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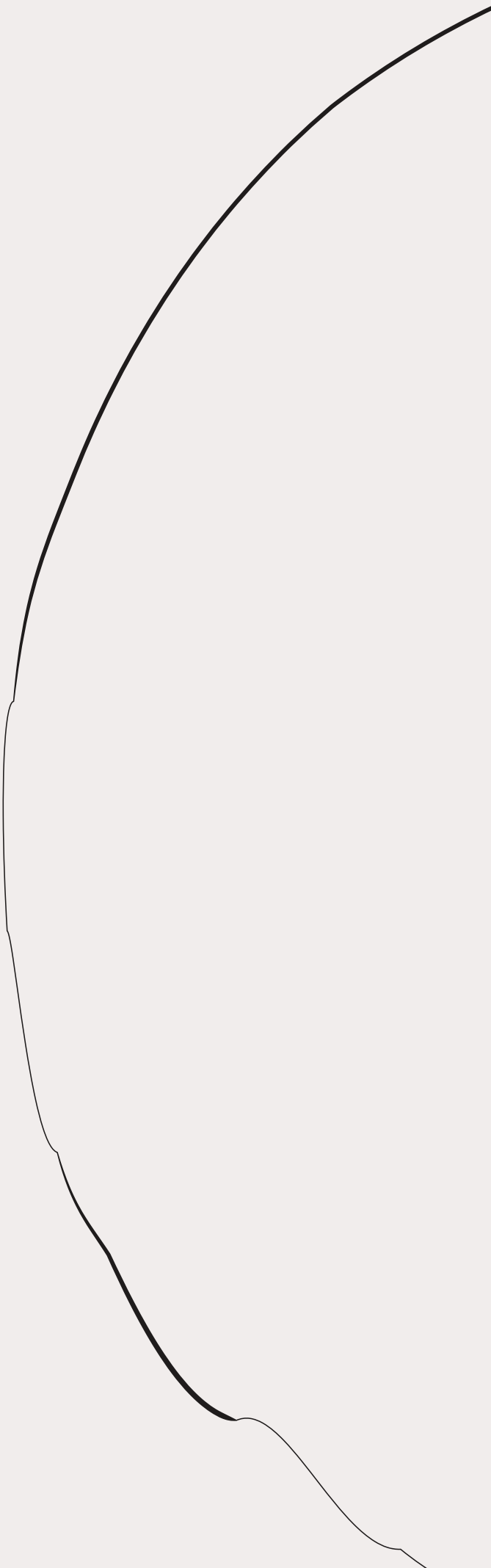

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Closing the Loop

Foreword

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Fashion designers have the unique opportunity to change the way products and materials are made, used and disposed of. As carriers of change, they are able to positively contribute to environmental and social impacts, re-utilising products and materials that will be part of the future of closed-loop systems. In order to do so, it is crucial these creative makers understand the complete life-cycle of the textiles and products that are being utilised in practice. Designing extends beyond the product; it involves people and society. If designers are more knowledgeable on the design and production processes, they can better carry out influence that will affect the future of fashion and consumption. This is a responsibility that is increasingly felt by fashion brands in general, however the added value of recycling as a business case still remains to be considered, in which reduction of impacts is felt across the entire supply chain of a product. Recycling should be seen as part of a bigger calling, deriving inspiration from nature which is based on ecosystems and cycles. Herein, designing is done for the benefit and good of people and the planet, narrowing the link between the makers of the clothes and the people who wear them. This instills a method of thinking in systems. The purpose of this pilot manual is that it paves the way for innovative and environmentally conscious products that reflect a philosophical and practical approach to recycling and sustainability in general.

Content

From linear thinking to collective creation and flexible ways of designing.

1.0 Introduction

Facing terms with fashion being one of the most polluting industries world-wide, the surges in textile recycling technology has opened a scope for (young) designers in their design practice.

The huge amount of garments that are discarded throughout the global fashion industry are generating a lot of waste. Up to 65% of the clothes that are disposed of go straight into land-fill according to TedResearch (TED n.d.). Because of this immense contribution to pollution, fashion also contains the extraordinary means to change this problem. The world has enough garments in circulation, and designers should seek the inspiration and willpower to make what already exists last longer to promote positive environmental and social change. Designing for longevity becomes an important notion for designers to adhere to, in which products are made to be made again. But maintaining the products at the highest value whilst reducing waste is a challenge, as well as diminishing the environmental impacts of production and consumption along with it. As an incentive to actively participate in the circular economy, this pilot for a Design Guideline on Recycling has been developed to encourage the act of recycling in various stages of a fashion product's life-cycle. At the same time, it intends to facilitate and ease the difficulties found when it comes to designing for recycling. The ideal scenario centres on merging the economic profit with the ecological and social profit of designing a fashion product.

Touching on a practical and philosophical notion, the research conducted for this guideline offers various approaches to what designers can do to prevent this obsolescence. With the apparel industry now consuming around twice as much fibre as it did 25 years ago, this industry has a major impact on environmental, social and ethical grounds. Recycling enables the usage of old products to feed new ones, whilst ensuring that the expiry date of a product is prolonged.

Embodying a circular process in the making of the products, yet still attain a level of commercialism as well as aesthetic feasibility can often be a challenge. There are difficulties in the recycling process already at the initial stage of a supply chain, and in order to come to innovative solutions it is vital designers do their part as well. When designers include efficiency and durability in their design ethos, the products can be designed to be made again and in turn align with the principles of a circular economy (Ellen Macarthur Foundation, 2015). When designing to close the loop, the design and production methods should have a positive effect on the consumer and the surroundings, with minimum impact on the environment. By adhering to these principles, a lot of waste can be avoided by re-using the garment at the end of its first life-cycle which results in more life cycles to follow. According to Quinn,"The concept of life-cycle textiles is inspiring a new paradigm of manufacturing processes" (Quinn 2015). It is not only relevant for designers to understand the impact their material choice has on the garments' recyclability, but also the role they play in the future of fashion and the negative implications waste materials have such as for example recent documentary RiverBlue (2015) portrays. Often the knowledge in how the material is processed is missing and makes it difficult for designers to calculate the environmental impacts of their products. Whereas in a circular economy, all of this becomes more transparent because the know-how of where the fibres and fabrics come from is clear from the start.

A circular economy is a continuous cycle of development, in which the products, components and materials are designed so that they can be restored and regenerated.

(Ellen Macarthur Foundation 2015)

Education in Fashion still projects an immense gap according to Lidewij Edelkoort (Tomas 2016), in which she highlights the lack of textile making by students themselves. She reflects on the defiance of previous systems that are no longer functioning nor viable in the future of the fashion industry, strengthening the need for new systems, rules and content. Given the absence of information and knowledge on the technical insights into recycling for design purposes, it becomes imperative for students and emerging designers to work collectively with other bodies of knowledge such as technical institutions and recycling companies. It comes down to thinking in circles as a community, by creating connections whilst closing loops. When adopting collective design methods, a design practice is treated as an ecosystem in which everyone benefits from. The textile industry still proves itself to be extremely conservative which should drive young designers to explore and experiment more in the recycling realm. It is important that a designer is generous with the acquired knowledge through his/her practice. In this manner, recycling in and for design becomes a journey, not a destination which builds up on previous knowledge merging with new technological feasibilities as well as innovations.

“We are turning into a collaborative society. Today, students share clothes, transform clothes, they do things in new manners… My vision is to motivate young people to rethink, reinvigorate, and reinvent what textiles are, and propose new ideas to the society through textiles.” – Lidewij Edelkoort

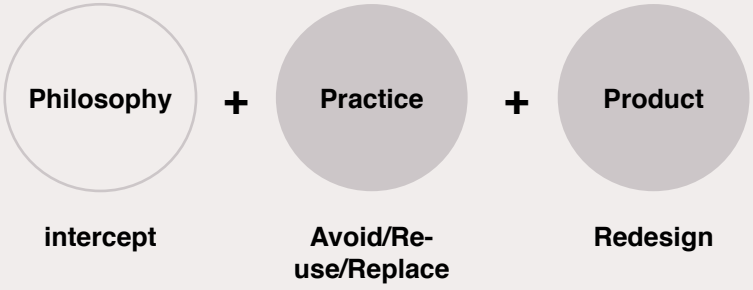
(Tomss 2016)

“We have to lead designers the way and through education - any designer can work with recycled materials if he/she wants.” – Anton Luiken

(Luiken 2016)

As a designer, it is of importance to contest against the damaging consequences of mass-production. Assuming that sustainability acts as an umbrella under which recycling is stemmed from, we should treat our design practice in a way that has a benefit for the environment, for society and offers commercial viability. These three factors should not be seen as mutually exclusive. Ultimately, it is about finding equilibrium between economic and environmental sustainability in the design practice. This bridges 3P’s in which recycling can be manifested: Philosophy, Practice and Product. Regarding these three pillars, this manual brings to light the practical challenges and solutions which designers inevitably face in recycling matters. As a result, the aim is to think, make and consume for longevity – all in the light of a more sustainable fashion industry. In order to do so, the efficiency of resources plays a central role in which eliminating waste by working with residue is key in both resources and money in order to carry out sustainable production processes.

Depending on how often you recycle a product, also depends on how long the product lasts. If someone enjoys wearing something for 15 years and you can do that for 4 times the life-cycle, it becomes worth it. And after that time you can probably still utilise it for something, perhaps not even visible anymore as part of a new product. These are ways to look at recycling through a new lens adding to a larger value system. Recycling for the future entails thinking in circles, moving in loops in creation and delivery. When considering the life-cycle of a product, a designer should include the resource extraction, the manufacturing process, how it is distributed, utilised by the consumer, disposed and recycled. Thus, a careful consideration in each step of the production process from fibre to waste is pivotal.



2.0 Background

The textile industry is currently one of the biggest global industries with a rise in export values of up to 50% in the past 10 years (Ethical Fashion Forum 2016). This industry contributes to so much pollution it only comes second to the chemical industry. To worsen matters, it involves harsh chemicals in production processes that range from growing raw materials to the finishing and dyeing of fabrics. This has only worsened due to fast fashion. According to the Friends of the Earth Europe report (2013), Europeans discard 5.8 million tonnes of textiles every year, with 75% going to landfill or incineration and only 25% being recycled. The textile waste in the Netherlands alone comprises out of more than 235,000 tonnes (BrightLoops 2016) of which 1/3 is collected and recycled. Textiles present serious issues in landfills when it comes to synthetic products which cannot decompose. Garments which do decompose such as wool for instance produce methane, which contributes negatively to global warming. In order to combat these alarming figures in waste and pollution, higher recycling targets need to be accompanied by aims for waste prevention and reuse.

When the 20th Century introduced synthetic fibres, textile recycling became more complex for two distinct reasons 1) fibre strength increased, making it more difficult to shred or open the fibres, and 2) fibre blends made it more difficult to purify sorting process.

(Gwillt and Rissanen 2011)

2.1 Challenges

The biggest concerns when it comes to recycling can be looked at from various segments of the industry. Firstly, the market retention proves to be problematic as the market pull is missing. The market is only recently slowly starting to catch up with the demand of recyclable materials. Designers do not easily have the luxury to create fabric from scratch, relying on what is available which often poses an obstacle. The geographic distances between raw material and fabric manufacturers present a big difficulty as a lot of textile production has been moved from Europe to Asia, challenging communication. When it comes to innovations for closed loop recycling, this geographic distance is not ideal. Sorted materials from residual textiles that are of high quality are also bleak within Europe. As a counter-movement, re-industrialisation of Europe becomes an exciting opportunity for recycling locally and adding competitive advantages (Elandervand Ljungkvist 2016). If the price of raw cotton will rise sharply in the next years, the circular system will become much more effective also from an economical point of view, as the companies in Europe can then better compete with the ones in Asia (Luiken 2016).

When considering the cradle-to-cradle approach, we take a product's life-cycle and connect it with a new product's life-cycle pushing forward a regenerative force. With this mantra, the goal is to produce clothes that will never implicate waste (McDonough and Braungart 2002). However, this approach takes the biological cycle and the composition into account in which biodegradability is an inherent part of it, which is not a feasible form of recycling. Textiles are usually contaminated with chemicals, dyes and various components which aren't designated to be compostable. A textile product therefore will always be a chemical product. There are often misconceptions

regarding the composition of textiles part of this technical circle (Luiken 2016). Biodegradable materials in many instances will have to include mould proof and anti-bacterial treatment attributes in order to prevent degradation in the usage. For instance, if working with a fabric that is anti-bacterial with silver yarns it cannot be put back into nature, contrary to popular belief.

As one of the oldest and most established recycling industries in the world, the textile recycling industry reclaims used textile and apparel products and puts them into new and interesting uses.

(Hawley 2008)

Turning the recycling methods into actionable and pragmatic manifestations is not always easy, given the lack of knowledge and lack of a standardised way of working. Yet, this offers room for adaptation and innovation in which students and designers can adopt both a philosophical and process-based way of working. The responsibility to transform the system and shifting the equilibrium is key to paving the way for recycling methods to be more knowledgeable and spread. In the past, recycling was perceived with prejudice due to the low quality of the outcome. Technology has thankfully become an enabler to produce better materials. This has resulted in a gain in acceptance in the fashion industry, as well as it becoming part of the consumer market.

Fashion brands demonstrate an interest in utilising recycled materials in their collections but they often fail to reflect on how the final product can be recycled again. Companies struggle with the knowledge of textiles overall within fashion brands, as there are a lot of assumptions about sustainability in general. When there is a lack in knowledge, the risks become higher, and so educational institutions have an unmissable chance to further deepen into the solutions that can ultimately be picked by the industry.

2.2 The Act of Recycling

There is an added value to the notion of second-hand and recycled clothing to be incorporated in a designer's working process, due to the nostalgic attributions such materials offer. History becomes part of future adoptions by a new wearer. Thus, this inheritance adds a sense of beauty and appreciation for what vintage, recycled and re-designed items stand for, offering unique stories that are re-embellished. Another form of re-using is up-cycling, which embodies a method in which the product's quality remains the same or is improved by adding further properties that will increase the life-cycle of the garment substantially. As we are now in the midst of mass-consumerism when it comes to fast fashion, this re-living of recycled wear offers the option to slow time and contest the big giants who contribute to incredible amounts of waste in clothing. Because waste in textiles is such an alarming contributor to landfill sites, recycling methods avoids a garment to end up at a landfill entirely. Another argument to adhere to this, would be the amount of clothing that is brought to developing countries as charity, which causes detrimental effects to the textile and clothing industries of these countries.

Because textiles are nearly 100 percent recyclable, nothing in the textile and apparel pipeline should be sent to landfills. (Hawley 2008)

The act of recycling textiles and garments can be divided into two methods: chemical and mechanical recycling.

Chemical Recycling

Chemical recycling is an innovation in the textile industry. This kind of recycling and chemical technologies enable the separation or dissolvement of certain qualities of fibres. An example of this is SaXcell, a regenerated virgin textile fibre made out of recycled waste (Saxion n.d.). This form of recycling should increase in the future, as it results in a better quality in the final material. However, the impact of the environment throughout this process needs to be reduced in order to offer more sustainable solutions.

Mechanical Recycling

Mechanical recycling currently offers the most sustainable in recycling textiles in general, which avoids changing the chemical composition of the fibres and simultaneously fortifying the fibre itself. It is also the most scalable method when it comes to post-consumer waste (Gould, 2015). In this form of recycling, the innovation lies in producing more fibres which can be utilised for the spinning process and producing materials which can go back into the yarns. Most of this form of recycling is currently aimed at production for non-woven materials in other industries, and therefore the technical demands are not as rigorous. It also has a larger dependency on the destruction than on the nature of materials itself and the starting material (how long the fibres are for example). However, this technique can only take place when there are large amounts of uniform materials (min. 10,000 kg) collected to be able to reproduce a batch of materials from it. The utilisation of mono-materials are therefore crucial to facilitate this process (Farley Gordon and Hill 2014). 95% of the materials goes straight into the final product within a sustainable process. There are certain limitations such as colour uses, in which you will never obtain the brightest white, or certain fibres that cannot be handled such as lycra which can only be utilised up to 2%. Metal threads for instance, also interferes with the machinery. In all cases in mechanical recycling, whether in synthetic and natural fibres, shorter fibres will always occur. However, by adding virgin materials the quality does not get compromised. For example, blending polyester and cotton can enable a garment to survive 60 - 80 washes whilst not losing the shape and piling too much. Blending can also result in increasing the content of recycled yarns, for instance, when utilising nano-fibres with recycled cotton. There is more freedom of choice in materials in this method of recycling.

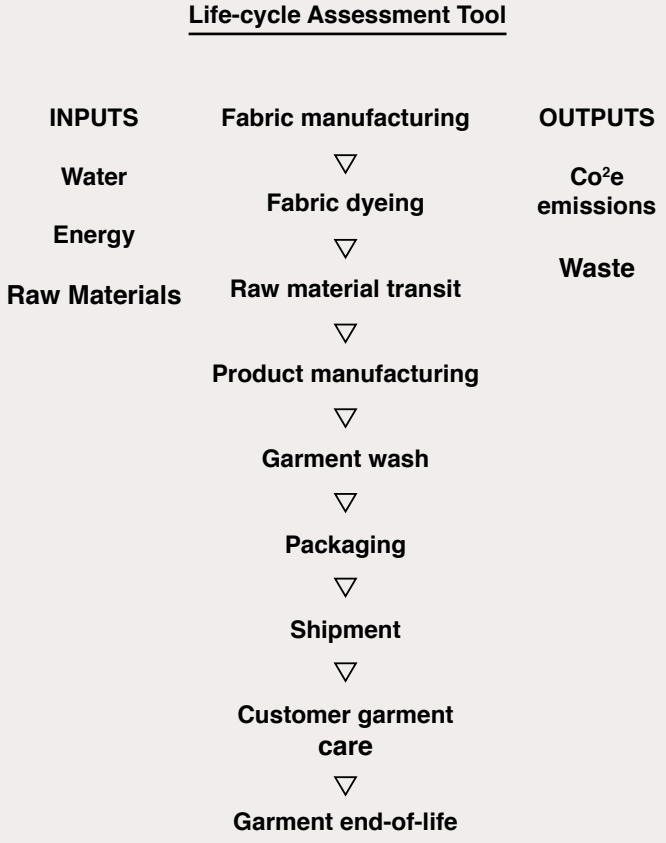
Design for Recycling vs Recycling in Design

These two methods of recycling when it comes to designing are tools to combat waste to end up in landfills, and can offer sustainable solutions to designing. Recycling in Design entails basing the entire design on recycled materials. When incorporating design for recycling methods, the life-cycle of a garment extends up to 4 times in which materials are re-utilised. When looking at adopting recycling in design methods there are limitations in colour, structure, irregularities compared to yarns out of virgin materials. Yet, it ensures recyclability in every step of the design process as it is already based on recycled materials from the start of the life-cycle. Both methods prevent textile waste to end up in landfills, and can provide important working processes that will influence the recycling process dramatically in a sustainable design

mantra (Luiken 2016). When it comes to Recycling in Design the materials utilised as a starting point are already recycled, which means an impact is already being made at the start of the design process just by opting for this. By utilising 30% - 50% of recycled content in a product already ensures a result in the most sustainable end-product. This does come with a limitation in colour usage, structure and brings irregularities. If designers are creatively able to work their way around this it offers a stronger recyclable product as a result.

The life-cycle analysis of the recycled materials is always at the top. Therefore it doesn't matter much if using cotton, wool, polyester or polyamide; although the environmental gains of recycling natural fibres are higher compared to the recycling of the synthetic fibres. This is because of the environmental impacts regarding land-use, CO_2 emissions, water and chemical use in natural fibres are much higher. By re-using existing fibres and textiles, there is no need to make these textiles from raw materials (such as cotton, wool, and synthetic fibres). This saves on the energy used and pollution caused during manufacturing processes like dying, washing, and scouring (Ethical Fashion Forum 2010).

The benefits of recycling apply in various phases of the environmental impact, reducing the need for landfill spaces, decreases the pressure on virgin resources and ultimately results in lessening pollution and energy savings. The raw materials and the processing of these raw materials takes up 70% of the environmental costs of the production making it worthwhile on recycling and on the



3.0 Practical Toolkit

By integrating design for disassembling products and considering the life-cycle of the product in its entirety, this guideline approaches pre-consumer waste and post-consumer waste as both being equally important. Herein, designers are stimulated to map a product's lifespan as well as the impacts it has in various stages of creation and consumption. The goal is to extend a product's lifespan when it comes to recycling, balancing the creative vision as well as the technical feasibility.

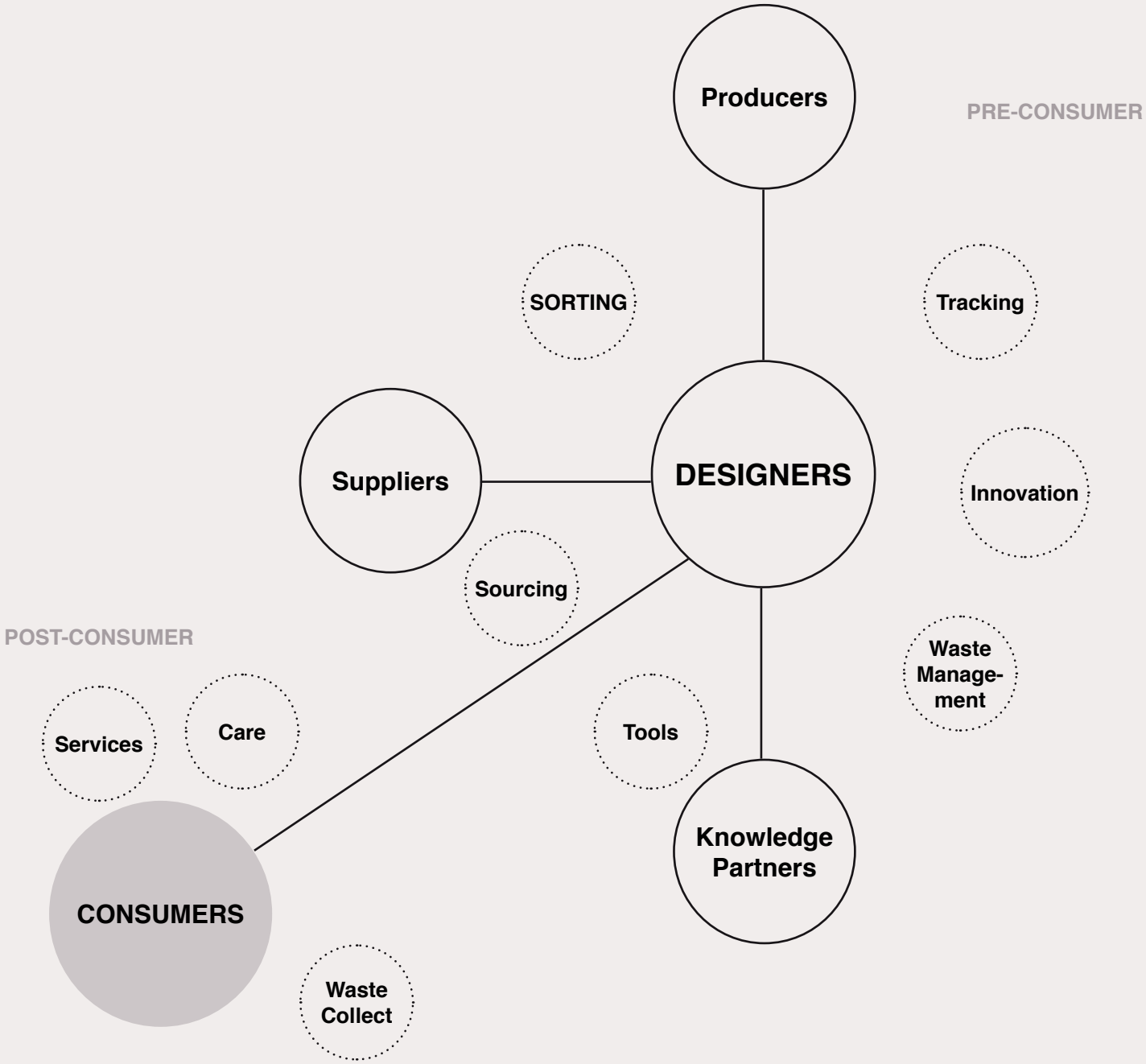
Pre-Consumer Waste

In pre-consumer waste, all by-product materials from the textile, fibre and garment industries are taken into account. This is all the waste that results from the production of clothing, throughout the supply chain of a garment before it ends in the consumer's hands. Pre-consumer waste can be processed efficiently in such manner that zero-waste production can be attained.

Post-Consumer Waste

In post-consumer waste, the definition lies in any type of garment the user no longer needs or decides to discard. This is the most obvious manner on how to re-use clothing which has been collected from consumers no longer wanting to utilise it. This does not solely reflect garments, but also introduces textiles from other industries such as interiors, automotive and other luxury goods. Post-consumer results in a large amount of woven and knitted materials combined in waste form. The blends of fibres and products challenge the uniformity of the materials collected in waste. This reflects directly in the fashion industry, as Denim is mostly recycled on large-scale basis as it is the most standardised material in the industry. Keeping the structure relatively straight-forward eliminates the issues of the uniformity in waste in post-consumer recycling. Therefore, as a designer, it becomes important to avoid creating various patterns and dimensions that reflect differing fibres as the uniformity of materials in post-consumer waste is currently the biggest concern.

Recycling should not be at the downfall of creating luxurious and/or desirable products. On the contrary, often the limitations and challenges should awaken a creative way to turn the problems that arise with textile waste into solution-driven and practical outcomes. The aim of this manual is to design a product that makes it easier and more practical to be recycled at the end of it's life-cycle, ultimately facilitating the metabolism of the garment. This means avoiding down-cycling, as well as incorporating zero-waste policies wherever possible.


Producers
PRE-CONSUMER
SORTING
Tracking
Suppliers
DESIGNERS
Innovation
Sourcing
POST-CONSUMER
Waste Manage-ment
Services
Care
Tools
Knowledge Partners
CONSUMERS
Waste Collect

The mechanical recycling process can roughly looked at in the following manner:

1)Collection 2)Sorting into wearable, recyclable, waste 3) Sorting again into colour and material (colour sorting helps eliminate the re-dyeing of textiles) 4) Remove all haberdasheries (zippers, buttons, etc.) 5) Cutting (making the materials smaller) 6) Shredding (drawing material from each other, increasing the volume and softness) 7) Blending/Mixing with Virgin Fibres 8) Carding (process in which the fibres are laid parallel) 9) Spinning, Weaving and/or Knitting 10) Design 11) Garment Production 12) Wearing 13) Waste

This process can be repeated on an estimation of 3-4 times, however the fibre will become shorter in each repetition which negatively affects the spinning process. In each phase, coherent choices need to be made in order to make mechanical recycling as efficient as possible. Sorting in any recycling process is key. If you can sort the material in the best way it will result in a better product. In addition, new business models help to increase collection, making it easier for consumer to dispose of their unwanted textiles.

As a rule of thumb, the act of questioning your own process at every stage becomes a focus exercise to maintain a recycling approach to designing as efficient as possible. As a designer it is vital to consider the materials normally used, making significant changes just by asking the right questions. Ask yourself: Where are the materials from? How is it made? Where is it made? By whom?

Can we do more with less? Question the ‘reason to be’ for every item you create or promote.

Design requires a constant research of new idioms, a battle against presuppositions, a push of the limits, and the continual refinement of responses to fundamental questions, like: What can design add to the world of plenty?

(Jongerrius and Schouwenberg 2015)

3.1 The 3 Pillars of Recycling

Incorporating recycling in design poses a challenge for students and young designers due to the functional and comfort implications, alongside the aesthetic preferences in the creative process. Recycling done beautifully remains an obstacle. However, within the limitations, especially in colour choices, there is room for innovation and aesthetic value. If a designer is engaged with technical know-how and has the means to think outside of the box, it will be much easier to design within these limitations. It is certainly not impossible, and often within the challenges (as much as these are minimising due to new technologies and possibilities) a designer can often come up with innovative products that can contribute to new perspectives and surprising results. To ease these obstacles, it is wise to consider the three pillars of recycling: philosophy, practice and product.

Philosophy

Philosophy is key because it starts with the mindset that is carried out in every step of the practice and the product. The philosophy behind recycling is based on representing the idea that everything is interconnected and interdependent. The designer of today and tomorrow needs to act and conceive products out of an integrated perspective that has everything to do with the networked world and connecting people. As with all sustainable issues, it shouldn't just be about using recycled materials to tick a box - it needs to be integrated in the brand identity and design process and own process of working. Rather be really disruptive rather than a little bit sustainable by being as radical as possible in terms of responsibility, picking up and disseminating knowledge on recycling practices. It doesn't make sense in just solely focusing on designing for recycling, it is necessary to adopt a mindset in a continuous basis for every step of the supply chain as well as the life-cycle of the product. Gong that extra mile is more beneficial than merely replacing yarns for recyclable yarns for example. There are more issues at hand in the textile industry rather than just the materials that designers work with. The philosophy behind this method is to give more choice as a designer to a consumer, without the need for more clothes. Ideally, a designer approaches it in a way that the products become amendable, transformable and adaptable offering disposable, recoverable and re-produce-able features. Through a pragmatic approach to recycling, you are able to reduce energy and water consumption alongside employing cleaner ways of production whilst decreasing emissions. Due to surges in technology, better practices in recycling are becoming more realistic for students and young designers ensuring a high recycling standard. Alongside, a requirement of wit, imagination and adherence when it comes to finding recycling solutions is necessary.

Developing design values are paramount to adhering to the philosophy of recycling. Human valuing and how to work together is an important aspect - designers can feed much more into this. In a brand and visionary perspective it becomes vital to adhere to values that are aligned with why recycling becomes important. Alluring others and being transparent in the design process and technical processes places design activism high on the agenda. Adopting a manifesto in which the basis of these values are looked at as principals would guide designers on the right path. Make conservation a habit in your practice which can be translated into such a manifesto. This also attracts complicity in others, and results in more collaborative efforts in which shared values drive designers to become change-agents and social innovators.

Practice

As a designer, it is imperative to inform yourself continuously with the right sources when it comes to recycling. Ideally, contact with a recycling company is essential to be informed on what is technically feasible. This manual includes a list of brands and companies that offer a wealth of information on sustainable and recycling methods that can help designers on the right path.
The way a designer acts in a networked community enables design for recycling methods to be easier and more efficient. It is imperative to create a culture of networking, sharing, borrowing and exchanging. This is about building close relationships to those who fuel your design process as well as consume it. Therefore designers should act as facilitators of sustainable enterprises in their own communities which will contribute to social innovation. The local or regional aspect becomes paramount, and it is no longer just a geographic marker; it becomes a quality, a value in itself. It is important for the designer to work with partners that adhere to technical research, market research, business research (finding new business models) and creation & development. As much as this guideline is focused on the design process, the attention towards strategic direction in marketing, selling, communication, and informing the consumer are necessary to close the loop. Therefore, part of the manual is also dedicated to these areas.

Design activism is important because it validates designers not only in the creative sector, but gives them a voice and something to be passionate about. It is vital to be informed on governmental policies regarding recycling, which inevitably influence textile production processes locally as well as the European legislative body in general.

Product

To be able to deliver a perfectly recyclable product, the design should be based on how easy it is to disassemble it. Designers that are interested in recycling generally always start from the material, having the end of the life-cycle of a product already in mind. This signifies the need to delve deeper into the topic of material choice, as the fabric choice has a significant influence on the outcome of the fibres after recycling. Developing together with producers, even if going through research and development can make a big difference in finding solutions to work with. Working with an eco-effective researcher during the design and development phase for example also aids this process. Global warming and water shortages are two of the biggest realities we are facing worldwide. By considering every stage of a garment's life, designers can make appropriate material choices in order to contest this. It is imperative to also reflect on what happens to the energy impact once the garment is in the consumer's hands. A designer's practice does not end once the garment is designed, but reflects on how the consumer is informed on utilising the product correctly and efficiently. Regarding water impact, cotton is the biggest culprit, using up to 29,000 litres per kilogram of water (TED n.d.). Choosing fibres that opt for lower water usage such as hemp minimises the water problem. Other solutions to minimise water usage would be looking at using water-less dye techniques, innovative ozone technology or utilising CO_2 instead of water.

The end of the lifetime of a product is not usually integrated as much in the fashion design practice (Van Dongen 2016). Firstly, it is difficult to claim what the lifetime is of a product. Knowing how to separate the components for recycling also is a grey area. There is limited knowledge on what can be combined and what can be separated. In terms of materials, it is imperative to consistently be informed on producing something with what is available and build close relationships with suppliers so they can aid in acquiring the materials in small quantities. A designer can also opt for experimental stuff that is not ready for market yet, because we see that on the market there is still too little high-quality material available. Owner of PULP, Natalie de Koning found out whilst building contacts she made with suppliers that they also have a lot of waste - therefore it was only logical to work with their waste (de Koning 2016). When it comes to sourcing, attending textile fairs such as Premiere Vision takes a lot of time and effort but is well worth it. For example, Martijn van Strien from the PostCouture Collective invests a lot of time in tracking the sustainable textile suppliers during such a fair. If this means talking to 500 suppliers and find 3 who will actually offer sustainable or recyclable quality, will bring major difference in a designer's practice (van Strien 2016).

"I design clothes that are meant to last. I believe in creating pieces that aren't going to get burnt, that aren't going to landfills, that aren't going to damage the environment."
– Stella McCartney

(McCartney 2016)

3.2 Do's and Dont's

The following list of do's and dont's is mainly based on designing for mechanical recycling purposes, being one of the most efficient manners to recycle currently. Adopting at least 30% of recycled materials in a design product is already a good start. If less, the sustainable quality is often compromised. Knowing the entire life-cycle of your product is key when assuming the following recommendations.

3.2.1 Pre-Consumer

Tools

By utilising the right tools, measuring and tracking techniques that are out in the market, strengthens the background knowledge of a designer and offers more informative design decision-making.

– An important starting point when employing recycling methods, is to refer to the Made By Benchmark (see page 33). Always opt for materials from class A or B.

– Tools such as the Nike Making-app and certification such as GOTS (The Global Organic Textile Standard) offer useful means to track environmental impact. Dutch brand Moyzo preferably works with natural materials with a GOTS certification for example.

– Mechanically recycled fibres are part of the most sustainable class, and should be utilised as a starting point.

– The online website Refinity.eu provides a list of local and international textile suppliers that adhere to certain certifications and standards.

– It might be too expensive for a designer to get certified, so finding suppliers that are certified ensures that at least certain chemicals aren't used.

– Always try to source materials locally first whenever possible and make sure to screen the suppliers for their environmental impact

– By incorporating design for recycling methods, the materials utilised can ultimately be recycled and disposed of in effecient ways in a post-consumer phase

An important starting point when employing recycling methods is to refer to the Made By Benchmark.

(page 33)

Fibres

– Longer staple fibres should be utilised for high-qualitative recycled fibre means.

– Mono materials are preferred as they are part of a single closed loop system. Approach polyester as a mono-material.

– Virgin/raw fibres offer more comfortable wearing properties.

– Natural fibres are easily degradable and the environmental impact at the end-use is less than synthetic fibres.

– Fibres should use a minimal amount of water and energy throughout the production process.

Yarns

– Starting with high-quality yarns ensures the final mixture will also be of a certain quality. This will give enough room/time to degrade to lower levels and end up with a viable product.

– Test recycled yarns and develop a database of what works and what doesn't, looking at the strengths, the evenness and colour. This can be incredibly useful when finding a right technical partner, to assess yarn spinning techniques, thickness, weave/tricot density, finishings as well as the chemical structure. Based on the findings, technical evaluations can be made for each phase the yarn is tested. A negative outcome is also a good outcome in the end when testing yarns.

– Source organically produced materials which are low-impact, such as organic cotton which is pesticide free.

– Opt for yarns that derive from your own locality or cultural heritage.

– Use low-twist yarns when opting for knitwear.

– Do not utilise elastomeric yarns.

– Do not utilise lycra (2% or less is accepted) and metal threads, as these interfere in the recycling process.

– Do not mix elastan and polyurethane with cotton.

Material

– The choices of materials are crucial in recycling for design purposes. The best choice a designer can make is already using recycled materials from the start.

Innovative technologies are paving the way for different yarns to be created, such as re-generated cellulose using wood pulp to create fibres that are of high-quality in a closed-loop system. As a designer, a constant self-informing on the new innovations arising is crucial to pushing a design practice future-forward.

– Keeping the material structure relatively straight-forward eliminates the issues of the uniformity in waste in post-consumer recycling. As a designer, it becomes paramount to avoid creating various patterns and dimensions that reflect differing fibres.

– The choice of the materials a designer utilises should be adaptable to the product he/she intends to produce, or vice versa.

– Ask yourself if you really need a specific material besides the aesthetic factor.

– Focus on a mono-material when designing. A final garment is easier recyclable if it consists out of a mono-material, making the sorting process more efficient.

– If going for a blend of materials, utilise a common blend.

– When looking at cotton, choose organic cotton as it is known to save up to 40% of water, does not contain pesticides or insecticides, as well as negates landfill by disposed garments.

Is the material toxic? (Find out where the material comes from, and if it is made with renewable resources. Is it traceable? Is it possible to recycle the material without harming the environment in the process?) Can you separate the material? (By avoiding waste in your designs the materials should enable disassembly and re-utilisation. Are you able to re-use the material in a technological cycle?) Does the material adhere to ethical and social standards? (Who produced the materials, and is the labour, land-use and other factors treated fairly?) How long will the material last? (How do you foresee the material being utilised after the end of a product's life-cycle? Try to predict the out-come of the usage of the material in question through planned obsolescence.) Is the material multi-functional? (Can you incorporate more functions to your garment when utilising the material? Can you design it in such a manner that the form follows function?) Is the material certified?

– Certificates such as GOTS can be very wise to take into account when buying materials and can save you time in tracking the way it is produced and how environmentally friendly it is.

– Avoid plastic where possible and replace with alternative materials. Avoid virgin plastic and replace with post-consumer recycled materials.

– Avoid coatings and prints due to their chemical nature which makes recycling difficult.

Labels

– Do not utilise leather labels. Instead opt for printed labels that are in the same materials as your product. As for hangtags, make sure it is recycled paper.

– When it comes to hangers, avoid plastic or metal ones (considering their lifespan succumbs to 3 months) and choose recycled paper instead. Ideally, you could create cloth hangers out of scraps of fabrics or the same fabric as your garment (see French label L'Herbe Rouge).

– Should you be utilising mono-materials solely, ensure the labels (and yarn) are in the same material.

– Ideally, laser-cut the label information in the same material your product consist out of, or embroider with the same composition in yarn.

Haberdashery

– Be weary on how to construct the garment. Assembling the product by hand can be a solution as seen in Dutch brand PostCouture. This is ideal because there is no actual connection - no sewing, bonding or laminating.

– It is a challenge to eliminate haberdashery in its entirety without compromising on the shape/silhouette of your design, as you do not want to end up with a shapeless model. If you must utilise haberdashery, ensure it is easily removable in order to facilitate the recycling process.

– Ultra-sonic bonding of seams in terms of technological advances eliminates construction problems.

– Avoid the utilisation of haberdashery as much as possible.

– Use knotting techniques to replace stitching.

– If you are utilising pure materials (mono-materials), haberdashery must be avoided at all costs.

– If it is necessary to use buttons, ensure they are re-used.

Measure

– Always monitor the impact the production process has on the environment as much as possible. Looking at every step of the supply chain, and estimating the environmental impacts of these can also be viable for a designer, ensuring you go from the garment end-of-life to the rebirth of a new product whilst taking into account the outputs and the inputs along the way (see page 12).

– Measure material data: What materials are used? How much of each material is used? From where did you source the raw materials?

– Measure financial data: How much did you spend on your suppliers?

– Measure environmental data: try to find out what how much water, co_2 and energy was utilised.

– When it comes to dead-stock and vintage fabrics, the fabric impact is hard to measure as they come from secondary markets. However, you can include it in the calculations of the life cycle impact which incorporates the transit of the fabric and garment washing.

– The impact packaging has should include manufacturing processes and the end-of-life impact for all the materials utilised.

– Life-cycle-assessment (LCA) can reveal the gains and losses made for each product scenario along its life-cycle. This can offer comparability between various products and enhance knowledge on how to perform better options to prolong the life-cycle with a positive impact on the environment (see page 12).

Design

– Focusing on designing for disassembly is the highlight of designing for recycling, going from eco-efficiency to eco-effectivity, to eliminate waste all together as a goal.

– A timeless design, which lasts beyond fads and trends is therefore preferable when it comes to designing for recyclable purposes.

– Going against the basis of fast fashion and producing season-less and circular clothing collections should be taken into account. Swedish brand, Filippa K does so willingly.

– Offer multi-functional approach to the products: clothing that can be worn in more than one way which minimise the act of buying and offer pragmatic solutions in terms of pocketing, etc.

– Anticipate how your design is constructed and include

alternatives or replacement pieces for constructions of your design that will easily tear or wear off. In this manner, it is not necessary to design a complete new garment at the end of its life-cycle, but in fact replacing certain pieces to slow down the life-cycle.

– Think of the purpose of your design, and for what use it is meant for. Outdoor garments will usually be chemically treated to withstand water and dirt, which makes them difficult for mechanical recycling purposes.

Question the 'reason to be' before designing a product.

Colour

– The brightest colours can never be attained, such as the whitest white. Take this into account in your aesthetic decisions.

– When blending colours, it is important that the yarns are already sorted in colour so that you can create evenness in certain colour ranges. This brings a certain level of risk, yet can also be very exciting and reveal unexpected blends in colour.

Pattern-cutting

– Designing from the material enables pattern-cutting to be approached as efficiently as possible, and zero-waste pattern-cutting should be striven for. This is done by taking the width of the fabric into account, which will determine the design ultimately.

– Under normal design practices, a waste of 10 - 20% of fabric is economically acceptable yet the ecological consequences of this is not ideal (Rissanen 2015).

– By looking back in the history of clothing, you can creatively deal with waste from cutting. Zero-waste design is not an entirely new concept if we look at traditional garments such as the Kimonos in Japan, or the Indian Saris.

– Knitting is considered an efficient process and produces minimal waste, depending on the selection of yarns, the processes utilised and the finishings. It also allows you to create your design from scratch, starting from the yarn. The type of yarns used need to be sustainably sourced in order to have it be recycled.

– Do not utilise knits that contain a mix of materials as this becomes a challenge for the end-of-life, and implicates problems in extracting materials (for example a natural yarn combined with a plastic yarn).

– There is a possibility to recycle parts of a product by removing panels and utilising them for new garments.

– Circular knitting introduces seamless tubes of fabric eliminating cutting and sewing whilst producing a garment in a single piece generation zero waste.

– The knitted material should not be too complex, aim for 1 - 2 structure(s) maximum. Do not vary in very open and very dense structures. Make sure the structures resemble one another.

– Knitting based on whole garment production reduces waste in the production process.

– Work with digital patterns whenever you are able to. In the weaving process, it is possible to implement zero-waste techniques as seen in Nike for example. The shoes are woven in one piece, avoiding the cutting of v various

Visit the factories personally and aim to build close relationships. It's not always easy or affordable to visit a manufacturer, but it's such an important investment if you can make it work. Seeing first-hand how the factories work, what their conditions are like and the people behind the products is key to knowing that you are acting in a fair, respectful way. It's also very helpful in building close, long-lasting and mutually beneficial business relationships. It will serve to ensure that you get great products that are delivered on time.

Production

– Keep production local which makes production on-demand easier, in turn minimising the impact on the environment and eliminating stock build-up.

– When producing local, you are not only empowering your community, you can also easily visit the production site (more frequently) improving the quality of your designs by closely monitoring the quality of the production.

– Find out how the factories you choose deal with waste, and that all potential waste products can be reused as a raw material for other processes.

– Producing on demand avoids the build-up of stock and allows a designer to better control the production.

– Ensure production is without hazardous chemicals to enable safe industrial recycling keeping human, animal and the ecosystems health in mind.

– Produce locally whenever possible. This eliminates production time and you can minimise the delivery time to your consumer.

– Opt for production on demand, which ensures a closer contact with the consumer as well as avoiding waste by ensuring the clothing is made to fit.

– A technology that can be quite beneficial in easing the disassembly process in production is the Wear2™ (wear-2.com) which incorporates special stitching yarns that can be easily removed when placing the garment in a microwave. Avoid metal haberdashery if opting for this.

– Laser and water-jet are options instead of cutting and utilising thread to weld a product.

– Look into nano technologies in production which are also contributing to the future of eliminating waste, in which adhesives, threads and coatings are minimised.

"The challenge of zero waste is to keep the design driven by function" – Tim Rissanen

(Rosenbloom 2010)

Waste

– Before a piece of clothing even reaches the consumer, a lot of textile waste can be prevented.

– Intentionally design products that leave behind as little scrap materials as possible.

– Incorporating waste management as part of your design studio or practice environment is complementary and essential to the design for recycling purposes.

– Classify waste management according to the order of importance.

– It is the responsibility of the designer to actively and creatively ponder on what one can do with the waste created.

– Do not utilise more material than necessary.

– Recycle or donate the scraps that result as waste from your design process.

– Ensure your waste does not end up in landfills by bringing it to a specific waste plant or waste depot in your area. Seek out suppliers who are able to utilise this waste for other means.

– It is important to not only be mindful of the waste of your product, but also the waste of your surroundings which includes food, office supplies, etc.

– Excess fabric could also be used to make something entirely new. Expand your collection by utilising waste, turning it into an accessories or underwear line.

Packaging

– Ensure packaging is plastic-free. If using plastic, ensure it is recycled, bio-degradable or bio-based.

– Tape should be bio-based and non-toxic.

– Garment bags are a big contributor to waste, and should always be re-used for full benefit.

– Opt for polypropylene fabric that does not tear, and ensure the packaging you use can be utilised for other purposes such as a reusable bag which can be used for grocery shopping.

– By keeping packaging as minimal as possible, the sole focus should be to prevent your products from being damages in shipping or transit.

Selling

– Share the story of your product to your targeted audience through transparency and authenticity such as fashion brands Everlane and Honest By.

– Allow the buyer to trace all the design steps back to the origin of the product.

– E-commerce utilises roughly 30% less energy than traditional retail. With a growing number of online consumers, this offers a solution when it comes to selling your goods in a sustainable manner.

– Take into account how shipping can be best treated in low-impact ways.

– Selling online also maintains your stock locality central, as opposed to dispersed when selling in physical spaces.

This keeps production at bay as well as gaining a better overview on stock that does not sell.

– Should you opt for a physical space, the power of storytelling can play a vital role in how recycling is divulged through inspirational visual material in film and/or visuals. For instance, PULP (de Koning 2016) does so by exposing an atelier and physical store in one, informing the consumer through written pamphlets on how the products are designed in a sustainable and eco-efficient manner.

“Revealing information about business practices allows companies to engage with customers in a new way, opening a dialogue and creating a different, more honest brand experience, a far cry from global conglomerates that have traditionally kept such information under wraps.”

(Hoang on The 10 Commandments of New Consumerism, 2016)

Marketing

– If consumers feel more attached to their clothing, their need to buy new products will be lessened. It lies in the designer’s hands to attribute meaning and communicate this to the consumer.

– Clarify and provide size guides and fitting models.

– Offering information on the composition, the care and wash instructions of your final product can be best communicated on a website for example. This also avoids extra labels and tags being attached to the clothing.

– For garment care, assume the average life of a garment based on 52 washes (Reformation 2016).

– Offering sound customer care can have a big impact on the water and energy impacts of a consumer, including tips and information on how to wash and iron each garment according to its specific requirements.

– Being upfront on the supply chain of your garment enables a deeper connection with the consumer.

– Revealing the ecological footprint of your product and unique attributes to your product can make sure the consumer handles the product with greater care.

– Leasing your designs could be another way to ensure the products always return to you such as Mud Jeans does with leasing their jeans. By opting for this method as opposed to selling, you can easier track the life-cycle of your products and utilise your own waste in recycling and bringing a product back to life.

– Offer subscriptions to customers as opposed to selling your products such as Lena the Fashion Library does. An added benefit is the control one has over the washing and care of the garments to ensure the clothing lasts longer.

– Should you adhere to certification processes, you can easily attribute universal coding systems to the products that make it easily recognisable on how the product

was made. This can reveal the usage of the materials, production methods, recyclability and fair trade.

3.2.2 Post-Consumer

In parallel to the pre-consumer phase of recycling, the post-consumer stage is heading towards the sharing-economy, in which consumers do not necessarily own the product but are users of the product instead. Once the product is out of your hands and in the hands of the consumer, it can be difficult to monitor the usage of the product. There are numerous methods to make sure the consumer is informed, aware and prepared to utilise the product in order to maximise its life-span. Furthermore, it is imperative to inspire and inform the consumer to know how to deal with a product once it does not fulfil its function any longer. Post-consumer disposals reflects a large amount of woven and knitted materials combined in waste form, which challenges the uniformity of the materials collected in waste. If we look at Post-Consumer waste - it is about avoiding the product ending up in landfills. Designers must also be responsible for an effective collecting system of used products for companies and consumers, so the products do not end up as waste. Developing customised services, care instructions and waste collection programs can solve this. There aren't a lot of brands that ensure that their products get back to them - they often use recycled materials in a mix of everything (which often include cheap yarns) which means they are re-using waste but not necessarily their own waste. As a designer it is important to still feel the responsibility for your product once it arrives in the hands of your consumer.

Waste

– Look at waste as a possible treasure that can enhance your design.

– Sort waste by colour before it is re-fibred and spun into a new yarn.

– Always intercept waste to end up in land-fills.

– Empower and encourage consumers to return end-of-life products to the loop.

– If you are not able to recycle the materials you work with due to it being a blend that cannot be separated or for any other reason, ensure it ends up at a recycling plant where it can be utilised for something else.

– A lot of brands often make use of other textile waste in their recycling methods, yet they do not utilise their own waste. Have your consumers bring back your product back to you at the end of the life-cycle. In this manner, you maintain your product in a closed loop and work with your own waste.

– Sort your and other textile waste on material and colour, which might be labour-intensive but offers the most sustainable possibility to recycle it after.

– Remove all haberdashery from the garment waste, if you are sure it is not part of the recyclability of the product.

– As a final option products can be sold or handed down to vintage and second-hand stores, this postpones garments to go to waste.

Services

– Reclaim products at the end of their life by persuading your customer to return end-of-life garments, this can be done through attractive discounts as a reward.

– Offer repair services in a physical or online setting which

– Offer services in which garments can be altered and adapted. Again, this contributes to lengthening the life of a product. A good example would be Mud Jeans, who also offer free repair services throughout the lease phase. Less ownerships results in less use of materials and resources.

– Offer styling advise in the consumer journey so that your consumer can make better buying choices.

– Provide end-of-life recycling services.

– Incorporate a recommendation along with your garment in how to care for it and consider a DIY repair instruction.

– Sell repair-kits such as fashion brand Patagonia does, to encourage a DIY repair and maintain longevity in the product use.

Customer Experience

– Through workshops, educate and connect with your consumer in a more intimate manner.

– Stimulate your consumer to learn how to sew and assemble patterns themselves, such as the Post-Couture Collective has done through DIY products.

– Direct workshops at repairing clothing incorporating methods such as Japanese technique Sashiko, which is all about repairing clothing utilising embroidery techniques.

– Organising on- and offline platforms in which the consumer is able to have personal contact with the maker can be a great way to exchange knowledge, information and ideas on recycling.

– Create social experiences that extend beyond just shopping so that consumers will be better informed and less inclined to consume as much.

– With crowd-sourcing for instance, the consumer is offered a share in the business which increases the feeling of responsibility in buying.

– Designers can play a pivotal role in changing the consumer mindset, by offering knowledge about the environmental impacts of textile products and the benefits of reuse and recycling.

Design for longevity. ▷ **Design waste out of the equation.**

▷ **Choose and become knowledgeable on smarter materials.**

Look for certified materials and suppliers. ▷

▷ **Visit the factories, build close relationships with producers.**

Question everything and everyone, even your own process. ▷

Adhere to Recycling as a philosophy, not just a process. ▷

4.0 End Note

The future of recycling looks promising, as the surge of new technologies paves the way for more efficient and quicker solutions. Recycling innovations will ultimately aid in making better use of the textile and garment waste in the future. New methods in the sorting process will become much easier by utilising near infra-red scanning for example. Also, the shredding process regarding blended materials could ultimately be resolved by special machinery that can detect and chemically break down different types of fibres. These technologies can become a reality, and it is up to designers to maintain themselves 'in the loop' as well as intervene to find solutions with other stakeholders. With a growing world population and climate change posing a real threat to our planet, aiming at zero waste is needed, not only in the fashion industry but throughout all other industries. Through recycling, designers can make closed loop systems a reality in their supply chains, enabling fashion to contribute to creating future worlds with meaning.

5.0 Database

This database offers a short overview on various tools, certifications, projects and brands that incorporate innovation, progressive methods and future-forward outlooks towards recycling and sustainability. As a designer, maintaining a personal contact list and database on such change-makers is not only a rich inspirational source, but can also lead to network opportunities and future collaborations.

Certifications & Tools:

BLUEDESIGN - bluedesign.com
The Bluedesign® system eliminates harmful substances right from the beginning of the manufacturing process and sets and controls standards for an environmentally friendly and safe production. This not only ensures that the final textile product meets very stringent consumer safety requirements worldwide but also provides confidence to the consumer to acquire a sustainable product.

GRS - Global Recycle Standard
This certification covers processing, manufacturing, packaging, labelling, trading and distribution of all products that are made with a minimum of 20% recycled material. The GRS is intended to meet the need of companies looking to verify the recycled content of their products and to verify responsible social, environmental and chemical practices in the production of these products.

GOTS - global-standard.org
This standard covers the processing, manufacturing, packaging, labelling, trading and distribution of all textiles made from at least 70% certified organic natural fibres. The final fibre products may include, but are not limited to, yarns, fabrics, clothes and home textiles. However, this standard does not set criteria for leather products.

HIGG Index - apparelcoalition.org/the-higg-index
The HIGG Index empowers brands, retailers and facilities of all sizes, at every stage in their sustainability journey, to measure their environmental and social and labour impacts and identify areas for improvement.

MADE BY FIBRE BENCHMARK - made-by.org/consultancy/tools/environmental
A transparent fibre benchmark that is published and generally accepted, comparing the environmental impact of the most commonly used fibres in the garment industry.

MAKING by Nike
MAKING is a tool to inspire designers and creators to make better choices in the materials they use, which includes data on widely used materials and allows users to rank them based on four key impact areas: chemistry, energy, water, land, and physical waste.

MODINT Eco-tool - modint.nl/ecotool
A transparent guideline that makes it easier to calculate different products and materials on their environmental impact based on (parts of) their life-cycle.

REFORMATION - thereformation.com/refscale
The Life-Cycle Assessment Tool tool calculates the CO_2, water and waste footprints of Reformation products, as

well as comparable products, including assessments of select fabrics and processes.

REMO - Recycling movement — joinremo.com
This recycling tool quantifies the environmental benefits using recycled materials, CO2, water and energy saving.

STANDARD 100 by OEKO-TEX® - oeko-tex.com/ots100
A certification system for the complete processing levels of raw, semi-finished and finished textile products, including haberdashery.

Companies on Sustainability & Recycling:

A-POC - mds.isseymiyake.com/mds/en/collection
This warp knitting collection line by Issey Miyake and Dai Fujiwara translates into seamless clothing resulting in minimal waste and efficiency in production processes.

BRIGHT LOOPS - brightloops.nl
Bright Loops claims to be truly circular in their sweater production. They adopt a zero-waste policy placing high attention on product development and looking at it as a continuous process, working with as many local and regional partners as possible and working collectively on new innovations and technologies. They involve consumers in the sorting process, where they get discount when purchasing a garment.

BYBROWN - bybrown.nl
Initiated by ReBlend the ByBrown collection is made out of 100% blended recycled materials, offering an innovative approach. ByBrown works with re-using and re-looping materials by re-connecting discarded materials, solely based on their own waste to develop new textiles and incorporate the usage of blended waste turning them into a high-quality woven and knitted collection.

CIRCLE ECONOMY - circle-economy.com
A social enterprise focused on scalable and practical solutions whilst spreading the circular message.

CLOSE THE LOOP - close-the-loop.be
Offers a database of designers that include recycling in their design ethos, as well as an online guide on the principles of a sustainable design process catered towards a circular fashion industry.

ETHICAL FASHION FORUM - ethicalfashionforum.com
A non-profit network platform in which tools and services are communicated for the fashion and textile industries, providing a large network and database on knowledge regarding sustainable working methods.

EVERLANE - everlane.com
A revolutionary fashion label embedded in classic clothing collections giving the exact breakdown of costs that account to materials, labour, duties and transport.

THE GREEN PEACE DETOX CAMPAIGN
- greenpeace.org/international/en/campaigns/detox
A campaign with 2020 as a deadline to asses fashion brands in an attempt to eliminate hazardous chemicals and account the textile industry to take responsibility for its contribution to toxic pollution.

HELLEN VAN REES - hellenvanrees.com
Dutch fashion designer who sources yarns that are leftovers from factories consequently weaving these yarns to make an entirely new garment without seams, cut-offs or remnants.

HONEST BY - honestby.com
A transparent fashion company offering a freely accessible list of sustainable suppliers (including recycled materials)

on their website, giving full details of sources, costs and retail mark-ups.

LENA THE FASHION LIBRARY - lena-library.com
A shared walk-in closet where consumers can borrow clothes instead of books, with over 900 items available, contesting the notion of ownership.

MISTRA FUTURE FASHION - mistrafuturefashion.com
A cross-disciplinary research program, involving more than 30 industry partners dedicated to research which is focused on the circular economy. Delving into how to best design materials products that change materials systems and social models, including recycling, up-cycling, low toxicity and closed loop aspects.

MUD JEANS LEASE A JEANS - mudjeans.eu/lease-a-jeans
This program changes the mind-set of the consumer by offering a leasing method, tacking away ownership from consumption. They also offer free repair services throughout the lease phase.

NUDIE JEANS - nudiejeans.com
Customers of Nudie Jeans are able to have their pair of jeans repaired for free at a Nudie Jeans retail store or opt for repair-it-yourself for which Nudie Jeans provides thread, patches and other useful materials in order to facilitate that.

PATAGONIA REPAIR AND CARE GUIDE - eu.patagonia.com/enCY/worn-wear-repairs
This section of Patagonia's online website offers a step-to-step guide on how to repair every product they sell from washing to care instructions, to repairing holes. Since 2005, Patagonia has been able to recycle 56.6 tons of own clothing and gear utilising the 4R strategy: Reduce (encourage consumers to only buy what they truly need), Repair (assume responsibility for repair), Reuse (sharing customer stories online on how they keep their products under proper conditions and help other consumers find a new home for used clothing), Recycle (worn-out clothing can be returned via post or dropped off in stores).

PULP - pulpfabrics.org
Designs based on pre- and post-consumer waste, this label founded by Natalie de Koning plays an educational role through workshops, online and offline platforms. Based on re-purposed materials, this label offers an inclusive platform for designers, students and consumers to make their own clothes.

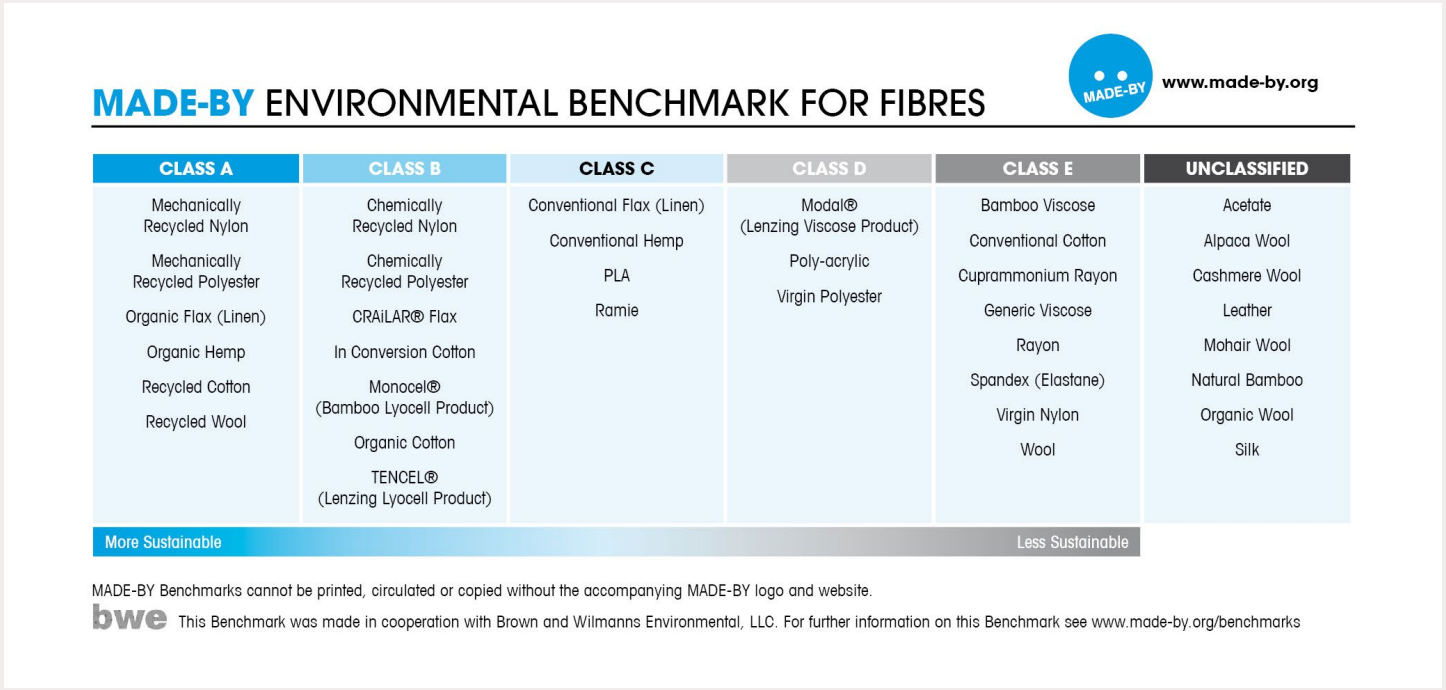
PURE WASTE - purewaste.org
Finnish brand makes clothing from rest materials, 100% derived from recycled yarns and fabrics, promising to offer the same level of quality and comfort as virgin materials.

THE POST COUTURE COLLECTIVE - PostCouture.cc
An inclusive collection that allows customers to customise and ensemble their own fashion pieces eliminating bonding, laminating or sewing in design. Working with digital patterns solely, all pieces can be re-used and recycled as all haberdashery is skipped.

TRAID (Textile Recycling for Aid and International Development) - traid.org.uk
A charity working to intervene in textile waste, turning clothing into funds embodied in a circular and sustainable approach in which production, consumption and waste is being tackled.

TRASH2CASH - trash2cashproject.eu
T2C is funded by the European Union and aims at creating new regenerated fibres from both pre-consumer and post-

Made-By Fibre Benchmark



MADE-BY ENVIRONMENTAL BENCHMARK FOR FIBRES

MADE-BY www.made-by.org

CLASS A	CLASS B	CLASS C	CLASS D	CLASS E	UNCLASSIFIED
Mechanically Recycled Nylon	Chemically Recycled Nylon	Conventional Flax (Linen)	Modal® (Lenzing Viscose Product)	Bamboo Viscose	Acetate
Mechanically Recycled Polyester	Chemically Recycled Polyester	Conventional Hemp	Poly-acrylic	Conventional Cotton	Alpaca Wool
Organic Flax (Linen)	CRAiLAR® Flax	PLA	Virgin Polyester	Cuprammonium Rayon	Cashmere Wool
Organic Hemp	In Conversion Cotton	Ramie		Generic Viscose	Leather
Recycled Cotton	Monocel® (Bamboo Lyocell Product)			Rayon	Mohair Wool
Recycled Wool	Organic Cotton			Spandex (Elastane)	Natural Bamboo
	TENCEL® (Lenzing Lyocell Product)			Virgin Nylon	Organic Wool
				Wool	Silk

More Sustainable — Less Sustainable

bwe This Benchmark was made in cooperation with Brown and Wilmanns Environmental, LLC. For further information on this Benchmark see www.made-by.org/benchmarks

consumer waste as well as looking into innovative ways of developing materials. The research approaches polyester as a mono-material, attributing it to a circular way of thinking diving deeper into the potential this fibre has on its own.

RECOVER UPCYCLED TEXTILE SYSTEM
- recovertex.com
Has been recycling cotton and post-industrial textile waste for over 70 years, through machines that have been adapted to pull a longer staple length of fibre than any other cotton recycler. This system regenerates cotton fibre derived from worn clothing and scraps in various colours without the use of added dye, without water and zero toxic chemicals which are usually requited for conventional cotton fibre. This encourages a future outlook for mechanical recycling, removing harmful impacts at every stage of production.

REBLEND RECYCLED YARN - reblend.nl
ReBlend is a circular fashion and textile agency that advocates working closely with fashion and interior designers as well as textile designers to minimise the ecological impact in turning old textiles into new yarns and materials, allowing no-longer wearable textiles to be maintained within a closed loop. These change-makers work mostly with post-consumer textile waste with no water usage, additive chemicals and zero dying to minimise the ecological footprint of textile recycling.

REFORMATION - thereformation.com
LA based brand incorporates sustainable design methods throughout its entire supply chain with a strong social message. Initiated a platform entitled RefRecycling allows consumers to create a recycling label for all the old garments and ship them directly to Reformation. This label provides a unique code which enables consumers to track the garments and how they have contributed to a positive environmental impact. With every item purchased, consumers can also measure carbon dioxide, water and waste savings online.

STATING THE OBVIOUS - statingtheobvious.info
Circularity agency driven by the belief that sustainable transformation is inevitable, focusing on supporting textile and fashion companies to design and assess circular strategies.

STELLA MCCARTNEY ENERGY OUTPUT REPORT
- www.stellamccartney.com/
This report, offered online for the public, calculates the non-economical effects of the clothing utilising certain methods that centre around placing a monetary value on the environmental costs and benefits of the brand across the entire supply chain.

SWEDISH STOCKINGS - en.swedishstockings.com
This stockings brand allows old stockings to be turned into lego, to ensure it does not end up in a landfill. Their challenge lies in separating the blend of polyamide and elastan, and they strive to ultimately be able to recycle old hosiery using zero-waste factories.

TEXPERIUM - texperium.eu
Texperium is an open-innovation centre for textile recycling, which aims to make the textile chain more sustainable and to offer new market opportunities.

WORN AGAIN - wornagain.info
Invested in textile recycling technology that can re-capture polyester and cotton from end-of-use textiles to be reintroduced into the beginning of the supply chain as new, restoring it to the virgin equivalent of the material.

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