A Product Lifecycle Approach To Product Development

To what extent can a circular systematic product development process be implemented to the apparel section of the discounter market?

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List of Abbreviations

**PDP**
Product Development Process

**DfL**
Design for Longevity

**DfR**
Design for Recycling

**DfD**
Design for Disassembly
1.0 Introduction

Through my traineeship at Lidl Hong Kong in the Sourcing Department, which was a part of a specialization program at the Amsterdam Fashion Institute, I was intrigued by the discounter culture. During my time there it became quite clear how big this side of the market was and how much more bigger it was going to get. What surprised me from my internship at this particular company, was the sense of freedom for exploring, openness towards innovation and their drive to make sustainability a core component in everything they do. With all of these points in mind I started to wonder what could be the next thing for a company of such grand scope like Lidl, Aldi, Target, Tesco’s, Walmart etc. regarding sustainability and textile innovation. I wanted to take “sustainability” a step further and therefore, instead of focusing on implementing sustainable technology or anything of that matter, I wanted to know how the discounter culture could thrive in a completely new business model and economy based entirely upon natural capital restoration and zero waste. Thus, the idea of implementing closed loop models in low-price, mass production came forward.

1.1 Research and Opportunities

As the fashion industry is the second most polluting business next to the oil industry (EcoWatch, 2015), there are no more excuses to not focus on sustainable solutions. In order to move forward and to thrive within the foreseeable future, we need to make it one of the main purposes within the industry. At the moment many corporate systems and lifestyles are based upon a linear model of ‘take, make and dispose’. But with fast fashion companies and mass merchandisers continuing to expand ‘take, make and dispose’ resulted in taking more from virgin sources than nature offers and disposing large amounts of waste in energy, water, textiles as well as in other areas that the environment cannot gradually break down anymore (Juliette Jowit, 2008). Especially with huge apparel companies offering low costs and producing high volumes.

To turn away from the old-fashioned linear model a closed loop system, or a circular model is presented as an alternative. The idea of a closed loop system is to ensure that the lifecycle of a product stays in a continuous loop as long as possible. The product is designed in such a way to ensure that its post-consumer waste can be manufactured into its next purpose in the most efficient way while still remaining the quality of its components (GreenStrategy, 2016). To entirely close the loop, the textile recycling system is an important part. By successfully implementing and investing in closed loop systems waste could be minimized and innovations within a natural based management can be pushed to their limits. Resulting in companies and big corporations to thrive in a circular economy in a society that continues to stress the importance of sustainability and giving them a step ahead economically and environmentally within the near future (Preeti Srivastav, 2016). Innovations and technological advances within sustainability and recycling towards the fashion industry that are applicable on a large scale is limited at the moment (Hannah Gould, 2015). Therefore, closed loop models and other advanced technological solutions for sustainability are usually experimented with and implemented on a very small scale, though proving they are viable.

Big brands such as H&M, Puma and Levi’s are starting to slowly implement closed loop systems through recycling campaigns involving consumer participation, showing the mere possibilities of closed loop systems on a large scale (Cyndi Rhoades, 2014). Though modern innovations within recycling has been praised, critics were soon to point out the true efficiency of recycling on a large scale for these brands (Marc Bain, 2015). In general terms, while 98% of textiles can be recycled only 15% is actually being used as most of the textiles that are collected consist of too many fibres that are considered too low in quality to be reproduced into its next purpose (Wovin, 2016). After multiple cycles of recycling, the quality of the fibres decreases. This is especially the case for natural materials such as cotton and wool. Though these recycling programs by big brands are a step forward into a positive direction, it has also been
described as a conscious marketing program that just makes things ‘less bad’ instead of truly going green.

1.2 Relevance

Even though it is only a positive thing that fast fashion brands are starting with these campaigns, here is why a different market could and should be the leaders on the march towards a sustainably efficient future; the discounters. Mass merchandisers, or discounters, are retail stores that offer an extensive range in products, such as food, stationery, clothing, accessories, appliances and the list goes on. Big players within this market are German companies like Lidl and Aldi, but also American brands such as Walmart, Target and K-Mart. In general, apparel sections in the mass merchandiser market or “supermarket fashion”, have a lower fashion cache, huge bulk production orders and, other than fast fashion companies, have a slower rate of presenting seasons and collections. These factors show that mass merchandisers should be the ones implementing closed loop systems as quality and practicality are usually leading factors during product development, than the demanding pressure of putting out trendy collections as quickly as possible to their audience. The slower rate of putting out collections and the usual simplicity of the designs and styles makes mass merchandisers more lenient and approachable to be the first ones within the textile industry to successfully go forward with a closed loop model, not a campaign. If closed loop models are the future that we are heading to, it is important to know what we can do in order to commercialize these innovations in the textile industry.

1.3 Research Questions

The goal of this research is to analyze current innovations and possibilities of closed loop models that are able to be implemented on a large scale and how to flourish in a circular economy as a mass low-cost, fashion merchandiser within the near future.

Main question: To what extent can a circular systematic product development process be implemented to the apparel section of the discounter market?

The following sub-questions are to be answered within this report to support the research:

- What does a closed loop model mean (in general terms)?
- What is the current situation regarding closed loop models within the textile industry?
- Why is the discounter the right market to implement circular product development models to their apparel lines?
- How can discounters apply circular product development models to their apparel lines and that are the potential opportunities and limitations?

1.4 Methodology

In order to perform this research, a few classic research methods within both primary and secondary research fields have been conducted. Next to performing on- and offline desk research for theoretic knowledge, interviews have been conducted with professionals within the industry to gain a deeper understanding on certain topics on the circular economy, closed loop models, textile innovations and sustainable production processes. General information on production processes and organizational structures of discounter retailers have been gained by my personal experience from multiple internships at Lidl Hong Kong within Textile Sourcing and Textile Product Development.

Limitations

The research done for the report was initially partly relied on qualitative field research, more specifically, qualitative interviews with professionals in the industry. Though, when difficulties within reaching out and conducting the actual interviews arose, it became apparent that this would remain a continuous limitation within the research process. Therefore, the presented deeper insights on circular economy framework development opportunities, ideas and opinions that were considered necessary to conclude this research report are limited.
2.0 Development of The Circular Economy

As Walter Stahel laid the groundwork for the circle economy framework, Ellen MacArthur and her foundation continued to extend on this today as the foundation is active in researching, publishing papers and case studies and collaborating with various important players to make sure that everyone interested can be involved in the acceleration of the circular economy. Recognizing the efforts in research that are done by both parties are important to define the circular concept.

For 200 years long the industrial revolution had enjoyed and flourished within a linear business model. Meaning, we collect raw materials, make products out of it and eventually throw them away once their purposeful lifecycle is finished. It is simple and clear, until we found out how wasteful this approach was. The accumulating waste of these products eventually ends up in landfills. This resulted in a linear process where we take more of the natural resources available and dump and destroy the waste, causing huge environmental disruptions.

Within a circular model, the idea is that products are designed to be restorative and regenerative to keep the components and materials valuable and optimizing at all times. It is a continuous development that preserves and enhances natural capital, optimizes natural resources and minimizes system risks by managing finite stocks and renewable energy flows. The circular model is workable at every scale. The circular economy has three principles which it rests on:

**Principle 1 - Preserving and Enhancing Natural Capital**
This is done through managing finite resources and maintaining flow of resources. When natural resources are being extracted, the circular model ensures that they are chosen carefully and treated by appropriate technology in order for these materials to flow in a loop as long as possible.

**Principle 2 - Optimizing Resource Inputs**
Through circulating products and materials at the highest possible quality through biological and technical cycles, natural resources can be optimized. Important to note here is that we must focus on designing for remanufacturing and recycling to keep materials circulating in the economy.

**Principle 3 - Supporting System Effectiveness**
This would be done through designing out negative qualities in the products. By revealing these negative qualities and components that could harm land, air, water, release of toxic substances and climate change, redesigning for regeneration becomes a logic response.

( Ellen MacArthur Foundation, 2016)

2.1 Initial Circular Framework: Walter Stahel

Walter Stahel is a Swiss architect who has been a huge influencer within sustainability developments. In 1976 Walter Stahel and Genevieve Reday wrote a research report to the European Commission in Brussels called “The Potential For Substituting Manpower for Energy”, where they proposed the idea of an economy that runs in loops and what the impacts were concerning job creation, economic development, resource management and waste prevention. This is supposed to create sustainable profits without costs of waste. Later on, these factors are referred to as the three pillars of sustainable development: ecologic, economic and social compatibility. Furthermore, in 1987 Stahel and Börlin published a report [called the “Economic Strategies of Durability – longer product-life of goods as waste prevention strategy”] where they showed that economics participants within a loop economy are able to achieve higher profitability than their competitors. Supported by 30 case studies they showed that a loop economy can be successfully implemented with a fully restructured framework of the industrial economy. (Product Life Organisation, 2016)
Many experts put out the idea of a “cradle-to-grave” system in response to Stahel’s reports, which insists on finding solutions to improve waste landfills, explaining that it is more in line with the current linear approach of the economy. This would make sense as the linear production model is based on ‘take, make and dispose’ (Product Life Organisation, 2016). Stahel soon responded that the true sustainable solution was to use durable products in a “cradle-to-cradle” loop, which is a production technique where all material inputs and outputs can be used as biological or technical nutrients. Simply put; all materials used within a cradle-to-cradle loop can either be composted (biological nutrient) or recycled/reused (technological nutrient). Together with Michael Braungart, the idea of cradle-to-cradle was promoted and elaborated on throughout the years. (Making It Magazine, 2013)

2.2 Future Circular Framework: Ellen MacArthur
Dame Ellen MacArthur is a retired British sailor from Derbyshire, UK. From her trip to South Georgia, MacArthur was astonished when she experienced that the previous thriving center of the whaling industry was completely ‘empty and soulless’ since the industry had died (McKinsey, 2014). The idea that a natural resource was used up to a point that it became no longer economically viable to harvest anymore made MacArthur realize that sooner or later the same would happen for oil and coal. This resulted into the Ellen MacArthur foundation, launched in September 2010. The goal of the foundation was to ‘accelerate the transition to a regenerative and circular economy’. Finding solutions to optimize efficient use of resources will only delay the process of resources running out. Instead, the goal must be to shift towards a circular economy that is based upon imitating nature (Ellen MacArthur Foundation, 2016). Today, the Ellen MacArthur Foundation remains an important platform towards research and acceleration of the circular economy.

2.3 Pioneering Ideas
The circular economy concept is originated and elaborated from many different concepts and it is therefore hard to name exactly one person to trace this back to, though it has been popularized in the late 1970s by several academics including Walter Stahel and Michael Braungart. The generic model of the circular economy has been led and developed by a few particular groundbreaking developments and ideas by leading innovators worth mentioning. To fully grasp the concept, these ideas will be mentioned as they will also be referred to within this research report.

2.3.1 Performance Economy
Walter Stahel and Genevieve Reday’s report, ‘The Potential for Substituting Manpower for Energy’ envisioned an economy that runs in loops (circular economy). Throughout the years, Stahel created the Product Life Institute in Geneva to develop his closed loop approach to production processes. The 4 goals of the institute consists of: product-life extension, long-life goods, reconditioning activities and waste prevention. Stahel also introduced the importance of selling services instead of products (functional service economy).

2.3.2 Cradle to Cradle
Michael Braungart and Bill McDonough developed the Cradle-to-Cradle process that is built upon Walter Stahels idea of a production process where all the material involved are nutrients, either technological or biological. One of the characteristics of the end-use of the product is meant to be either recyclable or biodegradable. This framework focuses on designing for effectiveness and efficiency to reduce negative impacts, using nature’s ‘biological metabolism’ as its model.

2.3.3 Regenerative Design
John T. Lyle developed innovations on regenerative design that could be applied in different frameworks that went beyond natural systems, such as agriculture where the concept was already developed, laying the foundation of the circular economy framework. In a regenerative designing process, “to regenerate” means “to create again”. It means that a regenerative system is intended to create and design something with the intention that the output is positively equal or greater than the input. It then uses its output as
new input what in other systems would have become waste. It is important to note that regenerative design is not the same as sustainable design. “Sustainable design aims to provide for fundamental human needs; regenerative design goes further in that it plans for the future co-existence and co-evolution of humans and other species.” (Regenerative Leadership Institute, 2016). As taken from the biomimicry play book: it is comparable to a plant that regenerates itself once it dies.

2.4 Conclusion
Based upon the foundations relevant research and definitions, this research papers continues to refer to the principles defined by the Ellen MacArthur Foundation as their research are deemed most relevant towards today’s global context to move forward. Though based upon Walter Stahels ideas, the Ellen MacArthur Foundation focusses strongly on research and solutions towards helping businesses transition to circular models and is therefore considered to be most relevant for this research paper.
3.0 Textile Industry In The Circular Economy Today

This chapter is meant to analyze the current situation of the whole textile and apparel industry to outline current efforts that have been met and the limitations that have occurred thus far, hindering the process of the development, as this will apply to the discounter market as well. For the textile industry, a circular economy can mean the following thing: “A circular textiles industry is based on a system where textiles products, fabrics and fibres are infinitely and effectively cycled through connected loops within and across industries in a transparent and economical way, where producers apply business practices that enable circular use of textile resources and promote social justice, and consumers have a healthy relationship with textiles, based on sustainable consumer practices” (Brett Matthews, 2015).

Furthermore, it is important to note that a closed loop model is not the same thing as recycling. Rather, recycling should be seen as an essential part of closing the loop in the process. A circular business model for the textile industry means changing the way products are designed, produced, shipped, bought and recycled. To make sure the ‘loop can close’, textile products need to be able to show their recyclability, making sure that disassembly of the materials is possible and to optimize logistics and infrastructure along the way.

3.1 Circular Economy and Closed Loop/Circular Models

Within this report, the following terms “circular economy”, “closed looped models” and “circular models” will be mentioned numerous times. As to prevent confusions between the definitions I will briefly explain how they are used in the context of this research report. The circular economy is referred to the concept of the economic framework that runs in loops as a whole. In order to flourish in a circular economy, closed loop models are presented towards businesses. Within this report, when referred to a closed loop model or a circular model, it is implied towards systematic and strategic business models that can be implemented in fashion businesses.

3.2 Emerging Importance of The Circular Model

As sustainability measures are continuously becoming a more important and ingrained part within the textile industry, there has also been a rise in maintaining and eliminating waste as companies start to act upon the responsibility of the harmful effects of their practices. Thus, the circular model provides an entirely sustainable and environmentally friendly production process that is designed to eliminate waste, as opposed to sustainable solutions that offer low impact solutions. Not only is it about reducing waste, it is also about resource productivity and most importantly, the circular framework provides a long term solution that is meant to sustain the environment in the long run. The reason for this rather sudden strong active interest is the fact that both the environment and the economy is starting to feel the pressure of the growing population, a growing middle class and the expected continuous thriving and prospering economy in developing nations. Therefore, the growing demand for virgin resources and its limited stock in natural capital has raised the attention to start sustaining the environment, while maintaining a flourishing economy. Virgin sources are getting more expensive, while opting for cheaper, man-made fabrics is getting more common. Consumer behavior and demands have been shifting towards a more sustainable behavioral pattern that leans towards sharing, collaborating and more environmentally conscious lifestyle choices. In a research done by the “Aspirational Consumer Index” 95% showed that millennials preferred consuming less in order to preserve the environment and 90% were willing to pay more for environmentally friendly products.

Next to wanting to drive an ethical and sustainable production process, the circular model is also argued to be a profitable opportunity for transitioning businesses, as is calculated by the Ellen MacArthur Foundation. These opportunities include material savings, increased productivity and job opportunities. The biggest savings in cost would be within material costs as extracting from virgin resources would not be needed anymore. According to the EU, businesses that apply circular models can save up to €630
billion. Next to that, it can generate up to 2 million additional jobs by 2030. In the U.K., the evolvement of the circular economy has a market net worth of £15 billion and has created over 10,000 jobs so far. Though, it should be noted that these numbers do not represent the textile industry by itself. Because the circular model is a young concept within the textile industry, it is difficult to find and present hard data solely on this. “All in all, the circular economy will lead us towards a future in which 9 billion people in 2050 can live well and sustainably.” (Frans van Houten, 2014)

3.3  Present and Future Scenario’s
Preventing waste is easier than eliminating waste. Therefore, it is important to recognize that designers and everyone involved in the production process should have an extensive understanding on the end-of-life uses of a product to ensure that designing for eternal endurance of the materials and designing out negative qualities can be possible. In the global context of today, it is important to realize that the product development process should be a framework based upon both active and reactive systems towards closed loop models. The process should involve active players to develop and innovate within optimizing resources and recycling processes (active), while also keeping in mind the waste that is already in the system (reactive). Reactive design approaches can be described as ‘extended life techniques’ instead of ‘designing for recycling’. The latter is not applied as often as the recycling industry and designing processes towards full recyclability are under heavy development. Therefore, at the moment re-active product development processes are a far more preferred approach (Kate Goldsworthy, 2014). However, this results in an imbalance between the active and reactive systems in the product development process that withholds the full potential of circularity in the textile industry.

In the following paragraph three scenarios (designed by Dr. Kate Goldsworthy) are shown to represent the current activity and future desired state of the textile industry within the circular economy.

Now
The textile industry finds itself today in a near closed loop circle. We are getting closer and closer, but we are by far not getting there yet in closing the loop successfully to make a change. At the moment the industry is struggling working with existing waste streams and enhancing product longevity. We find ourselves surrounded by fashion products that have limited life cycles and are produced by a limited choice of materials apt for the mass merchandising market. We are dealing with eliminating current waste streams as an effect of products produced without focusing on end-of-life use. This includes non-degradable products containing harmful chemicals that end up in landfills.

Figure 1. “Towards a Zero Waste Future: Creating Closed Loop Systems: Now” Illustration by Dr Kate Goldsworthy
Near
At the pace that we are at right now, we are heading towards an industry where the product development process is still depending on its limited choice of materials, but are designed through a process that focuses on an unlimited product lifecycle. Technological and chemical limitations within the recycling system would be taken into account during the design process. The loop is closed, but in a true closed-loop model, the recycling system needs to be able to treat incredible amounts of biodegradable waste as efficiently as possible for the materials to run in the loop infinitely.

Future
In the future, we would have an extensive library of biodegradable materials that can run in loops eternally, evolving from the limited choices in materials that we have now. The sustainable future of garment manufacturing will be interconnected and runs in constant loops in every part of the process. Regenerative designing will be optimized and will be the preferred approach towards product development processes to make sure we are active players (rather than re-active) in the circular economy. The future industry will be a transparent looped system where material resources are optimized eternally.

3.4 Challenges and Limitations
Constraints with technological limitations and insufficient knowledge on the topic has caused for a slow development and implementation of the model in the apparel businesses. Introducing and implementing new innovation in the industry always comes with challenges, risks and insecurities (Dhirendra K. Vapeyi and Roopinder Oberoi, 2015). But implementing sustainable development innovations is even harder due to the fact that it is dependent on several complex factors. This includes the dependence on investors and stakeholders and the consideration of not only technological and environmental considerations, but also the dynamics of social change (Hall, 2002). “Transitioning towards a circular textile industry requires innovation, risk-taking and collaboration in a highly traditional industry. Not impossible but challenging!” (Kate Goldsworthy, 2016). This chapter offers an overview of the challenges that the textile industry is facing at the moment towards implementing
closed loop systems. The key challenges and limitations that large scale apparel companies are facing in a circular business model or even restrains them from shifting towards it are listed as below.

### 3.4.1 Governmental Influence

As the importance of the circular economy has already been noticed by various governmental bodies, it is necessary that their influence is recognized as an essential part to accelerate and to push industries and consumers to slowly adapt to the circular economy, as with any global pursuits in order to drive a lasting change. This is a necessary step before immediately changing rules and tipping over once chemical and technological developments are advanced (Corporate Citizenship, 2014). The circular economy is described as a holistic concept on the economic framework. To shift from linear to circular, the development of the concept is not only depending on technology and funding, but is also heavily relied on a change of mindsets and active behavioral change. The problem is that current governmental influences on regulations and legislations are not pushing it far enough. (Hannah Furlong, 2016)

### 3.4.2 Textile Recyclability Limitations

Even though textile recycling seemed like a solid and environmentally friendly solution to reduce waste and optimize use of virgin resources, it soon became evident that the textile recycling industry came to face some inevitable issues. At the moment, the recycling industry is trying to work with the existing waste streams, which has exposed incredible realizations on the quality and recyclability measures of today. Concerning the percentage of the textile recyclability materials are relatively low and the quality does not come near virgin resources, it is clear that we are dependent on finding solutions for these flaws before anything else. This will be explained further.

**Textile Recycling On A Large Scale**

Most famously, H&M ran the first garment collection and recycling initiative on a large scale in the fashion industry, named the “closing the loop campaign”. The campaign supports consumers to bring back old clothes with help from collecting and recycling companies such as I:CO. In return consumers are offered discounts as a reward. Other companies like Nike, Marks & Spencers, The North Face and Patagonia were to follow after H&M through various recycling campaigns that includes customers returning their old clothes from that particular brand in order for them to disassemble their own materials and recycle them. Though, one of the biggest issue that large fast fashion brands such as H&M are running into now, is the fact they often find that their own materials are of incredibly low quality and are therefore not fit enough to be reused again. Their products are often blends of materials that combine either two or more fibres that it even makes it very labor-intensive to disassemble the materials. This issue should result in an urgent realization that the initial sourcing and use of relevant materials are an incredibly important part to close the loop in textiles.

**Low Quality of Textile Fibres**

At the moment, the more we disassemble fabrics and yarns and up-cycle them, the lower the quality of the product gets along the way. H&M tends to run against this problem during its recycling campaign, especially when it comes to natural fibres. At the moment, the highest number they can use for mechanically recycled cotton from their own post-consumer waste is 20% without weakening the quality. The issue with the man-made fibres is the fact that the fibres get shorter during the mechanical recycling process. Meaning that the quality of the fibres are getting lower and lower each time. They have to be blended with virgin fibres to reach H&M’s quality standards. (Carola Tembe, H&M Environmental Sustainability Coordinator, 2015).

**Technology**

To truly revolutionize the recycling system in light of the current textile industry situation, material recovery technologies is what is going to change the industry. The large scale recycling market is still heavily in development as there are not enough brands and companies who are active in the recycling industry. These technologies are currently either still developing or only available on a small scale and...
therefore not yet viable on a large scale. The textiles industry can therefore not be fully circular yet unless these machines are available globally. It is important to note that these machines need to be able to work with blended fibre compositions and produce high quality fibres in a sustainable way. To improve durability in fabrics, technically and chemically, that can be used continuously would be a huge step towards efficiency of recycling and ultimately to close the loop in textiles. (Brett Matthews, 2015)

3.4.3 Skills
Regarding the textiles industry within the circular economy, the industry is lacking in S.T.E.M\(^1\) based knowledge and skills that is needed to accelerate and perfect implementation strategies, innovation and design possibilities. There are many global platforms, organizations and companies that excel in circular economy, but these all represent separate organizations and movements. Promoting collaborative efforts between various sectors and also investing in these skills is highly necessary in order to strategically optimize them. (Corporate Citizenship, 2014)

3.4.4 Finances and Investments
At the moment, one of the most important parts towards implementing closed loop models is to invest in it. Many fashion companies are hesitant in doing so, as it involves a full restructuring of the system, which is always a high risk and especially when it is difficult to predict the precise desired outcome. But without these investments and finances the industry will never be able to close the loop. It is important to remember that closed loop models are beneficial in the long term, as is proven by other cases in different industries. This should encourage businesses and large scale corporate fashion companies to adopt a longer term mind-set.

3.4.5 Consumer Behavior and Mindset
The circle economy has been described as a holistic approach towards business. It is and it will be difficult to find support from the general consumer of the mass merchandising market, though it is necessary. The trick is to make these changes without depending on consumer participation as much as possible, in order for consumers to feel that they do not have to adopt to anything or make any efforts that could put consumers off (Brett Matthews, 2015). As research has shown, those with an income of $20,000 or less are more willing to pay more for sustainable products and services for positive social and environmental impact than those who earn more than $50,000 by 5%. It has also been shown that millennials\(^2\) are the ones who are most willing to pay more for sustainable products and/or attain an environmentally friendly shopping behavior next to Generation Z, the population under 20 years old (The Nielsen Company, 2015).

3.5 Conclusion
When we look at the shift in consumer behavior, it is important to keep in mind that the active sustainable consumer behavioral pattern are mostly under millennials and Generation Z, which we can consider to be the generation of the near future. The rationale for the circular economy is apparent towards eliminating waste and the long term efficiency for both fashion companies and the environment. Even though there is a growing interest in the circular economy, there are still not enough active players in the process to make a change. The lack of technological advancements, apparent hard data in long term financial success and knowledge in the subject has caused a hindrance in the development of the circular concept to reach its potential in the textile industry. Since it is still a relatively new concept in the textile industry, it means that not only can the closed loop model put a focus on improving the environmental and ethical areas in the industry, it is also a concept with room for innovation and can be an advantageous business strategy to stay ahead of competitors. Adopting a mindset that focusses on long term goals and benefits will not only visibly show the efficacy of closed loop models, but also to strive forward in making this approach successfully viable for big fashion corporations.

\(^1\) S.T.E.M stands for Science, Technology, Engineering and Maths
\(^2\) The research done by Nielsen defined millennials as everyone who were born between 1980-1997
4.0 Overview of The Discounter Market

This chapter is meant to outline the discounter market as a fashion retailer and to highlight its influence in playing an active role towards sustaining natural materials as it is a market that continues to grow bigger and better in the coming years. To understand why this market is apt towards sustainability innovation, an overview has been given that starts with introducing “supermarket fashion” and by presenting its strength and apparent importance as a fashion retailer through outlining relevant global trends. It should be noted that within this research paper I will focus solely on the growth and opportunities in the apparel line of the discounter market, or in other terms, “supermarket fashion”.

4.1 Definition of The Discounter

Simply put, a “discounter” is a large business that sells goods or services at less than the usual price, according to the Oxford dictionary. A discounter or a mass merchandiser is a retail store that offers a huge range of products. This can include food and beverages, apparel lines, accessories, homeware, hardware, electronics and the list goes on. Usually these are sold either under its own brand names or private brand names. Some of the biggest players include Walmart, Kmart, Target (United States), Aldi, Lidl (Germany). It is important to note that within this research paper we will specifically focus on full-line discount stores who offer extensive apparel lines in their product range, different from fast fashion retailers or traditional retailers.

4.2 Development of “Supermarket Fashion”

The discounter apparel line is often overlooked and underestimated as a competitive and influential player within its market. Nonetheless, they have shown to be a strong player who have evolved incredibly throughout the years within the fashion market to eventually become one of the biggest players as fashion retailers. In the UK, grocery retailers are amongst one the biggest fashion retailers, especially when it comes to clothing and footwear. Their focus on speed, efficiency and innovation is what characterizes their strength. The discounters overall success is highly dependent on various cultural aspects: consumer spending and the acceptance of the discounter, low-cost product concept. But also thanks to their efficient supply chain model, a focused product range and an overall “no-frills” approach. Discounters are also often willing and eager to taking risks in new innovations and investments in many different areas (Mirko Warschun and Peter Schmidt, 2011). The success of supermarket fashion was initially influenced by consumers’ impulse purchases in grocery supermarkets (Deborah Weinswig, 2015). Nowadays, supermarket fashion has committed to their significant brand awareness; low price, high quality. Today, it is a misconception that the low cost products are meant to be for consumers who have lower income. Consumers from middle and upper class income feel comfortable shopping at discounters because of their confidence in the product.

4.3 Consumer Driven Market

It should be mentioned that the influence of the discounter as a fashion retailer today is not only characterized by its efficient and flexible internal framework, but also through external macro and micro economic future trends that are pointing towards the even bigger potential growth and importance of the discounter. This part is meant to present a rationale towards the discounter as a key player in sustainable innovation through outlining the most relevant external trends towards the near future in order to understand the scope of the apparel line of the discounter.

What is important to remember is that discounters are not solely fashion retailers, but initially a supermarket or “hypermarket” retailer. Internally, it is an interesting case where really two types of mass merchandising retailers and processes are merged together and belong to one another. This means that both markets can benefit from each other’s potential, strength and growth and are able to collaborate together in ways that other fashion retailers are not able to. One of those benefits is that supermarket retailers have an incredible collection of behavioral data amongst other knowledge on their consumers,
which can cover more than half of the adult population per country (Katie Smith, 2016). “By truly understanding the motivations of customer purchases, supermarkets have a greater ability to win share of wallet and therefore address the rise of discount retailers” (Sara Hughes, 2015). Therefore, discounters have an incredibly saturated knowledge on their consumers habits and behavior and are able to serve to their everyday consumers effortlessly according to their collected data. With the rise of the environmentally conscious consumer and a growing middle class (World Business Council for Sustainable Development, 2016), it is only natural that the discounter is growing together with their consumer’s needs and opt for a more sustainable process offering sustainable products. This influence is already seen in their other product offerings, such as organic foods.

4.3.1 Consumer Driven Design Development

Throughout the previous years, socially conscious retailers have been performing well each year through and through and especially amongst the millennials. Now more than ever consumers will have access to product information like never before, meaning that the focus on ethically sourced products will be growing stronger. This will stem from the consumers personal motivation “to do good” that will be an important weighing factor in their shopping behavior and purchasing decisions. These changing consumer demands will result in a product design development that is strongly lead by consumer’s needs (KPMG, 2013). Consumers want to know where they’re products are coming from and how it is produced. Through the technology of today, they are able to get this information more easily. For the discounter market to weigh in on this trend is only natural as most of their competitors have already implemented sustainability programs.

4.4 Conclusion

Supermarket chains have found a distinguished advantage as they have an incredible understanding in consumer behavior and consumer needs due to their great collective of data on consumer behavioral pattern of the majority of the everyday adult population. The concept of fast fashion mostly goes against the idea of closing the loop as it thrives on consumerism and fast changing trends. Therefore, fast fashion brands simply cannot be sustainable nor close the loop. Thus, in what way are discounters more eligible to actualize the benefits of closed loop models in the fashion industry? Supermarket fashion is not strongly dependent on trends and fads, making it easier to focus on quality garments. Next to that, supermarkets also serve to a large and varied group of consumers, making it accessible to everyone. Combined with a focused, efficient and flexible framework the discounter finds itself in a unique position towards the flexibility of implementing innovation and the potential to become a leading fashion retailer, focusing on sustainability and raw material preservation, while increasing market competition. Driven by a stronger consumer demand in sustainability-driven products, discounters are the right size offering the right kind of products to the right type of consumers to make a significant change environmentally and financially.
5.0 A Product Lifecycle Approach

The importance of product design towards life cycles and end-of-life uses are rarely evaluated as the focus lies more upon improving internal processes, manufacturing and logistics. Leaving the product development process (PDP) a traditional process with little room for innovation and creativity when it comes to sustainability innovation (AT Kearney, 2010). Thus, a product lifecycle approach towards product development is what we should strive towards to in the circular models. The approach is meant to focus on sustaining materials and will affect the company’s system towards the environment from manufacturing, production and distribution. The benefits that come with focusing on product lifecycles can mean adapting cleaner production processes, increase better quality in clothing and brand value for companies, manufacturers and suppliers. While it can also help consumers pointing towards a more sustainable consuming behavior through offering a more transparent background details on materials (Lifecycle Initiative, 2016). Not only is it about the impact we will leave on the environment today, but more importantly it is about the impact we will have on the future.

This chapter will present three main approaches towards circular product development processes that are highly focused on the product lifecycle as a whole. This includes designing for product longevity (DfL), design for recyclability (DfR) and design for disassembly (DfD). The design approaches are specifically those that involve low consumer participation efforts and highly depend on internal systematic efforts, considered to be relevant towards the discounter market as it involves easily adaptable PDP’s.

5.1 Apparel Line Product Development Process (PDP)

About 96% of all companies worldwide to minimize gas emissions and improve supply chain maps, which is a rather traditional approach towards implementing sustainability with lack of room for innovation and creativity in product development systems. Designing circular does not necessarily mean producing less and offering less to consumers, but more about offering efficiency, optimization and sustainability as core components of the product. Offering the same desired outcome, but with different inputs and more efficient end-uses. Therefore, it is important to understand the PDP of the discounter apparel line today as a reference towards understanding product lifecycle approaches that enhances the circular economy. The simplicity and efficiency of their supply chain map and PDP should make them more lenient towards implementing sustainable development innovations.

The chart that is shown in Figure 4 can be considered a basis for the current discounter product development process. The discounter apparel line is known to be of a very extensive range. This can include trendy items for men’s, women’s and children’s, such as accessories, workwear, active wear, performance wear, swimwear, uniforms and more. They are known for producing simple styles, using limited and commercial choices in materials and claiming to focus on high quality. They also offer a wide range in sizes, meaning they offer a good selection for every shopper. The movement of trends and styles for supermarket fashion shift slowly, compared to fast fashion items. Usually the collections are aligned with the seasons, meaning they will present about 4 collections a year. Which is considered as low in today’s context. When it comes to product range, they are constantly evaluating their ever-expanding product. The average discounter offers about 1000-3000 products (Mirko Warschun and
Peter Schmidt, 2011) and approximately about 250 million to 300 million garments are produced per year per discounter.

As discount retailers have a large amount of stores spread globally, they usually have appointed buyers for every country and/or region that will eventually select final bulk orders. Out-sourcing is usually preferred to South-East Asian countries, considering the price/quality level. Many suppliers and manufacturers are eager to have these discounters as their clients as this will usually result in assurance in huge quantity orders for the suppliers, low production prices for the retailers and a good and lifelong relationship between the two parties. Designs are often simple and do not include complicated styles and trimmings, resulting in a less complex PDP. This allows for innovations to be implemented more easily.

5.2 Design for Longevity (DfL)
Ultimately, in closing the loop, the goal is to create and produce garments that contain materials that can be sustained to elongate product lifecycles and enhance end-of-life use degradability. The core of designing for product longevity lies in sustaining the materials as long as possible. Therefore, designing for product longevity can be seen as a significant approach towards a closed loop PDP. The challenge that comes with DfL processes is that the knowledge and skills are there, but it is the actual convincing of investors and stakeholders to invest more in production towards sustaining product materials. It is difficult to convince a company that drives on consumerism to produce items that will make the constant bargain-crazed consuming behavior less attractive. The recommended product lines for a DfL approach would be basic everyday styles. These are most suitable for product longevity due to simplicity of design and timeless consumer usage.

5.2.1 Aim
DfL means making sure that all components of the garment are completely optimized to ensure that the lifecycle of the garment can be eternalized. The average life span of a garment (from retail consuming to landfill) is 2.2 years. Extending this lifecycle by three months per item only can already reduce carbon, water and waste footprints up to 10% and cut resource costs (WRAP, 2016). The determination of product longevity is dependent on two major components. The design process and the lastingness of fashion and style trends.
5.2.2 PDP Key Characteristics
For a PDP based on product longevity, it is important to note that even the smallest design measures can ensure the lengthiness of a product lifecycle and every aspect from seams to pleats to dyestuffs should be taken into account. A DfL approach could influence the PDP in the following different ways.

Sustaining Style
Repeating classic and timeless styles and shapes over the time being would be the most efficient way to design. Timeless fashion items are meant to be worn over time as it transcends changing fashion trends. As mentioned before, the same would count for materials and colours. Not only in seasonal trends, but also in more sustaining quality. This sort of systematic design approach could work well for a discounter, as the focus on trends are not as emphasized as the focus on durability and overall quality.

Multifunctional Features
Furthermore, small creative changes in the design construction can include multifunctional or detachable parts and patterns, stronger seams and/or adjustable trimmings. The use of multifunctional features can sustain the productivity of the end product through versatile and adjustable consumer use throughout its lifecycle.

High Quality Material
It is important to note that quality assurance would be one of the most important parts to focus on in a DfL approach throughout its entire process. And even though measures towards recyclability should be taken into account for its end-of-life use, the main focus will remain on sustaining the materials in the initial stages of the lifecycle. It would be important that the material choices are of high-quality, enduring fibres that prove to be of high performance, strong colour fastness and are resistant to pilling. We could think of fibres such as wool, polyester and nylon that are known to be strong and enduring fibres. Including viscose and elastane in knitted garments can be useful for recovery properties for close-fitted garments. (WRAP, 2016)

5.3 Design for Recycling (DfR)
The initial focus of recycling is to turn unwanted textiles into new raw materials to create new textiles. The recycling process is dependent on donation and collection of old clothing or other unwanted textiles. This mainly includes post-consumer textiles (unwanted garments) and pre-consumer textiles (left-over scraps of yarns and fabrics). After collecting, the usable fibres get sorted and processed into new textiles that are ready to be used for production of new garments. The rest of the unwanted textiles or unusable fibres gets either down cycled or discarded. Approximately 65% of recyclable post-consumer textiles are pure materials, of which cotton is the largest part. The most blended material are a blend between cotton and polyester (Circle Economy, 2016). For a DfR approach, product lines that are based upon polyester would work best, such as sportswear. This is to ensure eliminating existing plastic waste and to maintain high quality for recycling on a large scale, which is easier done with fabrics such as polyester.

5.3.1 Aim
The aim of DfR is to design products specifically to facilitate the proper recyclability components and materials for the end-of-life use (Kate Fletcher, 2008). At the moment, most of the DfR approaches have resulted in low impact attempts and recommendations on how to reuse and recycle existing textile waste. Because of the incredible stream of waste, DfR approaches were more directed towards finding a solution towards the current stream of waste, rather than focussing on designing products out of specific components made to recycle.

5.3.2 PDP Key Characteristics
One of the biggest limitations in textile recycling is the fact that most of the clothing produced today are made out of blended fibres, which they can not sort apart in large volumes. This issue causes for the
textile recycling system to slow down while the outcome of the upcycled product is usually of lesser quality than the original material. Therefore, ensuring a high quality of fibres and colourfastness is one of the most important demands towards recycled products. However, it is important to note that even though DfR does not focus on solutions towards eliminating existing waste of streams, it does not mean that components in products designed through a DfR approach should not contain materials from existing textile waste; as long as it is assured that the quality of the old textiles/garments are suitable for a limitless lifecycle stream, it is only encouraged to use these materials.

**List of Requirements**

A DfR approach towards PDP will not necessarily differ much from the basic PDP. Rather, its presence will be more seen as a checklist of recommendations towards natural and chemical fibres that should be referred to. Such criteria checklist should contain the following requirements (Kate Fletcher, 2008) (Subramanian Senthilkannan Muthu, p. 114, 2016).

<table>
<thead>
<tr>
<th>Easy re-dyeable textiles</th>
<th>Using easy re-dyeable textiles ensures the use of hazardous chemicals and waste of outputs during the regular dyeing process are limited.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High quality of natural/virgin fibres</td>
<td>The use of high quality natural fibres is preferred in the textile recycling system as the quality is higher compared to man-made fibres and are more versatile, meaning it will last longer in the product lifecycle.</td>
</tr>
<tr>
<td>Length of staple (and filament) fibres</td>
<td>When it comes to man-made fibres especially, the fibres get shorter during the mechanical process of recycling. This means that the quality of the upcycled product gets lower each time it gets recycled. It is therefore important to use long stapled fibres that are usually found in natural fibres such as cotton, wool and silk.³</td>
</tr>
<tr>
<td>Minimal use of blended fibres (preferably opting for monomaterials)</td>
<td>Using monomaterials instead of blended fibres is preferred as it will eliminate the process of sorting the blended fibres, which would make the recycling process easier.</td>
</tr>
<tr>
<td>Elimination of toxic substances usage</td>
<td>Minimizing toxic substances within the first cycle of production would mean that the usage of these substances can be eventually eliminated.</td>
</tr>
<tr>
<td>Detachable trimmings</td>
<td>Using detachable trimmings would have a high positive impact on the textile recycling system as it often requires a lot effort and in some cases it is not even possible to detach buttons, zippers and other trimmings from the garments without ruining (the quality of) the garment.</td>
</tr>
<tr>
<td>Printed instructions on garment care and treatment instead of labels</td>
<td>Care and treatment instructions may be printed on the insides of the garment for ease of removal during the recycling process.</td>
</tr>
<tr>
<td>Instructive care labels on end-of-life treatment</td>
<td>Highly instructive and descriptive labels on how to treat garments for recycling can help consumers treat their garments with more attention towards its end-of-life use.</td>
</tr>
</tbody>
</table>

Table 1 “Design for Recycling: List of Requirements”

An example of DfR is shown in the case of Vaude, a German outdoor wear company who developed the Ecolog System. Vaude created a system where they have a selection of materials to use throughout their PDP that allows designers to develop products that were 100% made out of polyester. This product made completely out of one single material could be recycled afterwards as a whole and turned into

³ Also outlined in chapter “3.4.2  Textile Recyclability Measures”
polyester resin without involving the process of sorting the materials. (Kate Fletcher, 2008). One of the limitations of DfR and the limited use of materials is the fact that it could encourage and “increase the dominance of monoculture plantations of fibre crops like cotton, with a significant environmental burden” (Kate Fletcher, 2008).

5.4 Design for Disassembly (DfD)
The DfD approach towards PDP was initially commonly used for the electronic equipment industry where products such as mobile phones, cars and computers were constantly being re-newed and re-modelled as it tried to keep up with changing consumer demands. Therefore, it was not surprising that the interest in this approach also turned towards the fashion industry. The original DfD approach has three main principles throughout its PDP: selection and use of materials, selection and use of joints and fasteners and design of product components. It should be noted that the efficacy of a DfD approach is partly dependent on the final choice of recycling method. Therefore, it is advised to adjust the right choices and use of materials, trimmings and seams and the design process to the recycling method or the other way around beforehand. The right product lines to apply a DfD approach for would be fashion items that usually have a lot of trimmings and/or high number of complicated patterns. Through making sure that these fashion items are still keeping up with the trends, but keeping them minimal and simple in design will conclude in an incredibly effective approach towards disassembly.

5.4.1 Aim
The DfD and DfR approach are somewhat aligned to each other. Both are aimed towards a PDP that optimizes sustainability of the materials through the recycling system as a part of a product lifecycle approach. Though, different from a DfR approach, DfD is aimed towards the ease of disassembly of the garments through designing for maintenance, repair and recovery of the materials. DfD takes its approach from both DfL, as it designs for restoration and recovery, as well as DfR, as it also designs for ease of disassembly before a recycling process.

5.4.2 PDP Key Characteristics
Selection and Use of Materials
Different from the DfR requirements, it is not necessarily needed for the end product to be completely homogenous. As previously established, the use of blended fibres should be avoided as it is the most difficult part to sort and disassemble. If different materials are to be used in one garment, than they should be easily separable so materials can be recycled seperately. Though, the rule for materials in DfR should be that the materials “should in no way compromise the structural requirements of the design” (Active Disassembly, 2005). However, the designer should always initially make effort to find and use materials that are easy to store and recycle.

Selection and Use of Joints and Fasteners
In terms of garments we can think of trimmings and seams, such as buttons, zippers, thread, linings and labels. It is important to carefully choose the usage of trimmings as some of these parts remain difficult to disassemble without damaging (the quality of) the fabric it is attached on. Therefore, the most ideal situation would be to minimise the usage of trimmings at all. If trimmings are to be used, they should at least be of the same material per type of trimmings for ease of disassembly and recylability.

Design of Product Components
For the ease of disassembly there should be a focus on minimalism. This rule should be applied to the design of the garment as a whole. Minimal use of complex materials, numbers of materials and patterns are preferred. When it comes to complex garments, disassembly can be made easier through developments in laser and/or water-jet technologies where the use of threads in seams can be eliminated (Kate Fletcher, 2008).
5.5 Recommendation and Implementation

Recommendations and conclusions within this chapter are solely meant for product development. While other areas such as sourcing, merchandising, production and marketing will be affected greatly through implementing closed loop models, these will not be highlighted. The new approach should be focusing more on offering overall quality and optimization of materials and design components in order to sustain those materials and eventually design for further end-of-life use.

5.5.1 Business Objectives and Goals

For discounters, implemented closed loop models and business strategies remains an untouched area. In reality, the increased interest in making sustainability efforts a core responsibility in production processes and a standard pillar of responsibility in corporations is usually pushed through consumer demands. One of the biggest discounters, Lidl, is one of the proven cases for this matter. As a successful discounter, it has promised to focus on environmentally friendly and ethical processes along the way. This is shown in their strict social compliance measurements towards suppliers as one and in their constant efforts to introducing viable sustainable solutions in their products as the other. Naturally, as a consumer driven discounter supermarket, most decisions are based upon continuous developing consumer behaviors, wants and needs. It is a widely shared consensus that doing anything by imprinting the sustainability stamp as one of the core values will culminate into a process with higher costs, longer procedures and overall more effort, resulting in a more expensive product. In reality, what is important to note is that prices and procedures do not get higher and longer, but rather more transparent. Industries and companies fail to see the long term benefits of sustainability as it actually revolves around efficiency. Along the way, it can create jobs, it can be environmentally efficient and cost saving all at the same time.

To measure a successful implementation strategy of product lifecycle approaches in product development for a discounter, it is important to start working with existing waste. In example, existing fashion companies who have applied closed loop models have started to collect both external and internal textile waste for recycling and present these recycled garments in separate conscious and environmentally friendly collections, creating conscious alternatives for consumers. In order to avoid extreme changes in product ranges for consumers, discounters can adopt this implementation concept as well. One of the biggest responsibilities for product development for discounters is identifying trends, collection planning and choosing materials and colours. Designs are either done in house or by external design companies. Therefore, for product development, it is important that different approaches are applied to different product lines, depending on materials, style and product purpose to choose the correct end-of-life treatment (reduce, re-use, recycle). Recycling and sorting companies will have to be sourced accordingly. Adopting product life cycle approaches will have to take into account extra costs for textile storage warehouses, recycling and sorting processes and shipping. Eventually, the goal is to be less reliable on virgin resources, enhance innovation concerning waste and product quality and cost efficiency.

5.5.2 Implementation Strategy

The product lifecycle approach towards product development process offers a solution to sustain materials as long as possible. Further relevance for the discounter market to shift towards a product lifecycle approach towards PDP is that they have a flexible supply chain map based on speed and no-frills, meaning that there is more room for innovation and implementation for them as opposed to a high fashion market that relies heavily on trends, craft and a more complex critical path. In today's context it is important to mention that no real sustainable development is possible without the changes in mindset and behavior of both consumers and companies and initiatives from governmental influences. This is highly needed to push boundaries, drive innovation and accelerating advancements towards making a change.
When looking at the three proposed approaches of which are able to be successfully applied to the discounter PDP we should keep in mind that these are specifically chosen to deal with large scale volumes of bulk orders and that are conformant to the abilities of creativity in the discounter PDP. Ultimately, these approaches should be combined to optimize the efficiency of the PDP. This is also depending on specific product lines and choice of end-of-life use in order to close the loop. Therefore, it is not meant to implement one approach for all product line PDP’s as each product line has its own advantages and limitations. Rather, the approaches should be applied to specific product lines at once to truly optimize a product lifecycle approach.

A product development team should not only have the ability to recognize trends, but should also understand basic textile engineering at least. Ideally, a product development team that is implementing closed loop models should have an extensive knowledge on textile engineering and technology. For now, discounter that are only starting with implementing these models should work closely together with a sustainability sciences team and/or fabrics team (internal). In order to stay atop and to push creativity and innovation, it is important that all teams have the same mindset and goal towards closing the loop. Next to this, acquiring a special research team within the sustainability department can be helpful to excel in this area. The biggest change for product development is the fact that they will have different requirements in their choice of materials, style and creative opportunities as they now have to start thinking of end-of-life possibilities. It is a misconception that implementing closed loop models means “flipping the whole system upside down”. In reality, this is not the case as it will mostly require a different mindset towards designing.
6.0 Conclusion

We have come to a point where a change in the traditional framework of fashion is necessary for the industry to grow and to evolve in order to sustain existing natural resources. Luckily, great interest has been shown by huge players in the market and incredible efforts towards closing the loop has been made. Though, these efforts have been met by great difficulties and low impact short-term benefits as it remains difficult to change traditional product development processes on a large scale today. With the rise of mass merchandising, the “supermarket fashion” retailers have shown to be incredibly strong players within its market and has proven to continue to grow through strong increasing interest from consumers and the discounters ability to respond effortlessly to their consumers desires. The discounter market has optimized its supply chain and processes to an extent where they have become lead players in the fashion retailer market, serving to an incredibly extensive consumer range. However, the shift of consumer values towards product design, product quality and the way consuming behavior is driven by product-ownership values (quantity over quality) towards a more sustainable and environmentally friendly driven behavior in life choices is becoming more apparent. Consumer driven choices will be made more often in design processes as they will become more vocal through technology and today consumers are demanding more product transparency. As a highly consumer led business, the discounter should be growing together with its consumers, ensuring the balance between supply and demand in order for this market to grow even stronger.

Thus, **to what extent can a circular systematic product development process be implemented to the apparel section of the discounter market?** This is highly dependent on global trends and advancements of today and the near future. In today’s context, implementing circular models to discounter PDPs can be implemented gradually in order to fully close the loop in the near future. In light of this, circular PDP’s are translated to product lifecycle approaches as a solution towards closing the loop through product development. Design for longevity, design for recycling and design for disassembly are three approaches towards circularity that are recommended to PDP’s in mass merchandising markets as it involves minimal changes in transition, minimal consumer participation and is workable on a large scale. The three approaches are applicable to the discounter PDP depending on specific product lines and choice in end-of-life use, and if applied correctly can heighten the optimization of a PDP. It is important to make use of several approaches in one PDP and match them to specific product lines as each line have their own characteristics and limitations.

Going fully circular is limited at the moment due to lack of existing relevant technology that are commercially viable in the industry. But most importantly, lack of experience and knowledge within this field are holding discounters back to invest in circular models when it is needed towards understanding how we can optimize product development processes and systems. Going circular or implementing closed loop systems is not about just implementing technology. This would mean we would have circular technology in a linear system. It is about changing mindsets towards sustainability and long-term benefits and changing strategic frameworks. However, it is important to note that sitting still is not necessary. The circular model is highly dependent on collaborative efforts between all players within this process and this is what is ultimately going to accelerate and strengthen the circular model in the near future. It is important to act today to benefit from the opportunities that circular models can propose tomorrow.
7.0 Reference List


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Appendix

Appendix I “SIPOC Diagrams”
Through the SIPOC diagram (Supplier, Input, Process, Output, Customer), the potential of the circular PDP’s will be outlined and assessed. The SIPOC diagram is a common tool used to assess PDP outputs and inputs and identify relevant elements for improvement and implementation efforts. The tool is used to define a new process approach before implementing.

**Design for Longevity SIPOC**
Design for Recycling SIPOC

**Supplier**
- Headquarter/Buyer
- (Recycled Yarn) Manufacturers
- External/Internal Waste Collector
- Merchandising Team
- Product Development Team

**Input**
- Sales Report
- District Buyer Directions
- Trend Analysis
- Collection Planning Reports
- Reference Samples

**Process**
- Product Development

**Output**
- Completely Homogeneous Collection and/or Easy Recyclable Collection
- Labels on End-of-Life Care and Info on Waste Collection Points for Consumer Textile Waste

**Customer**
- Headquarter/District Buyer
- Retail Customer
- External/Internal Waste Collector
- Recycled Yarn Manufacturer

---

1. **Trend Analysis and Material Selection** (Through Distinguished Material Library)
2. **Tech Pack and Sampling** (No Blended Fibres, No Toxic Chemicals, Easy Re-Dyable, Care Labels on End-of-Life Use)
3. **Price Quotations Per Selection**
4. **Bulk Confirmation Order From District Buyers**
5. **Ready For Production**
Design for Disassembly SIPOC

Supplier
- Headquarter/Buyer
- Manufacturers/Suppliers
- Internal Material Storage
- Merchandising Team
- Product Development Team

Input
- Sales Report
- District Buyer Directions
- Trend Analysis
- Collection Planning Reports
- Reference Samples

Process
- Product Development

Output
- Easily disassembled clothing collection
- Disassembled components to be used for further recycling or re-use

Customer
- Headquarter/District Buyer
- Retail Customer
- Internal Material Storage

1. Classic Shapes and Trends Analysis and Material Selection
2. Tech Pack and Sampling (Easily Seperable Materials, No Blended Fibres, Minimal Number of Patterns,
3. Price Quotations Per Selection
4. Bulk Confirmation Order From District Buyers
5. Ready For Production
# Appendix II “Discounter Lifecycle PDP Approach Recommendation Table”

<table>
<thead>
<tr>
<th>Discount Product Lifecycle PDP Approach Recommendation</th>
<th>DfL</th>
<th>DfR</th>
<th>DfD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>- Fibre manufacturer for high quality and enduring long staple/filament fibres</td>
<td>- Fibre manufacturer for high quality and enduring long staple/filament fibres</td>
<td>- Fibre manufacturer for high quality and enduring long staple/filament fibres</td>
</tr>
<tr>
<td></td>
<td>- Dye supplier for strong colour fastness (mass dyed yarn)</td>
<td>- Dye supplier for strong colour fastness (mass dyed yarn)</td>
<td>- Dye supplier for strong colour fastness (mass dyed yarn)</td>
</tr>
<tr>
<td></td>
<td>- Recycled yarn manufacturer</td>
<td>- Outsourced/internal waste collecting company</td>
<td>- Supplier of durable trimmings</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>- High longevity clothing collection (with average extension of product longevity of at least 3 months per item)</td>
<td>- Completely homogeneous clothing collection and/or easy recyclable clothing collection</td>
<td>- Easily disassembled clothing collection</td>
</tr>
<tr>
<td></td>
<td>- Labels on end-of-life care and info on waste collection points for consumer textile waste and further internal material flows</td>
<td>- Disassembled components to be used for further recycling or re-use</td>
<td></td>
</tr>
<tr>
<td><strong>Recommended Product Lines</strong></td>
<td>- Basic everyday styles are most suitable for product longevity due to simplicity of design and timeless consumer usage <em>(basics)</em></td>
<td>- Product lines that are based upon polyester to work with existing plastic waste and ensure high quality recycling on a large scale <em>(sportswear)</em></td>
<td>- Fashion items with trimmings and many or complicated patterns <em>(lingerie, outerwear, fashion items, denim)</em></td>
</tr>
<tr>
<td><strong>Cost Efficiency</strong></td>
<td>- Production costs can increase through sourcing of durable materials and dyestuff</td>
<td>- Production costs can increase through sourcing of durable materials and dyestuff</td>
<td>- Costs can increase through sourcing of durable materials and dyestuff</td>
</tr>
<tr>
<td></td>
<td>- Production costs per item can increase through use of recycled yarn (by minimum of +20%)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>- Costs can increase through process of disassembly</td>
<td>- Costs can increase through process of disassembly</td>
</tr>
<tr>
<td></td>
<td>- Costs can increase through textile waste collection and disassembly</td>
<td>- Costs can be cut through re-use and restoration of materials in the long run</td>
<td>- Costs can be cut through re-use and restoration of materials in the long run</td>
</tr>
<tr>
<td></td>
<td>- Costs can be cut through re-use and recycling of materials in the long run</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>4</sup> This percentage is specifically the case for recycled P.E.T (polyethylene terephthalate)