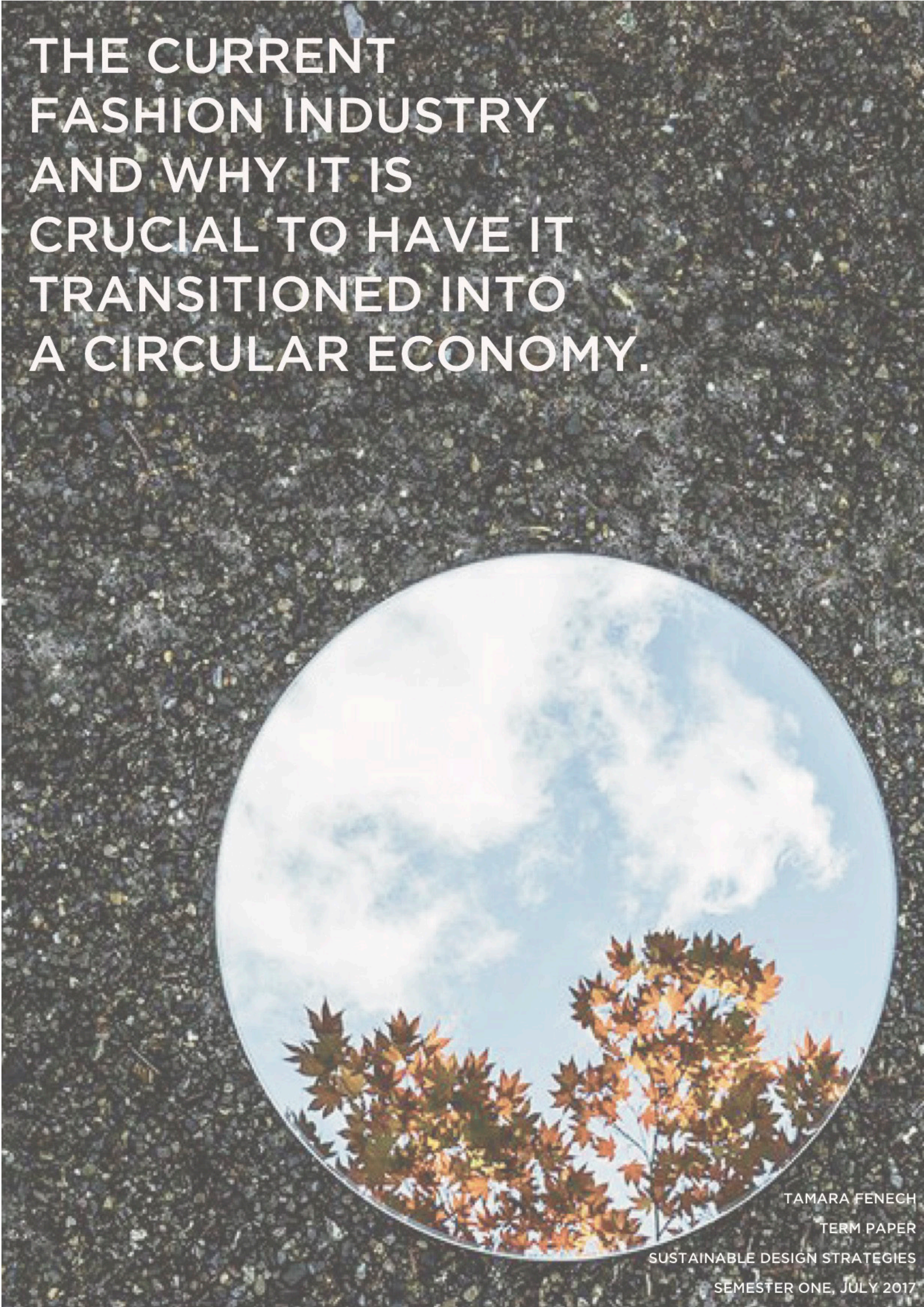
THE CURRENT FASHION INDUSTRY AND WHY IT IS CRUCIAL TO HAVE IT TRANSITIONED INTO A CIRCULAR ECONOMY.



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TERM PAPER

SUSTAINABLE DESIGN STRATEGIES

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1.
INTRODUCTION

As Kay Politowicz, Co-founder of TED Research at the Chelsea College of Art, said, “the circular character of time was evident in the seasons, movement of the planets, the earth around it, the sun and so on. Historically that has always been the case, it’s always been the symbol of the natural world” (Politowicz 2016). She points out that the circle is a structure in which the world has always emanated with, as it provides eternal flow of movement while curating for a naturally abundant outcome. Ultimately it suggests that the circle is the only way in which we can guarantee eternal sustenance.

The circular economic model has therefore based its principles through this imitation of nature, by understanding what is already naturally there and how, when considered wisely, this will actually benefit the continuation of this organic cycle. Ultimately, by thriving on abundance, and aiming for longevity, the model inherently operates in a sustainable mind-frame. With multiple opportunities created throughout each stage of the cycle, it enables resources to be used to their utmost ability – envisioning end-of-life solutions from the start in order to optimize the usability of resources as much as possible.

The apparel industry is currently placed on the opposite side of the circular spectrum, where its fast paced model intrinsically fuels and encourages waste in order to “survive”. With today’s scarcity in finite resources, it is about time that circular models are adopted and operated in, if we intend on alleviating the destruction caused by huge industries such as fashion.

In this paper I will highlight the reasons why circularity is the only way forward within industries in general. Focusing on the fashion industry, I will analyze what is meant by this transition and how it is able to translate within the fashion industry while keeping it global economic drive alive. Ultimately, the aim is, as Braungart and McDonough put it: “The role of commerce is to stay in business as it transforms” (2009, p.151).

2.
FASHION AS A GLOBAL DRIVER

With an annual revenue of €1.5 trillion generated by the apparel and footwear sector, it is not surprising that the fashion industry has become a clear and strong engine for global development (Global Fashion Agenda & The Boston Consulting Group [GFB & BCG], 2017, p. 2. Placing itself as one of the largest consumer industries, the industry also employs around 60 million people along its value chain, which spans over an extensive and complex global scale (GFB & BCG, 2017, p. 2). Modeled as it is around an inherently linear system of production, fashion has consequently evolved into a "take – make - dispose" mind frame. In doing so, however, the industry has failed to factor in possible environmental and social impacts induced by its ever-accelerating speed and has concurrently underestimated its footprint altogether. Currently, the industry relies upon a large quantity of cheap, easily accessible materials and energy (Watson, Eder-Hansen and Tärneberg, 2017, p. 1). One of the most common examples which highlights this situation is the cultivation of cotton which occupies 2.5 per cent of global agricultural land and which in turn uses of 12 per cent of all pesticides and 25 per cent of insecticides (Minney, 2016, p. 13). Furthermore it is also "estimated that £100-million worth – about 350,000 tonnes - of used clothing goes to landfill in the UK alone every year" (Minney, 2016, p. 17). As a result, this model has increased pressure onto the world all in the name of the fast fashion phenomenon.

It has recently been estimated that the global population is expected to rise to 8.5 billion people by 2030, resulting in a 2% annual GDP growth in the developed world, together with an annual growth of 4% in the developing world (GFB & BCG, 2017, p. 8). With such trajectories in mind, The Global Fashion Agenda and The Boston Consulting Group in a report entitled 'The Pulse of the Fashion Industry' concluded that overall consumption related to the fashion industry would rise by 63% (GFB & BCG, 2017, p. 8). Therefore, were it to continue with this current linear economic model, the industry would proactively be taking strenuous measures, while consistently creating an undoubtedly large footprint. With such antiquated foundations, this linear model is reaching its physical limits – and with the incessantly high speed of fashion, as we know it today, we have reached a stage in which the industry must address its contribution by carrying out serious changes from within. As Dame Ellen MacArthur, founder of the Ellen MacArthur Foundation (2017), points out, "the way we produce, use, and reprocess clothing today is inherently wasteful, and current rising demand increases the negative impacts."

2.1
AN OUTDATED LINEAR MODEL

FIGURE 1: THE LINER ECONOMY DIAGRAM (DESSO, N.D.)

Resulting from the development of the Industrial Revolution, the linear model was a structure which had not been planned, but which neither was without motive (Braungart & McDonough, 2009, p. 21). It was in fact driven by the desire for the acquisition of capital, while simultaneously fuelled by the advances in mechanized equipment. In such circumstances, the only aim for industries back then was to "manufacture products as efficiently as possible, with the intention of distributing the greatest volume of goods to the largest amount of people" (Braungart & McDonough, 2009, p. 8). At the time, society displayed a kind of naiveté' towards the environment and believed that nature would simply absorb any potential damage and still continue to flourish - a constant undying and regenerative source. The then "mother earth" perception viewed nature as a seemingly endless supply of natural "capital" (Braungart & McDonough, 2008, pp. 24). With all this in mind, the emergence of a deeply rooted infrastructure took place based on a "linear, one-way cradle-to-grave model - in which resources are extracted, shaped into products, sold and eventually, disposed of in a "grave" of some kind, usually a landfill or incinerator" (Braungart & McDonough, 2009, p. 27). All the while, as industries continued to grow on the strength of this model, it was inevitable that environmental foresight was inexistent; let alone an area of concern.

Nowadays our understanding of nature has nonetheless dramatically changed and, as former US Vice President Al Gore noted in his 2007 edition of Earth in Balance, “we have radically transformed the fundamental relationship between humankind and the earth” (p. 5). We no longer consider the earth as our ‘mother’ - on the contrary we have developed a certain attitude towards the environment, one that nurtures the notion that the earth is indebted towards human kind for its survival, rather than the other way around. “The results of this profoundly new relationship between humans and the earth are devastating. It is now not so much a relationship as a collision” (Gore, 2007, p. 6). In fact, the demand for the earth’s natural resources has doubled in the last 45 years (Alcoforado, n.d.). With this inflated demand of finite resources, in conjunction with the ongoing high rate of extraction (of the very same natural resources that were used in the 19th century - such as timber, water, coal and land, to name a few) we have finally acknowledged that the ‘never ending’ supply of natural ‘capital’ is being depleted and, in actual fact, is in peril of dying. Having said that, the linear system still prevails, and “modern industries still operate according to paradigms that developed when humans had a very difference sense of the world” (Braungart & McDonough, 2009, p. 26).

2.2
ECO EFFICIENCY VS. EFFECTIVENESS

So far, our solutions towards repairing this largely destructive system have been derived around the idea of efficiency - curating the belief that the only way to alleviate this crisis will be through efficient execution. With words like reduce, avoid, minimize, sustain and limit being central to the language used in environmental advocacy, industries and individuals have been conditioned to simply take a “less bad” attitude towards the way we extract and consume our finite natural resources (Braungart & McDonough, 2009, p. 45). This myopic view, however, is not a solution that will eliminate the problem. It is rather one which merely slows down our destructive impacts, while ultimately generating an equally unwanted footprint just the same. Presently, the human race has taken up the mission of “saving the planet” –this idea is, however, believed to be the very same thing that has kept us back from making actual and worthwhile improvements. Instead, this notion has turned the problem into an “ethical” ideology17, and once ethics is on the table, it becomes somewhat of a subjective matter and one that will ultimately never produce constructive solutions to the problem. This attitude has, in turn, riddled human kind with a sense of guilt towards a problem which they feel they can never fully solve, when considering the magnitude of the problem in hand.

As Michael Braungart rightly pointed out in the 2009 edition of his book 'Cradle to Cradle, re-making the way we make things', "we cannot rebuild the environment if we are fretting, … we cannot move forwards if we merely "blame and shame" ourselves and others." He goes on to argue that, instead, we need to focus on applying a more symbiotic approach towards our relationship with the environment, one that is ultimately more cooperative with nature (p.11). He argues that, "in the face of the environmental crises, I do not stand here like the English king Canute, who thought if he shouted he could turn back the tide. I see the tide, you see it, and perhaps our solution is to learn to surf." (Braungart & McDonough, 2009, p. 16).

As previously highlighted, efficient behaviour has so far been the forerunner and main driver towards achieving a sustainable future. As consumers and as industry stakeholders, we have been inundated with a vast amount of information on what we should and shouldn't do with a view to enable us to transform our habits into ones which are more efficient – projecting the belief that this concept is the primary solution towards the substantial change which is so desperately needed. Investing in energy-saving light bulbs, reducing shower times and car-pooling are just a few of the behavioural changes which we, as individuals, have been encouraged to adopt in the hope that, collectively, we would help towards eradicating the damage inflicted so far. As for the industry, the concept encourages ideas like investing towards 'cleaner, faster and quieter engines for machines' (Braungart & McDonough, 2009, pp. 51), in 'cutting the amount of toxic waste created or emitted, and in minimizing the quantity of raw material used altogether' (Braungart & McDonough, 2009, pp. 53). Therefore it is concluded that, an "eco efficient model built within a linear system, seeks only to minimize the volume, velocity and toxicity of the material flow" (Ellen MacArthur Foundation [EMF], 2012). And while it is in fact an outwardly admirable and, even noble, concept (with definite validity when put in the correct context) ultimately, as Michael Braungart & William McDonough (2009) outline, it is a shortsighted strategy that does not run deep enough (p.61). They go on to argue that 'relying on eco-efficiency to save the environment will in fact do the opposite; it will let industry finish off everything, quietly, persistently, and completely; and as long as modern industry is so destructive, attempting only to make it less bad is a fatally limited goal." (Braungart & McDonough, 2009, pp. 62).

When focusing on what not to do, as a concept, "eco-efficiency" merely "works to make an old, destructive system a bit less so" (Braungart & McDonough, 2009, pp. 62). Hence, this is why Braungart & McDonough (2009) point out that amid the rapid rate of production within industries, its application is simply ineffective and jarring. "To be less bad is to accept things as they are, believing that poorly designed, dishonorable, destructive systems are the best humans can do" (Braungart & McDonough, 2009, p. 67). While continuously factoring in the extreme and complex state of environmental depletion (which has ultimately been caused by this tenacious cradle-to-grave model), the authors also argue that this "eco-efficient" concept has been reduced to functioning as a tool in order for us humans to purge ourselves from the heavy burdening and damage that we have caused, hence its limitations (Braungart & McDonough, 2009, p. 66).

When it comes to recycling, for example, since the materials are not designed with the intention to ultimately be recycled, only some materials are in fact recycled, and often just as an end-of-pipe solution. Therefore, instead of true recycling, this process is more accurately one of down-cycling - a downgrade in material quality, a process which simply limits the usability of the material, while altogether maintaining the linear, cradle-to-grave dynamic of the material flow system (EMF, 2012). Through this understanding, the inevitable question that arises for Braungart & McDonough (2009) in the end, is 'why are we trying to optimize the wrong system? (p. 142). They highlight that within a linear model, 'instead of trying to optimize nature's abundance, we automatically try to get it out of the way (p. 85).

While understanding the supply and opportunities of nature's abundance, they put aside the old model of product-and-waste and instead, they adopt the idea of embracing the challenge of being effective, in contrast to being just simply efficient - coining the term "eco-effectiveness" as opposed to "eco-efficiency". In doing so, Braungart & McDonough (2009), therefore encourage the belief in favour of gaining a true understanding and respect towards the rich mix of considerations and desires (p. 72). They precisely point out that ultimately, "even the most rigorous eco-efficient business paradigm does not challenge basic practices and methods: a shoe, building, factory, car or shampoo can remain fundamentally ill-designed even as the materials and processes involved in its manufacture become "more efficient" (Braungart & McDonough, 2009, p. 76). When defining 'eco-effectiveness', Braungart & McDonough (2009) talk about the idea of working on the right things – on the right products and services and systems – rather than focusing on making the 'wrong things less bad". They then go on to say, that once we are working on the right things, "then doing them "right" with the help of efficiency among other tools makes perfect sense" (p. 76). In dismissing the 'cradle-to-grave' model altogether, they enthusiastically embrace a different model, known as 'cradle-to-cradle' - operating within a circular mind-frame, instead of that in a linear one. Rather than apologizing for the earth's materials and resources, alternatively, this innovative approach transfers the focus from 'saving the planet' to a focus that learns how to thrive on the planet instead (Braungart & McDonough, 2009, p. 11) - i.e. effectiveness. In the true meaning of sustainability, the key goal towards a circular system is not to make human industries and systems smaller, as propounded through efficient behavior, but to instead design industries to get bigger and better in a way that effectively nourishes the rest of the world (Braungart & McDonough, 2009, p. 78).

3. CIRCULARITY

In a video produced by the Sophie Politowicz (2016), the co-founder of TED research at the Chelsea College of Art in London, Kay Politowicz, poetically explained that, “the circle is a symbol of strength – circular structures are the strongest, physically speaking - that not only evokes notions of defense but also containment and inclusivity. It connects void to form and the two become interdependent”. The structure of a circular economy is fundamentally based on this interdependent idea. With its practical application to modern economic systems and industrial processes gaining momentum in the late 1970’s2, the concept has since then been refined and developed by means of many different schools of thought, for example ‘cradle to cradle’ and ‘blue economy’, to name a few (EMF, schools of thought c2c, n.d.). As a concept, The Ellen MacArthur Foundation described it as an economic system that is “restorative and regenerative by intention and design”, with the ultimate “aim of keeping products, components and materials at their highest utility and value at all times” (EMF, into to the circular economy, n.d.). This is enabled through a system that curates a way of celebrating the diversity in material flow (Braungart & William McDonough, 2013, p. 43). Opposite to today’s linear structure whereby all businesses and production processes are optimized on an individual basis, designing for the circular economy focuses on how to collectively maximize the processes while securing as low an environmental impact as possible. Within a circular mind-frame, materials and products are purposely designed to be either upgraded or, to be re-circulated in order to be used again through as many cycles as possible (Mistra Future Fashion, n.d.). In doing so, the concept primarily acknowledges that in order for us to gain the best optimization and effectiveness, resources need to be categorized into two different cycles of material flows. These are better known as the ‘biological cycle’ and the ‘technological cycle’ - whereby the distinctive differentiation between the two allows all materials to keep working within their own cycles, fuelling the rhythm and achieving a continuous flow. as seen in figure 2.

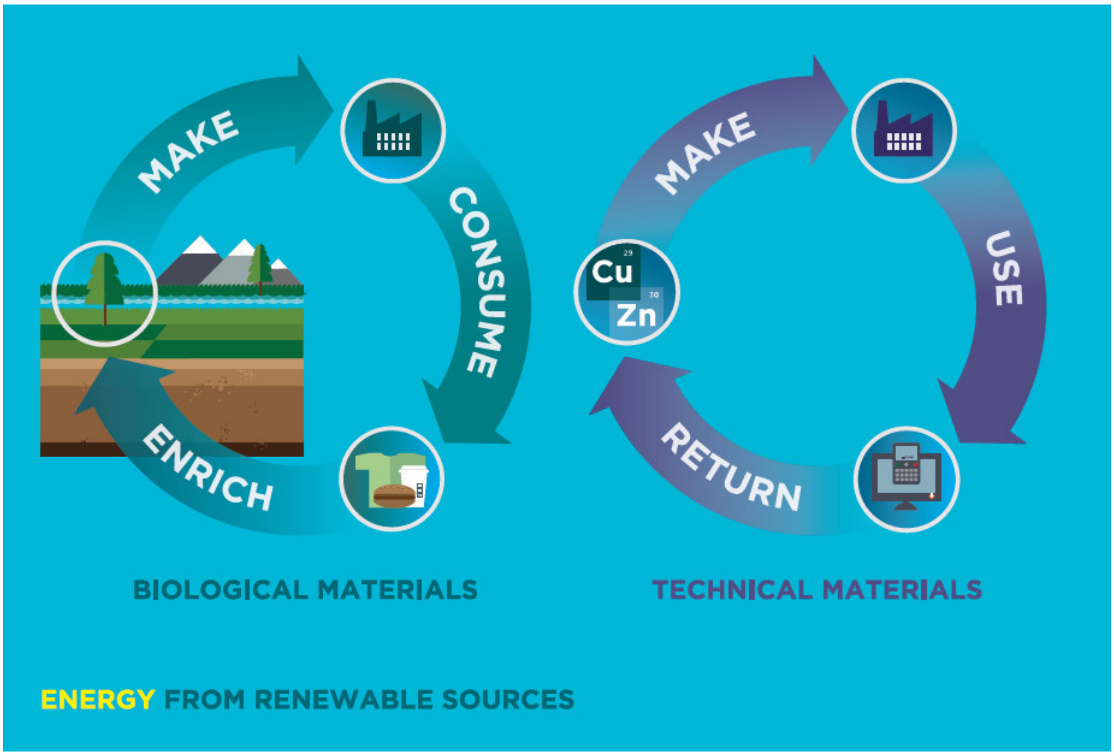

FIGURE 2: TWO CYCLES (ELLEN MACARTHUR FOUNDATION, N.D.)

Becky Earley, a head researcher with TED Research, says that “the circle expresses this idea of constant movement – it represents mobility – revolution - the infinite and universal flow of energy” (Politowicz, 2016). Hence, as cited from the Ellen MacArtur Foundation (n.d.), a circular structure allows the “designing of products that can be ‘made to be made again”. While taking insights from the study of living systems, a circular approach permits the optimization of holistic systems as opposed to singular components – understanding, by analogy, that ultimately, the tree is nothing without the forest. As materials and components belonging to the biological cycle are safely compostable and bio degradable, they inherently help to grow more stuff, hence no resources are lost, instead, they actually contribute towards natural capital, rather than reducing it. Whereas in the technical cycle, this system would focus on the non-biodegradable materials and components, like valuable metals, polymers and alloys – while still maintaining their level of quality at all times. Through a return and renew system, contrary to the current throwaway culture, products are designed to be disassembled whereby materials belonging to the technological cycle, would be recovered, maintained and reused – abetting in continuing their use beyond the shelf-life as individual products.

Therefore, when designing, ones mind-frame must engage in a holistic way of thinking from the start of the design process, touching base with the intention of the system while constantly keeping in mind the journey of the product throughout the whole supply chain, including its use phase and its afterlife. In fact, Braungart & McDonough (2009) explain that in order to design in a circular and fecund system, one must begin by expanding one’s vision from the primary purpose (of a product or system) to considering them in their wholesome form. Envisioning the goals and potential effects of these very products from an immediate and wide-ranging standpoint, with respect to both time and place. While altogether aiming in engaging with the entire system – cultural, commercial, ecological – of the way things are made and what they form a part of (Braungart & McDonough, 2009, p. 81).

3.1 CRADLE TO CRADLE

This school of thought is directly imitated from nature's highly effective cradle-to-cradle system – a system of nutrient flow and metabolism, one that which ultimately eliminates the very concept of waste (Braungart & McDonough, 2009). As Adriana Rodrigo (2015), a resource use campaigner, from Friends of the Earth, rightly pointed out, we need to go "beyond simply improving how we deal with our waste, and instead address the fundamental problem of why we've got so much of it in the first place". In their latest book entitled 'The Upcycle' (2013), Braungart and McDonough explicitly state that human beings don't have a pollution problem; rather, they propound that it is a design problem that we have instead. They argue that if we had to conceive a more intelligent design solution from the get-go, we would have the opportunity of avoiding thinking in terms of waste, or contamination, or scarcity altogether. "Good design would allow for abundance, endless reuse and pleasure" (p. 7).

In contrast to the current 'disposable' mindset of creating to just simply use products, cradle-to-cradle allows us to celebrate materials in a way that permits us to enjoy them more than once – a true initiation of abundance (Braungart & McDonough, 2009, p. 103). Through the differentiation of the two distinct metabolism cycles, described by Braungart and McDonough (2009) as the biosphere and the technosphere, the cradle – to - cradle strategy therefore enables a careful management of material flows. When producing for these cycles, the design is therefore shaped and determined according to the materials that act as the valuable nutrients for their particular metabolism cycles – guaranteeing that all products and materials will eventually return safely, while contributing to a continuous flow of movement. In the end, this way of thinking and designing aids for a new mindset to emerge and develop, understanding that 'form follows evolution' and ultimately goes beyond just function (Braungart & McDonough, 2009, p. 104). To put it simply, as already previously mentioned, when designing in a circular system, resources and materials are either safely regenerated in the bio-cycle or recovered and restored to a high quality in the technical cycle" (EMF, principles, n.d.). When describing the two metabolisms, and the ways in which we need to keep them healthy, valuable and successful, Braungart and McDonough (2009) emphasize that it is important to avoid any contamination of the two, and to honor each nutrient to the particular cycle that they belong to. They explicitly point out that if materials belonging to the technosphere would end up mixed into the biosphere, these materials would simply damage the nutrient flow of that particular metabolism, when returned into the cycle – and vice versa; They clearly note that biological nutrients are ultimately also not intended or designed as food for the technical cycle, whereby the contamination would only lead to a weakening in quality of the nutrient's value – making "their retrieval and reuse more complicated" (Braungart & McDonough, 2009, p. 105), hence interfering with a smooth flowing metabolism. As referred to in 'The Upcycle' (2013), Braunghart and McDonough clearly state a fundamental question needed when designing for a 'cradle-to-cradle' reuse concept, particularly when referring to the fashion industry. They probe designers to constantly allude to this question: "can this garment return safely to the technosphere or biosphere without contaminating either, while being rejuvenated as materials for new cycles?" (Braungart & McDonough, 2013, p. 53).

3.2 THE BIOLOGICAL METABOLISM

As previously discussed, when accommodating the biological metabolism (biosphere), we specifically refer to a biological nutrient: "a material or product that is designed to return to the biological cycle" (Braungart & McDonough, 2009, p. 105). As Katja Hansen (2012), senior researcher at The Academic Chair Cradle to Cradle for Innovation explains, the biological nutrient is one derived from products and materials that are consumed in the process of fulfilling their purpose, for example food, shampoo and detergents. These are specifically defined as consumption products, whereby through the means of their lifecycle, they are no longer retrievable and therefore cannot be recovered as their original form. Instead, however, they are recovered by entering the environment through diffused pathways acting as a regenerative nutrient towards the creation of new and renewable resources to make new products from. As highlighted on the Ellen MacArthur Foundation (2013), "Circular Economy Overview, Characteristics", when referring to biological materials, it is also important to first envisage a cascaded way of thinking before returning the nutrients directly into their metabolism cycle. Identifying that the biological essence of value creation from these materials, lies in the opportunity to diversify their additional and prolonged value, by means of the power of cascading them through to other applications, as depicted on the left side of figure 3. For example, when referring to the textile industry, clothing can first be reused as a 'second hand' item, then they can be ripped and used for the car industry, then as insulation, and so on, until they are finally composted.

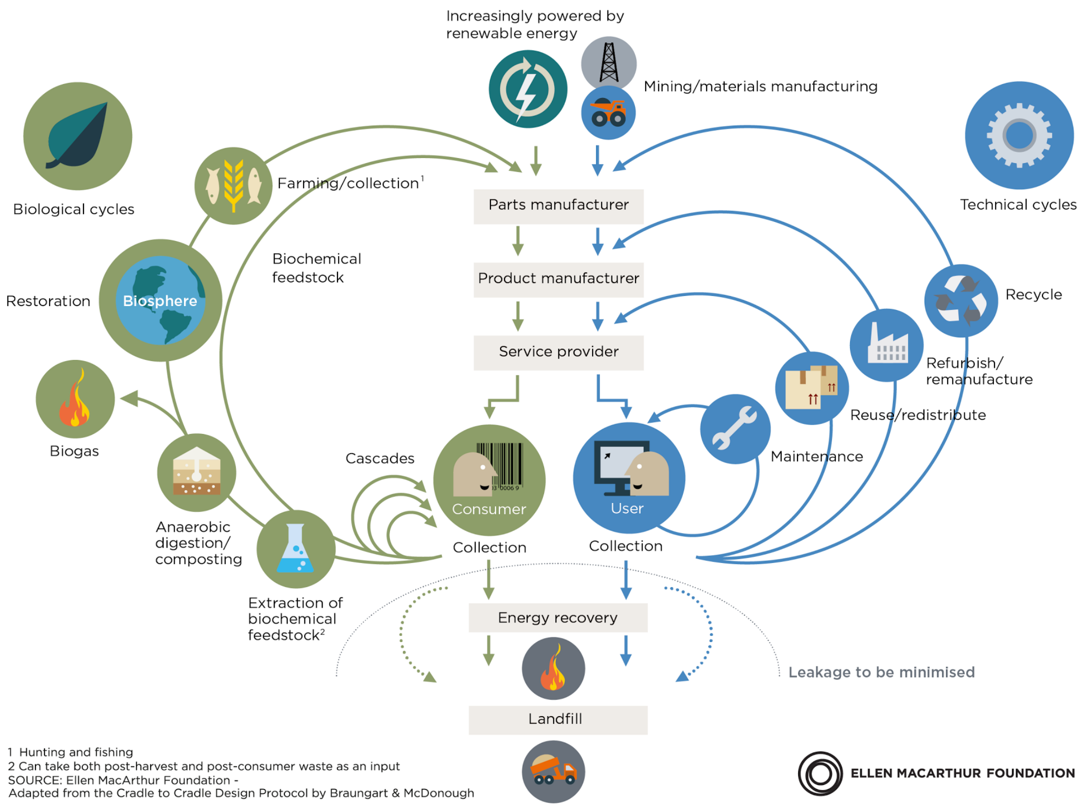

FIGURE 3: CIRCULAR ECONOMY SYSTEM DIAGRAM, THE BUTTERFLY DIAGRAM (ELLEN MACARTHUR FOUNDATION, N.D.)

3.3 THE TECHNICAL METABOLISM

When providing for the technical metabolism (technosphere), we refer to a technical nutrient: “a material or product that is designed to go back into the technical cycle, into the industrial metabolism from which it came.” (Braungart & McDonough, 2009, p. 109). The focus of this cycle lies within the opportunity of retaining the integrity and highest utility, of these said products and materials, at all times (Iles, 2016). Defined as products of service, Hansen (2012) refers to them as, “anything that you just use - that provides you with a service, but you do not actually consume the material”. As seen in figure 3, the technical metabolism yields a hierarchy of circles, with the smaller loops representing the most effective impact. Recycling being the largest circle, is described by Joe Iles (2016), Editor in Chief of Circulate, as “the loop of last resort”, besides the fact that the process decreases the material quality due to the amalgamation of resources, he says that taking a product or component and returning it to the original material it was made of, gravely strips away a majority of the value that has already been invested in order to make the product in the first place, like labor or energy (Iles, 2016). The innermost loops, defined as ‘share’ & ‘maintain’, enable the life of the material or product to be stretched out, and while it fulfills a longer use time, it avoids entering into the ‘remanufacturing’ overhaul as the immediate option.

4.
WHY CIRCULAR FASHION?

As discussed in the previous chapters, industries working within a linear ‘take-make-dispose’ mindframe are inherently operating in a system of high impact, whereby the planet and people are consequently suffering the consequences. Among these industries, lies fashion; an industry that, according to the report carried out by The Global Fashion Agenda (2017) entitled ‘A Call For Action’, amounts to 4-6% of the EU’s environmental footprint, solely through the consumption of textiles (p. 3). It is estimated that “an average kilogram of textiles has a carbon footprint of 15kg and a 10,000 liter water footprint” (p.3). The current cultivation of cotton plays a large role in the water footprint, whereby it is estimated that 1 cotton t-shirt relies on 1,700 liters of water (Hoskins, 2014). In fact, in 2014, NASA made a shocking announcement that the Aral Sea in central Asia had been completely dried up (figure 4). The result of this devastating disaster was largely linked to the fashion industry, whereby an irrigation system from the river water, which was set up by the Soviet Union back in the 1950’s, had been incessantly used to cultivate cotton crops that took up 1.47m hectares of land (Hoskins, 2014). And while the environment has been distressed in order to keep up with the fast pace of fashion, the report also highlights that, around 30% of garments hanging in our wardrobes has not been used for at least a year, while much of the 9.5 million tonnes of textiles that EU citizens purchase each year is discarded long before it is worn out. In the end, over half of used European textiles still ends up in mixed household waste which is ultimately destined for the landfill or incineration (GFA, 2017, p.4).

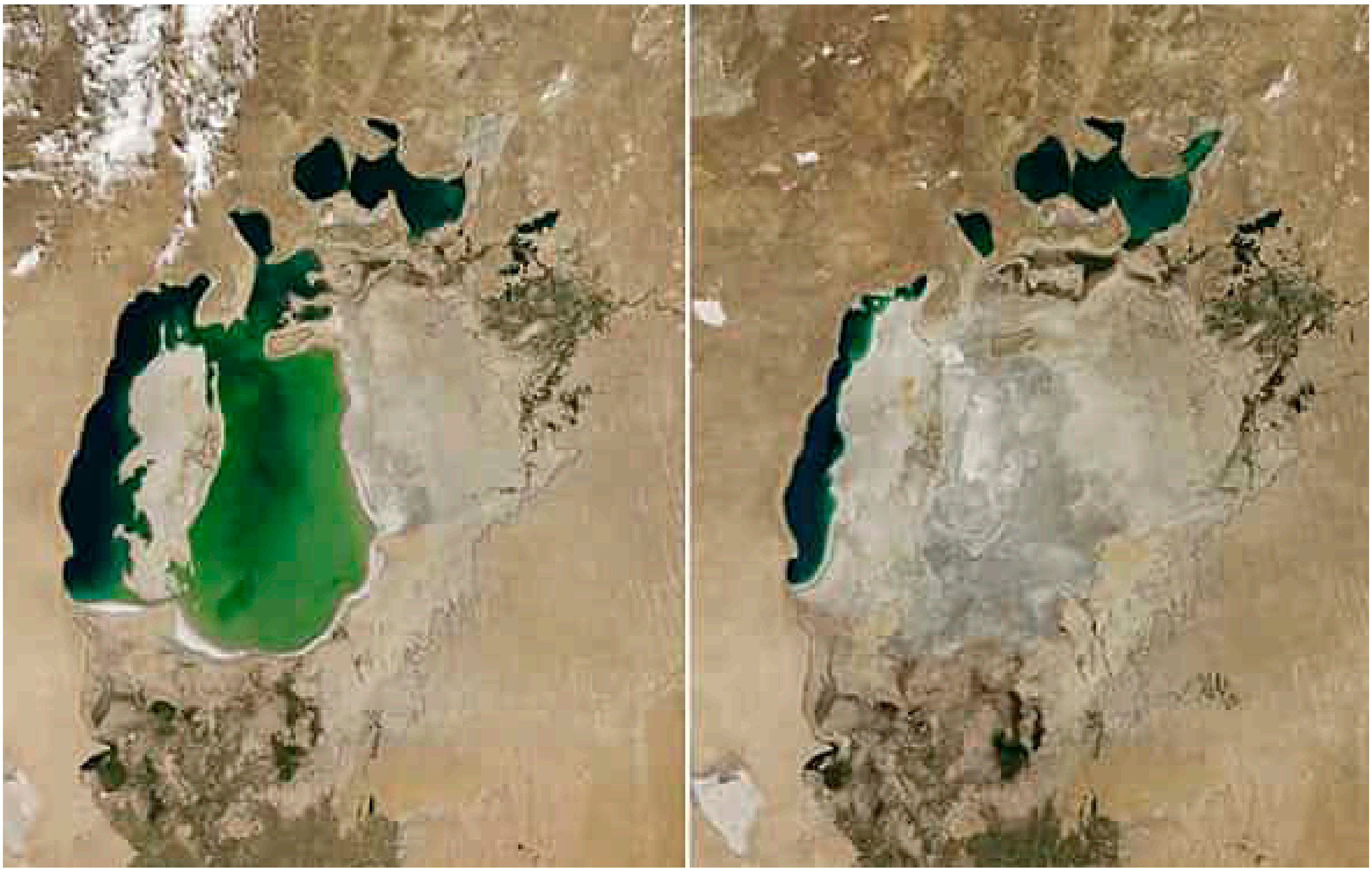

FIGURE 4: THE ARAL SEA IN 2000 ON THE LEFT AND 2014 ON THE RIGHT. PHOTOGRAPH: ATLAS PHOTO ARCHIVE/ NASA (THE GUARDIAN, 2014)

The truth of the matter is that the fashion industry is inherently and largely contributing towards resource depletion and that this needs to change now rather than later. Hence, the despairing need for transitioning into a circular system, which will enable fashion to flourish in an abundant ever-flowing way! In the report 'A Call For Action' (2014) it was also emphasized that with the generated value empowered by a circular system that runs throughout the whole life cycle of a garment and going beyond its point of sale, any fears of jeopardizing profitability are alleviated. "Reduced revenue due to lower volumes can be more than offset by the increased value derived from individual garments, through reuse, resale, repair services and eventually the recovery of materials to produce new products" (GFA, p.1). A circular structure provides the industry and consumers with a platform that enables the opportunities of extending the active life of materials, and in the face of tomorrow's resource scarcity, it is in our interest to begin this critical transition. "This prolongation of usage will substitute virgin material inflows to counter the dissipation of material out of the economy" (Earley, R. & Goldsworthy, K., 2015, p.3).

4.1 CIRCULAR STRATEGIES FOR THE FASHION INDUSTRY

As previously discussed, working within a circular supply chain, as depicted in figure 3, refers to a holistic model for a product to either go through a compostable process at the end of use (biological cycle), or be (endlessly) re-usable in the technical cycle, by means of the hierarchical inner loops. "Firstly, "to accelerate flows, companies need improve how they trace material flows" (Lacy, 2015, p. 41). Ultimately, in order for the industry to thrive, it must establish systems and strategies within business models, developing ideas on how to treat the 'end-life' of a garment. Working with what is known as 'collaborative consumption' and engaging consumers to act as 'prosumers'8 is key in providing opportunities for material cyclability. "It enables both a changing mindset around products and their use and promotes extended product lifetimes" (Ellen MacArthur, 2013).

4.2 THE BIOLOGICAL CYCLE

When referring to the accommodation of the biological cycle within the fashion industry we specifically refer to natural fibers and biopolymers, which are usually supplied through agricultural methods such as cotton cultivation. Through their ability to biodegrade, these fibers therefore act as the perfect nutrients for the 'biosphere', whereby the materials are easily and safely returned into the metabolism, supporting new growth and completing the cycle, thus enabling for a true recycling process to take place. In fact, Goldsworthy (2014, p. 9) points out that designing with materials that harmlessly biodegrade back into the environment is the most exemplary example of cradle-to-cradle thinking.

However, especially in reference to fashion, this is not as straightforward as one might think. Even though all materials derived from animal or vegetable bases are 'biodegradable', it does not necessarily mean that all fashion products made from these fibers will be able to act as safe nutrients. When considering all the dyes and finishes that are used in the manufacture stages, these factors may contaminate the flow beyond repair. For example, an organic cotton product printed with biologically safe dyes is C2C compliant; however, the same textile overlaid with even the smallest spot of gloss or metallic finish is not (Goldsworthy, 2014, p. 9). Therefore, it is crucial for designers to understand what acts as exemplary nutrient and what doesn't, while altogether working on innovations that help maintain the metabolism to its ultimate ability.

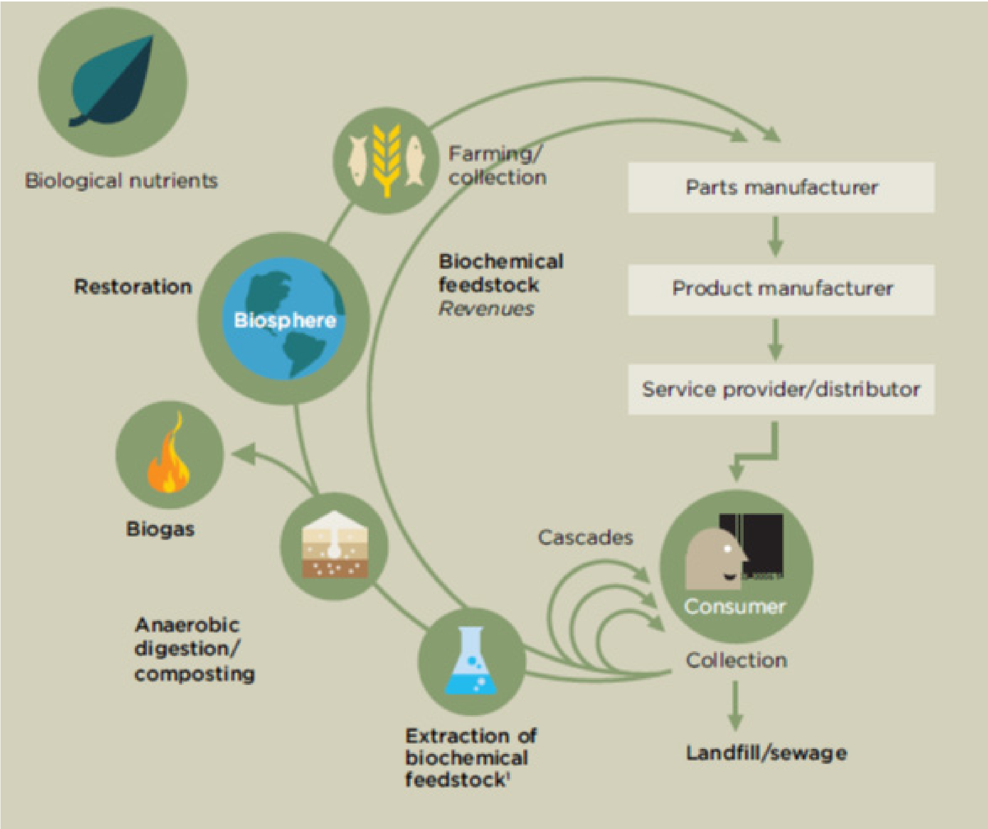

FIGURE 5: THE BIOLOGICAL CYCLE (ELLEN MACARTHUR FOUNDATION, N.D.)

4.3 THE TECHNICAL CYCLE

4.3.1 MAINTENANCE / PROLONG

When referring to the technical cycle (figure 6) the "maintenance/prolong" loop has been established as the most direct form of material flow, whereby it proves to be the approach having the least impact. This is referred to as a system which extends the active life through prolonged ownership, either by simply keeping it for longer or by means of in "renting, sharing, lending, gifting or bartering of resources" (Lacy, 2015, p. 85). Within this loop, we also see tactics such as repair and care processes encouraged to the user, inspiring to preserve the value in the product for as long as possible (Goldsworthy, 2014, p. 4). A very good example is Nuudie Jeans, who offer free instore repair services for thier jeans. To a better understanding of the wide effects this loop has, according to a report entitled 'Valuing our Clothes', WRAP (2014), 'extending the life-time of a garment by just nine months reduces carbon, waste and water footprints by around 20-30% each and cuts resource costs by 20%' (p. 4). However, "although this has obvious environmental benefits it is arguably the strategy which has the least potential for design input" (Goldsworthy, 2014, p. 4).

4.3.2 REUSE / REDISTRIBUTE

Moving onto the second tiered loop, "reuse/redistribute", we refer to the "re-using of products 'as-is'"(Fletcher, 2008, p. 100) i.e. second-hand clothing, whereby it provides multiple opportunities in contributing towards the flow. While enabling the redirection of products to new owners, which have been discarded in a useful state of repair, this loop also requires no design intervention, hence, largely reducing the demand and need of virgin resources (Goldsworthy, 2014, p. 4). "Avoided environmental impacts with this approach include impacts of materials processing and product manufacture (materials, energy, emissions, wastes) plus avoided landfill impacts (air emissions, leachate, visual impact)" (Goldsworthy, 2014, p. 4). In a report carried out by the University of Cambridge (2006, Well Dressed?), "(…) The energy used to collect, sort and resell second-hand garments is between 10 and 20 times less than that needed to make a new item."

And while the loop alleviates environmental pressures, it is also a perfect representation of the extended economic value opportunity that a circular model provides, as previously mentioned. Whereby the 'second-hand' industry in known to be "worth USD 1 billion per year" (Well Dressed?, 2006, p. 12) This loop has been widely supported by means of charities and commercial enterprises that enable consumers to play an active role within the motion, ASOS Marketplace acting as a prime example.

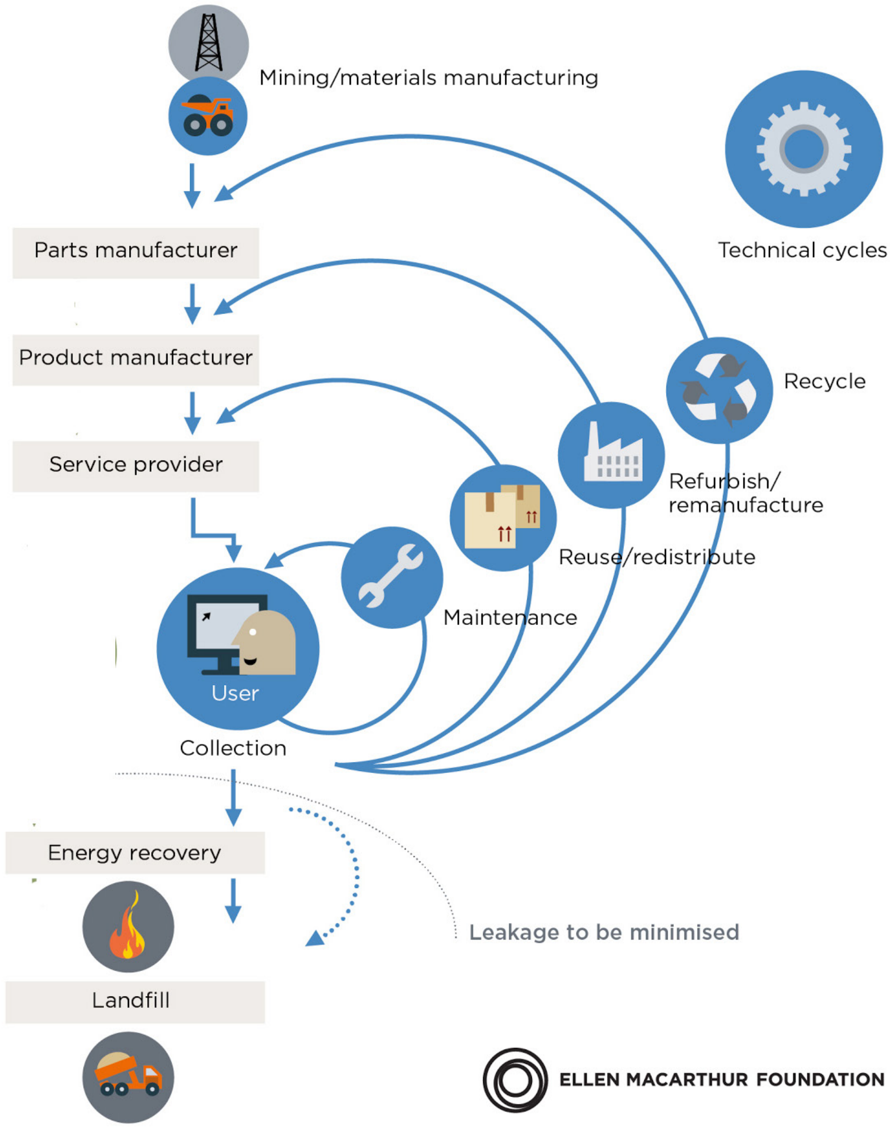

FIGURE 6: THE TECHNICAL CYCLE (ELLEN MACARTHUR FOUNDATION, N.D.)

4.3.3
REMANUFACTURE

When referring to the third loop in the technical cycle, known as ‘re-manufacture’, Kate Goldsworthy (2014, p. 4) associates this cycle as the most predominant one from a design point of view, with design acting as the agent for transformation hence enabling resources to keep flowing in a healthy and safe manner. Just as the previous loops, it starts with the point of disposal that ultimately permits the flow, materials are returned and ‘transformed’ into a new lifecycle all be means of re-design, where by the waste stream becomes the valuable point for motion. “At product level, re-manufacture is used to convert a waste product into a new product of value” (Goldsworthy, 2014, p.4), better known in fashion as ‘up-cycling’. ‘Up-cycling’ within the fashion industry has gained a lot of momentum in the past few years, whereby brands have zoomed in on ‘exclusive up-cycle’ lines, providing consumers with alternative purchasing choices. We have also see brands that have built their business models solely around this point of resource, the perfect example being The Reformation. More over, there has been a rise in brands, which are offering a resistance against ‘dead-stock’, and ‘end-of-roll’ fabrics which are otherwise discarded by factories, for example ‘Anekdot Boutique’ based in Berlin.

4.3.4
RECYCLE

When it comes to the final tiered loop in the technical cycle, better known as ‘recycling’, we are confronted with a slight paradox. As we mentioned earlier, so far recycling processes tend to be more of a ‘down-cycling’ result, whereby the fibers are unable to retain the needed quality, therefore more often than not, they are anyway mixed with virgin fibers. Having said that, however, ‘even the most sophisticated (and energy intensive) processes of shredding fabric, reclaiming fibers and re-spinning them into new yarn is thought to use less energy than the production of new items” (Fletcher, 2008, p. 103). “The actual process of recycling involves reclaiming fibers from existing fabrics using either mechanical or chemical methods” (Fletcher & Gross, 2012, p. 70).

When referring to a chemical procedure, this is only suited to synthetic fibers, whereby the polymers are broken down through chemical induction, order to reformulate the fibers, creating new ones in return. (Fletcher & Gross, 2012, p. 71). When it comes to chemical recycling, the procedures “can produce fibers of a quality comparable to that of virgin materials” (Global Fashion Agenda & The Boston Consulting Group, 2017, p. 44), which is ideal. Unfortunately, however such recycling is only suitable for nylon and polyester. Having said that, “the claims made for energy savings of recycled polyester and nylon material over virgin material are fairly similar: both fibers demand around 80 % less energy to recycle than to make virgin intermediate chemicals from oil and convert them to fiber” (Fletcher, & Gross, 2012, p. 72). On the other hand, a mechanical process tends to provide wider opportunities, as it is suitable for all types of fibers. With today’s lack of technology, however, this process can also be considered to be restrictive, as it is “difficult to reach viability as these have significantly lower quality than virgin fibers” (Mistra Future Fashion, n.d.). Therefore, as mentioned above, in order to achieve a fiber-to-fiber result, todays technology only enables us to use 20% of regenerated fibers, mixed with 80% virgin fibers, in order to achieve the quality of strength needed for fabric manufacturing (Mistra Future Fashion, n.d.). In fact, at present, it is more likely for recycled fibers to find their way into insulation materials and as stuffing materials, namely for the car industry, then as a remake of the original fiber. However, despite these limitations due to the lack of available research, mechanical recycling still provides significant savings over virgin material production (Fletcher & Gross, 2012, p. 70), as long as it is not solely used for fiber-to-fiber results.

At present, recycling techniques are still faced with many limitations, mainly due to the fact that most materials include a blend of fibers, restricting the ability to fit within any kind of recycling treatment “as a result, material blends are not recycled today” (Mistra Future Fashion, n.d.), and are simply destined for landfill. However, companies like H&M are collaborating wiht companies like I:CO, as in store collection services .

5. CONCLUSION

“Negligence is described as doing the same thing over and over even though you know it is dangerous, stupid, or wrong. Now that we know, it’s time for a change” (Braungart & McDonough, 2009, p. 117).

The complexities behind today’s apparel industry are manifold, however, we have reached a stage in which the industry and even consumers now, are rather aware of its devastating outcomes. As highlighted in this paper, we must begin to operate within a more positive approach towards the idea of sustainability, whereby effective action is achieved. The traditional route of sustainability is no longer adequate – minimizing waste and energy usage is clearly not enough, we have gone beyond the point of repair and if we choose to tackle the destruction in this way, we are guaranteed to be too late in the endeavor. As discussed, the “efficient” approach is hardly dealing with the problem, and although its intentions seek out to be that of a sustainable performance, it is merely scratching the surface of what actually needs to be done.

The circular system on the other hand, clearly provides the apparel industry and many others, multiple opportunities in which they are able to perform sustainably. In a system were resources are treated with the great respect that they deserve, their value becomes hightened throughout various stages of its use, oppening up to more economic possibilities. Therefore, instead of a short sighted solution, circulartiy provides the fashion industry with a long term solution in which it is able to continue to grow and actually thrive in, and ultimately gain more economic strength, without having to diminish our finite resources in the mean time.

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