# Using Lifecycle Assessment to evaluate responsible consumption and production (SDG goal 12) in fashion supply chains

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Fashion supply chains have massive environment impact, producing 2-8% of global carbon emissions (UNEP, 2019), water pollution, waste and using micro-plastics. Fashion growth and the throwaway culture prevails, so how can fashion supply chains respond to the challenges of being responsible in consumption and production (SDG goal 12) by 2030. This paper using lifecycle assessment to examine the challenge for clothing supply chains. Brands were revealed to have made some improvements , e.g. sustainable product lines, reduced packaging and use of sustainable materials. However, a typical garment utilised micro-plastics, was dyed using toxic substances, made by workers treated poorly, over-packaged, generated excessive carbon during transport, laundered with toxic chemicals and releases micro-plastics into the waste water, before disposal. Circular fashion and digital fashion could help stem the tide of environmental destruction, however, it is difficult to envision this enough will be done to achieve responsible consumption and production by 2030.

**Keywords**
Lifecyle Assessment, Sustainability, SDGs, Net Zero, Carbon Footprint, Zero Carbon, Responsible Business, Environmental Management, Fashion

**Intended Development of the Paper**
This is a developmental paper which shows initial analysis of the lifecycle of an item of clothing. This paper needs development including, a more extensive literature review, additional lifecycle analysis of further garments, more through discussion and analysis.

**Word Count** 2000 words

## 1 Introduction

Fashion produces 2-8% of global carbon emissions (UNEP, 2019) and is far distance from being carbon neutral by 2030. Indeed, the Ellen MacArthur Foundation (2017) revealed that if fashion continues on its current trajectory the share of carbon could by 26% of global carbon emissions by 2050. However, the environmental impact of fashion supply chains is more far-reaching than just carbon impacts. The process of dyeing our clothes and other processes in the clothing supply chain represent approximately 20% of industrial wastewater pollution worldwide (WRI, 2017). Approximately 93 billion cubic metres of water each year is used by the fashion industry which contributes significantly to water scarcity in some regions (UNCTAD, 2020). An alarming one truck of textiles is landfilled or burned every second (UNEP, 2019). Washing clothes releases 500,000 tons of microfibers into the ocean each year (Ellen MacArthur Foundation 2017 and McFall-Johnsen, 2020). Furthermore, the conditions and pay for textile workers continues to be appalling (Labour Behind the Label, n.d.).

The average consumer bought 60% more in 2014 than they did in 2000 (McKinsey and Company, 2016). Although, there is evidence towards more sustainable consumption with 57% of European fashion consumers making significant changes to their lifestyles to lessen their environmental impact, and more than 60% going out of their way to recycle and purchase products in environmentally friendly packaging (McKinsey and Company, 2020). The fashion sector continues to grow, despite slowing some during the pandemic, it is still projected to reach revenues of US $987,065m in 2022 (Statistica, 2021). Globally, there is still a prevailing view of clothing as disposable product amongst consumers. This paper raises the question: How can fashion supply chains respond to the challenges of achieving the UN Sustainable Development Goal of responsible production by 2030?

This paper utilises lifecycle assessment to examines the gap between now and 2030 in attaining goal 12: sustainable consumption and production. An embedded case study design is used to explore the production of garments using lifecycle assessment methodology which reveals a significant gap exists despite industry endeavours.

## 2 Fashion and Responsible Production and Consumption Initiatives

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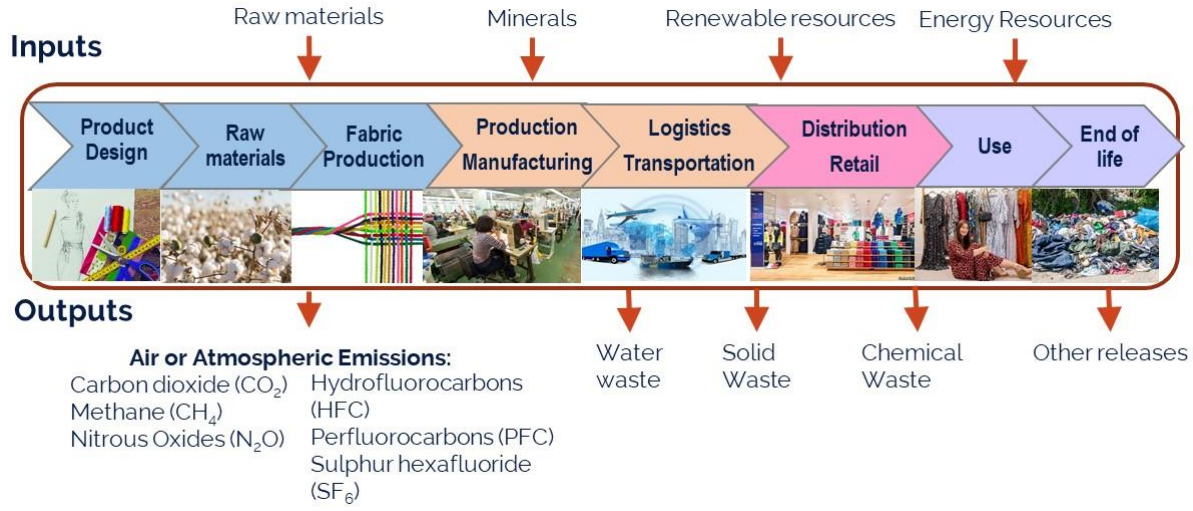
The industry sector, local governments and the UN have launched several initiatives to promote sustainable fashion. The UNEP (2018) have focused on fashion as a major polluter and have galvanised the industry into action. The UK government, through WRAP have launched Textiles 2030, which is a voluntary agreement to collaborate on carbon, water and circular textile targets. Textiles 2030 signatories will also contribute to national policy discussions with UK governments to shape Extended Producer Responsibility and other critical regulatory developments (WRAP, 2021). The Ellen MacArthur Foundation (2018) conducted a project into how circular economy can be incorporated to redesigning fashion's future. This project has been the catalyst for change in the industry, alongside other initiatives. The British Council for Fashion launched The Institute for Positive Fashion. They have completed Phase 1 of their circular fashion project which created a blueprint for circular fashion (Institute for Positive Fashion, 2021). This has three main targets 1) reduced volume of new physical clothing, 2) maximised utilisation through product circularity and 3) optimised sorting methods and material recovery. Thus, driving the industry to stop producing products for landfill, but to create circular products. The concept of circular fashion is a powerful one, this research uses lifecycle assessment to investigate whether big brands are approaching circularity and sustainable fashion.

### 2.1 Lifecycle Assessment Methodology

The approach in this paper is to use an embedded case study design to explore garment's lifecycle to reveal the gap in supply chains in terms of responding to the challenge of being responsible in consumption and production (SDG 12). Lifecycle assessment focuses on examining the life cycle of a product to identify the various environmental impacts during that product's life (Blackburn, 2015, Gardetti and Torres, 2013 and Klöpffer and Grahl, 2014). The boundary of the analysis depends on the focus, in this study the impact was assess from raw materials (cradle) to the disposal phase (grave). In the circular fashion approach, this analysis would be cradle-to-cradle and the end of one lifecycle would become the beginning of the next. However, in this study, no truly circular garments were analysed, hence, a cradle-to-grave analysis. Figure 1 depicts a typical clothing lifecycle from product design through to end-of-life. This figure shows the main inputs and outputs from the process of designing, producing and consuming a garment.

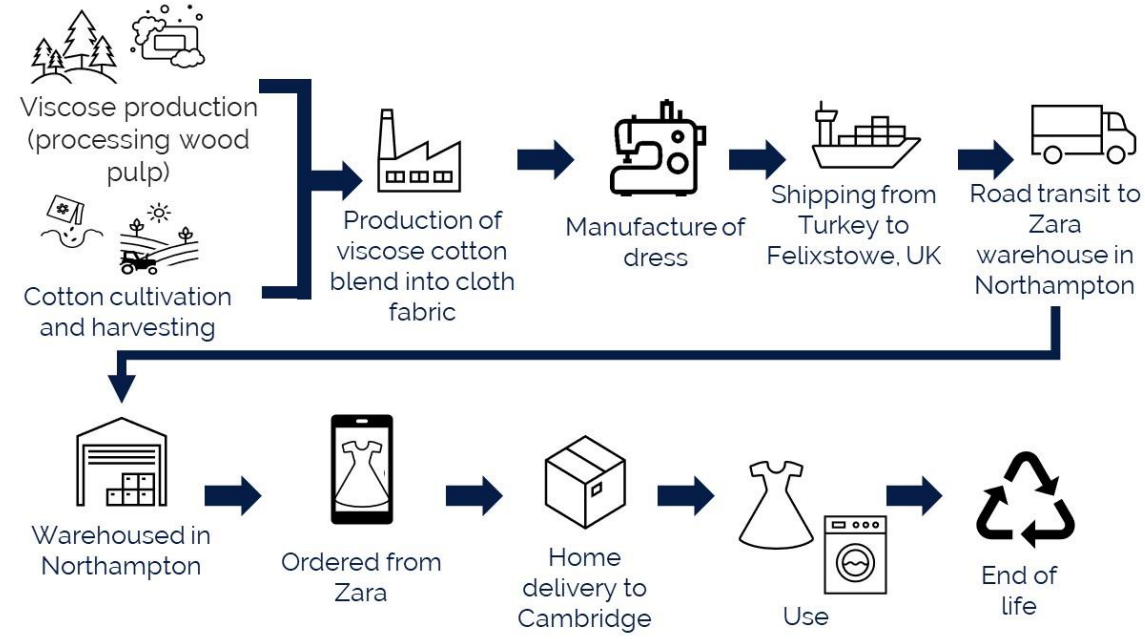
**Figure 1: Typical lifecycle of a garment and the key inputs and outputs**




## 3 Analysis

Lifecycle assessment was conducted to trace the garments and their supply chain impacts on the environment and society. One of the garments researched was a dress from Zara, the lifecycle of this garment is summarised in figure 2. The lifecycle of the dress included the production of the viscose cotton blend, which utilises water, bleach and chemicals in the production. The cultivation of the cotton itself sometimes utilises chemical fertilisers and the wood pulp required for the viscose can contribute to deforestation. The exact conditions in the factory in Turkey are not known, but recent reports show poor working conditions in the region. The dress is packaged and shipped and then road transportation to the warehouse in Northampton, UK. There is further transportation for the home delivery before the dress reaches the consumer. The consumer wears the dress and washes it, before making end-of-life decisions.

**Figure 2: The lifecycle map for a dress from Zara**



The environmental and social impacts of the lifecycle of the dress were examined in more detail, as indicated in table 1. There were some areas where it was possible to collect quantitative data, other areas a more qualitative evaluation was undertaken. Assumptions are explained in the table. There were identified some good practices in the lifecycle. The Better Cotton Initiative has a much lower impact on the environment. However, the production of viscose revealed problematic use of chemicals and localised pollution. Zara's Green to Wear 2.0 initiative has likely had a positive impact in the manufacturing stages, however, there is less evidence to support good working conditions. The impact of logistics and transportation is calculated to produce approximately 78.28 gramme of $CO_2$ – based on worst possible case scenario. Washing and care of the garment will produce carbon and chemical leaching into wastewater. Although the product is biodegradable, this will likely take 20-200 years to fully decompose.

**Table 1: Dress Lifecycle**

| Lifecycle Stage | Analysis |
|---|---|
| **Raw material and fabric production** | Fabric:<br>82% Viscose<br>18% Cotton<br>Comditel are responsible for dyeing, patterning, and finishing of grey fabric for the Inditex group.<br><br>Viscose (Rayon) is made from cellulose extracted from the wood bark, typically bamboo, pine, or eucalyptus trees. Inditex use Lenzing. The process of spinning into yarn is chemically driven and can untreated carbon disulphide can pollute wastewater. Viscose plants used by Zara have been found to pollute nearby residential areas at three times the permitted level (Hoskins, 2017).<br>Cotton Zara's organic cotton is grown from non-genetically modified seed and cultivated without fertilisers or chemical pesticides. In partnership with Better Cotton Initiatives, financing agricultural projects in India and Asia to promote better ecological techniques for sustainable and responsible management of natural sources. |
| **Manufacturing** | The dress is made in Turkey which is Inditex's 2nd largest sourcing market with 189 suppliers. (Gestal, 2019). Turkish economy is dependent on the fashion industry. Euromonitor reports textiles accounted for the greatest share of exported goods from Turkey in 2015, accounting for 18.5% with the value reaching to £13.4bn. (Bearne, S., 2017).<br>Zara's Green to Wear 2.0 standard aims to minimise the environmental impact of textile manufacturing. Inditex have developed The List programme, which helps guarantee both that production processes are clean and that our garments are safe and healthy. |
| **Logistics and transportation** | The cotton produced in India and viscose in Austria was transported to the manufacturing facility in Turkey. The product was then likely moved to Zaragoza logistics centre and then onto the distribution centre in Northampton, UK, before being sent to the consumer in Cambridge.<br>**Cotton** - Mumbai, India to Mersin, Turkey = 3720 nm or 6,889 km (6,889km X 15)X0.000072 = 7.44 grammes of $CO_2$ at the most (based on 0-15 kg $CO_2$ emitted)<br>**Viscose** - Vienna, Austria to Mersin, Turkey = 2142nm or 3,967 km |

| | |
|---|---|
| | (3967 km X 15)X0.000328 = 19.52 grammes of $CO_2$ at the most (based on 0-15 kg $CO_2$ emitted)<br><br>**Cotton Viscose Blend Dress-** Mersin, Turkey to Port of Algeciras Bay = 2102nm or 3,893 km<br>(3,893 km X 15)X0.0004 = 23.36 grammes of $CO_2$ at the most (based on 0-15 kg $CO_2$ emitted)<br><br>Port of Algerciras Bay to Felixstowe Port = 1561 nm or 2891 km<br>(2,891 km X 15)X0.0004 = 17.37 grammes of $CO_2$ at the most (based on 0-15 kg $CO_2$ emitted)<br><br>**To warehouse -** Felixstowe to Northampton = 196.2 km<br>(196.2 km X 91)X0.0004 = 7.14 grammes of $CO_2$ at the most (based on 51-91 kg $CO_2$ emitted)<br><br>**To** household - Northampton to Cambridge = 95.6km<br>(95.6 km X 91)X0.0004 = 3.48 grammes of $CO_2$ at the most (based on 51-91 kg $CO_2$ emitted)<br><br>**Total:** 78.28 grammes of $CO_2$.<br><br>**N.B. There are some assumptions made here on the specific route and the $CO_2$. calculations are based on industry averages.** |
| **Packaging and home delivery** | Packaged in tissue paper and recyclable envelope. The 'Green to Pack' 2016 programmed based on the circular economy. (Inditex, 2016) |
| **Consumption and use** | Used occasionally. Care instructions:<br>• Machine wash at max. 30ºC/86ºF with short spin cycle<br>• Do not use bleach<br>• Iron at a maximum of 150ºC/302ºF<br>• Dry clean with tetrachloroethylene<br>• Do not tumble dry<br>The impact of washing detergents release chemicals into wastewater. |
| **Disposal** | Viscose is biodegradable but can take 20-200 years to fully biodegrade as it is a synthetic material (Hill, 2017).<br>Zara offer a clothes recycling campaign – transforming clothing into raw materials (if they are unusable) to be used within production of their new clothes. However, due to the blend of viscose with cotton, separation is difficult. |

## 4 Conclusion

The response of brands to the challenge of responsible consumption and production has revealed a mixture of achievements, e.g. sustainable product lines, reduction in packaging, use of sustainable materials, etc. However, a typical garment purchased today, is still largely utilising plastics causing micro-plastic pollution, dyed using toxic substances, made in a factory by workers treated poorly, over-packaged, transported excessive distances generating carbon emissions and utilised for a short period by the end consumer with the laundering

process using further toxic chemicals and releasing micro-plastics into the waste water. It is possible that the combination of circular fashion and digital fashion could help stem the tide of environmental destruction. However, when analysing the average garments produced today - it is difficult to envision enough will be done to achieve responsible consumption and production as envisaged in UN SDG goal 12 by 2030.

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