REDUCING THE TRUE COST OF COTTON T-SHIRTS

Final report
July 2021

THE GREENS/EFA
in the European Parliament

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Authored by

True Price™

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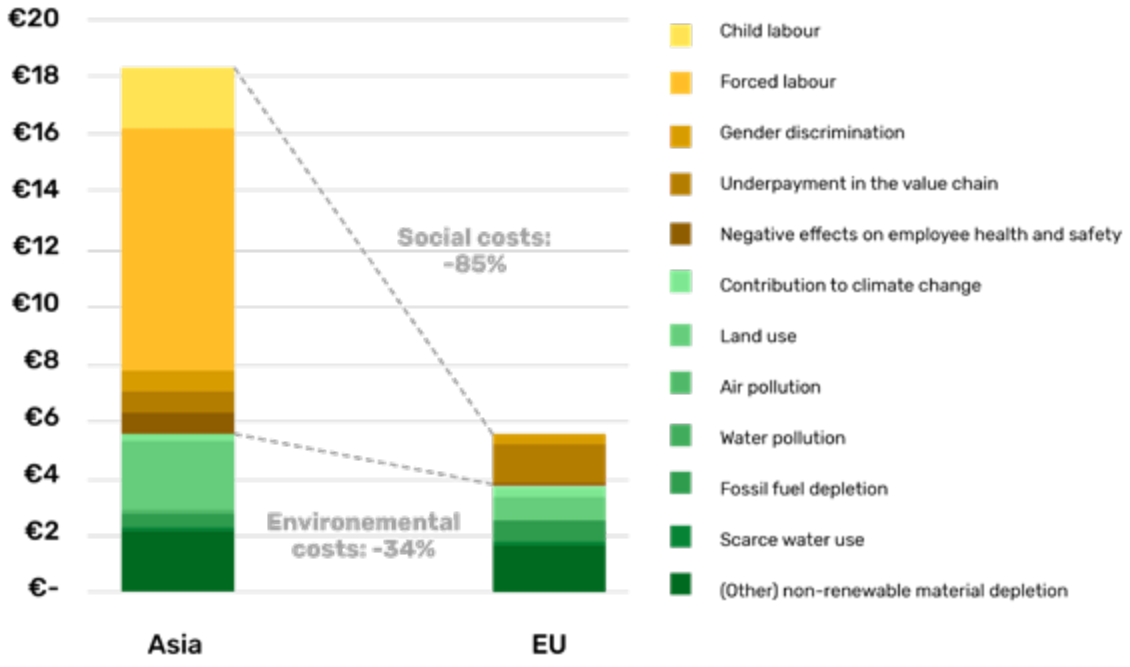
1. SUMMARY

This study, commissioned by the Greens/EFA group in the European Parliament (Greens/EFA), was conducted to get better insight into the social and environmental costs of the garment industry. The garment industry has been infamous for frequent violations of human rights and environmental standards in its production chains. We calculated the external (thus, the social and environmental) costs associated with the currently dominant value chain of cotton t-shirts sold in EU27[1] and the external costs associated with an alternative (EU-based) value chain. The aim of this study is to support the Greens/EFA to raise awareness, impose high environmental standards and improve labour conditions in the garment industry by shedding light on the true costs of the globalized garment industry.

The external costs of cotton t-shirt production per value chain (EUR/t-shirt)



1 Unless explicitly stated otherwise, EU refers to EU[27].

In an ideal world, there would be no external costs meaning that farmers would uphold environmentally friendly farming practices (using no toxic chemicals and properly managing water), that there would be no underpayment, forced labour or child labour in the garment industry and that we would allow biodiversity to thrive. Unfortunately, this is currently not the case in our garment industry. By making explicit where the damage lies, we aim to move towards a socially just and environmentally sustainable garment industry.

This report finds the external costs of a cotton t-shirt produced in India and Bangladesh was €18.27/t-shirt in 2019. These externals costs are mainly driven by the presence of forced labour (46%) and child labour (11%), biodiversity loss from land use (13%) and scarce water use (12%). The external costs of a cotton t-shirt produced in Greece and Italy was €5.58/t-shirt in 2019. The main contributing factor of these external costs is caused by the large consumption of scarce water for the cultivation of cotton.

On a more detailed level, the environmental cost (EUR/t-shirt) of cotton cultivation in India is higher than in Greece, mainly due to lagging yields. Many Indian farmers fail to reach the yield level of other cotton producing countries. To improve yields, many Indian farmers use excessive amounts of agrochemicals which are damaging to nature and people. Conventional farming practices must be replaced by organic farming practices and proper water management to reduce the external costs of cotton cultivation.

Additionally, specifically to India's cotton farms and fabric production sites, the issues of forced labour and child labour must be addressed. Other social issues we often observed are gender discrimination, lack of safe and healthy working conditions and underpayment. Importantly, the issue of underpayment (or workers receiving wages which are below the local minimum or living wage) is especially relevant as it is strongly interlinked with other social issues.

The negative effects of safe and healthy working conditions often result from workers not being trained on the proper use of personal protective equipment (PPE), PPE not being available or workers not wearing it. In addition to the toxic chemicals used for cotton cultivation, toxic substances are also used for dyeing and printing fabric. When workers do not properly use PPE, treating fabric or crops with toxic chemicals will have negative consequences for their health.

In all steps of the two value chains, the commonly used type of energy (whether it be used as electricity or fuel) is largely grey energy (meaning it contains energy sourced from non-renewable energy sources). Amongst others, this results in damage to people and planet via contribution to climate change, air pollution and fossil fuel depletion. To eliminate these external costs, grey energy should be replaced by green(/renewable) energy.

Moving cotton t-shirt production from India and Bangladesh to Greece and Italy would reduce its social costs by 85% and the environmental costs by 34%. Subsequently, the remaining social and environmental costs as included in this study can be eliminated by:

1. Ensuring that workers are paid the local living wage, receive equal pay for equal work (regardless of their gender) and are trained on and properly use personal protective equipment (PPE), and;

2. Ensuring farmers implement environmentally friendly farming practices and proper water management, replace use of toxic chemicals by environmentally friendly alternatives and replace any grey energy (such as electricity used for machinery) by green alternatives.

2. INTRODUCTION

2.1 THE GARMENT INDUSTRY

Clothes are a basic human necessity but also a popular form of individual expression. Cotton t-shirts are known for their versatility and widespread use, coming in a variety of colours, forms and finishes. The cotton used to manufacture t-shirts is mainly cultivated in Asian countries such as India and China (Statista, 2021). Once cultivated, cotton is processed into fabric and used to manufacture the shirts. Garment manufacturing offers employment to millions of people in Asia. The production of T-shirts thus offers demonstrable benefits in the form of working opportunities in the countries involved in its value chain.

However, the garment industry is also associated with negative impacts on people and the planet. These

impacts are costs to society incurred during the production of garments, but which are not paid for by the consumers or companies involved in the value chain. An example of such external costs is the labour rights violations, which workers in the garment industries of some Asian countries often face (D'Ambrogio, 2014).

The OECD states *"businesses can play a major role in contributing to economic, environmental and social progress, especially when they minimise the adverse impacts of their operations, supply chains and other business relationships"* (OECD, 2018) indicating that companies and organisations -for example, in the garment industry- must take responsibility for the social and environmental impact which their operations, supply chains and relations result in.

The Greens/EFA group in the European Parliament (Greens/EFA) recognises the need for change in the global garment industry. In its trade policy, the EU recognises the build-up of global values chains has had a dichotomous impact on societies (European Commission, 2021) and stresses its commitment to fair trade and the need for EU assertiveness to combat unfair practices. Amongst others, the Greens/EFA want to raise awareness, impose high environmental standards, and improve labour conditions in the value chains of the garment industry as to support the EU in its transition to fair and sustainable trade and minimise negative impact on people and planet.

The results of this report illustrate that our current economic system is unable to meet societal needs. It focuses on financial and economic gains and fails to value and prioritise human rights, the environment, and people's life satisfaction over profits. How can we adjust our economic system such that it creates value for people and planet? What is needed to move away from the polluting practices present in our current system? And how will we ensure value creation for people and planet in our economy?

Before further diving into the garment industry's impact, basic aspects of the industry are summarised as to gain understanding of the industry assessed in this study.

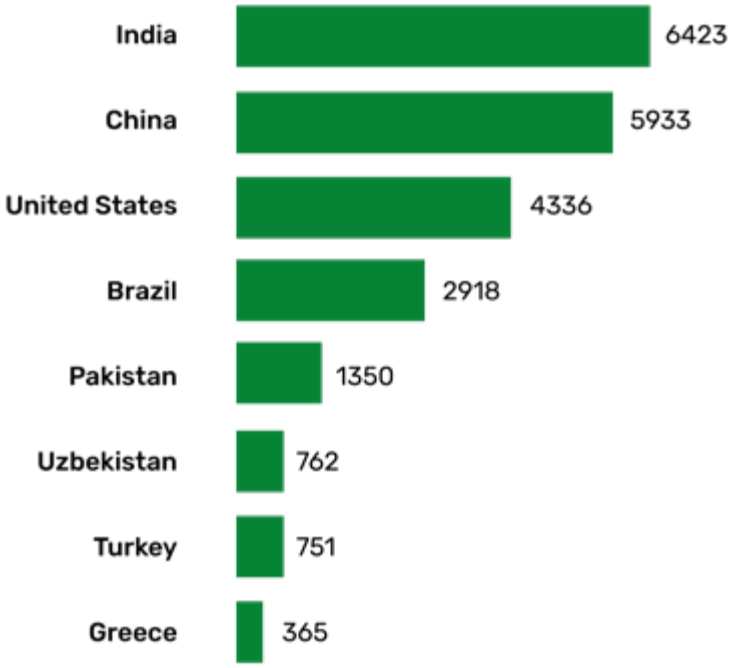
2.2 BACKGROUND INFORMATION

The roots of the modern-day garment industry lie in Europe and North America. Since the 1960s, the geographical distribution of the industry has changed as employment moved away from Europe and North America to Asia and other parts of the world (ILO, 1996). In 2019, the Asia-Pacific region accounted for 65 million workers in the industry (75% of global share) (ILO, 2020), most of whom are women (Stotz & Kane, 2015).

The current garment industry is truly globalised with value chains spread across many countries and continents (Stotz & Kane, 2015). The industry observed a trend towards faster and more flexible production with lower prices for garments such that today's garment industry characterises high volatility, low predictability, and low profit margins (ILO, n.d.). The globalised industry allows for production to occur where cheap labour is found. Now that wages in some traditionally considered 'low wage-countries' are on the rise (most prominently, China (Donaldson, 2017)), the garment industry is making its way to other countries such as Ethiopia in its search for cheap labour (SOMO, 2019).

The EU currently obtains most of its clothing from Asia. In 2019, EU imports of cotton t-shirts were mostly from Bangladesh (47%), Turkey (16%) and India (11%) (EUROSTAT, 2021). India is the world leading cotton producer, closely followed by China (Statista, 2021). European cultivation of cotton is relatively small compared to the global scale. Greece is the EU's largest cotton producer and produced an estimated 6% of India's cotton volumes in 2019/2020 (Statista, 2021). Within the EU, Italy is an important garment producer (accounting for 45% garments) (World Bank, 2018; EURACTIV, 2016).

Figure 1: Leading cotton producing countries worldwide in 2019/2020 (in 1000 tonnes)



The evolution of the garment industry has brought about large, globalised value chains in which social issues are common and difficult to monitor (Stauffer, 2017). The COVID-19 epidemic has laid bare how fragile and out of balance this globalized industry is. Those on the producer side are suffering as large fashion brands cancel and refuse to pay for orders, neglecting to pay for the consequences (ILO, 2020).

"A humanitarian crisis is unfolding in Bangladesh, with the fate of 4.1 million garment workers in the hands of western fashion brands, who have reportedly cancelled over $2.8 billion in orders as the COVID-19 crisis escalates … many brands are refusing to accept completed garment orders" -Forbes Magazine

The Greens/EFA recognize this imbalance and stress the need to learn from the past and for the EU to establish trade that is more sustainable and just in the post-COVID era. The European Parliament's Responsible Business Conduct Working Group is working to establish binding rules for companies to identify and address risks to human rights, good governance and the environment resulting from their supply chains (Greens/EFA, 2021).

2.3 TRUE PRICING

The true costs of producing garments (for the EU) must be estimated as to obtain insight into why putting the wrong price tag on externalities creates unfair competition on the market and hampers the socio-ecological transformation of the garment industry. This ambition can be achieved by using True Pricing since it is a unique method to quantify and present external costs [2] of production. The True Pricing methodology gives quantitative insights into the direct external costs which are not part of the purchasing price of a product, but which are paid by society nonetheless – for instance by local communities (air and water pollution), by future generations (climate change) or by employees (health and safety risks). The aim of True Pricing is to minimise products' external costs. This can be done by creating transparency about external costs and showing how

2 In this report, the terms true cost and external cost are used interchangeably.

industries can be transformed to improve their social and environmental impact. Complementary, governing bodies can facilitate and accelerate reduction of external costs via incentives (such as taxes and subsidies).

Figure 2: Explanation of the true price and external costs

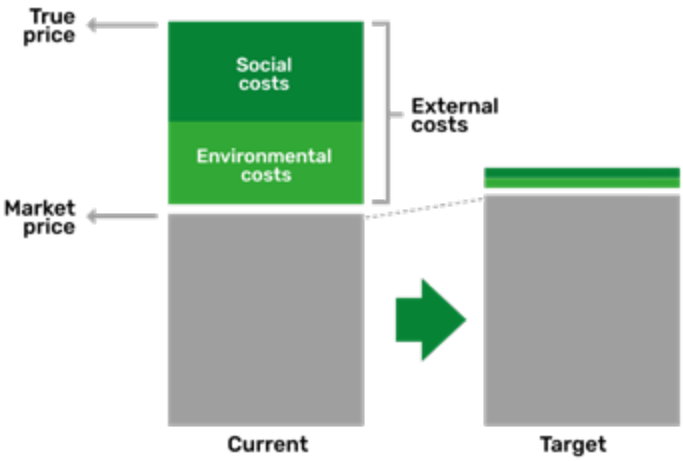


Figure 3: Publications on true pricing

This information can be used to:

• Identify the largest external costs of cotton t-shirt production (pre-COVID-19) and levers of change;

• Draft a roadmap to rebuilding global trade to ensure it will become more socially just and environmentally sustainable in the post-COVID era. We shall avoid all sorts of abuses and raise the societal and environmental standards;

• Strengthen advocacy for just and sustainable alternatives by providing fact-based and tangible arguments;

• Inform policy makers and regulators on the benefits of internalising external costs.

While the garment industry offers economic opportunities to many people in Asia, a true cost assessment of the industry is required to complete the picture and fully understand the industry's impact. Therefore, this report describes the external costs of two distinct value chains of a cotton t-shirt. The results give insights into the alternative ways of producing t-shirts, faced in today's garment industry. The two value chains are: 1) Cotton cultivation, fabric production, transportation within Asia, t-shirt manufacturing in Asia and transportation to the EU, and 2) Cotton cultivation, fabric production, transportation within the EU, t-shirt manufacturing and transportation to the endpoint in the EU. Both value chains end in the European Union since this study aims to bring positive change to garment production for the EU.

Firstly, this report describes the study's method, including the approach to the study, the scope of the assessed value chains, assumptions and limitations, main data sources and details on the True Price methodology. Secondly, the results of the assessment are presented. Thirdly, recommendations are discussed as based on the results of the assessment for establishing fair and sustainable practices in the garment industry.

3. METHOD

The method section of this study consists of three sections:

• **3.1 Approach:** Description of the steps that were taken in carrying out the four studies discussed in this document.

• **3.2 Scope, assumptions & limitations and data:** Outline of the scope, assumptions & limitations of the value chain assessments and the main data sources used for the assessments.

• **3.3 Methodology and costing:** Overview of the methodology applied throughout the assessments and descriptions of the costings per impact.

3.1 APPROACH

Step 1: Scoping

The analysis starts by scoping the boundaries of the project. These boundaries are determined together with the Greens/EFA during a scoping session. The scope of the analysis includes two cases – the production model that represents the currently dominant value chain of a cotton t-shirt (set in India and Bangladesh) and a European alternative to attempt to establish a more socially just and environmentally sustainable alternative production model. The scope refers to geographical scope, product definition, impacts in scope and year of measurement.

Step 2: Model building

The True Price tool provides the true cost of a product and allows for converting externalities into monetary values using monetisation factors as based on the True Price methodology. Sector literature is used to map a clear value chain and customise the True Price tool to the value chain of cotton t-shirts.

Step 3: Data collection

Value chain and LCA-data for both cases are collected from studies performed by True Price and other parties in the sector. These secondary data sources include for example sector reports, national statistics, international databases, LCA data and academic studies. Some aspects related to the garment industry are well-documented and abundant in reliable data while others cause data gaps. To fill these gaps, True Price either derives the datapoint from the other value chain's datapoint or makes an assumption to fill the gap [3].

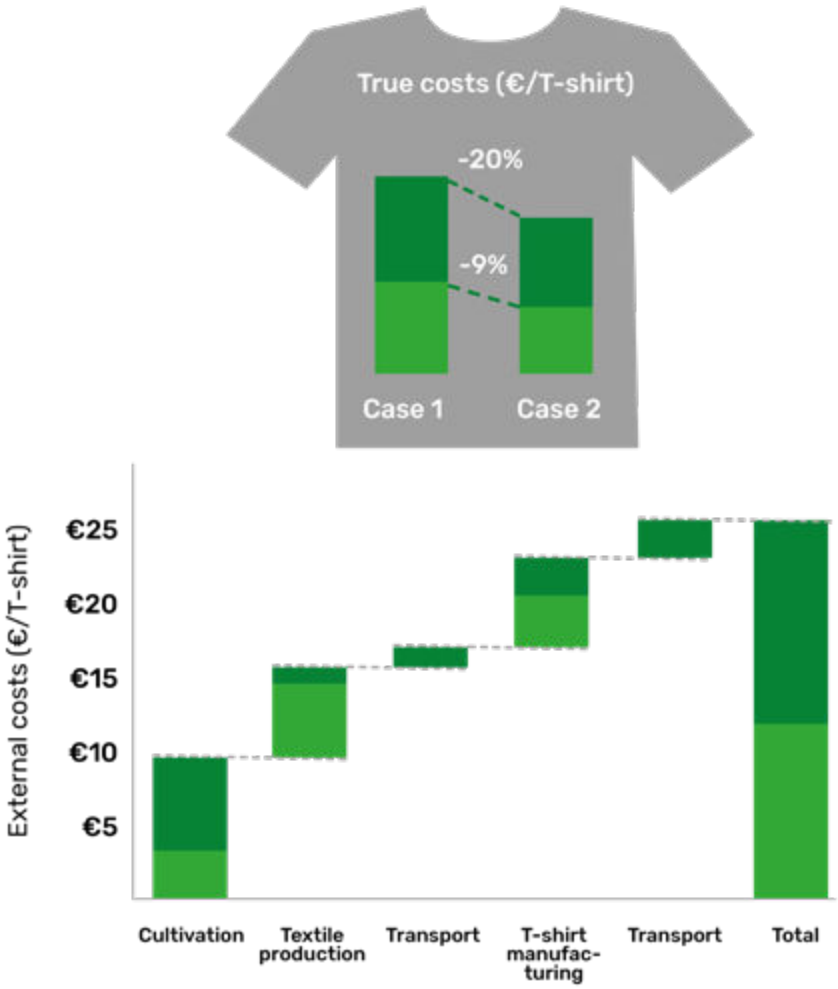
Step 4: Analysis and validation

For each production process in the value chains, True Price performs an in-depth analysis which includes the true cost gap and a comparison of the two value chains. It provides insights into the drivers of the true cost of production in the EU and in Asia. The models and analyses were validated by multiple members from True Price to ensure accuracy.

Step 5: Reporting

In the reporting step, all findings and processes are reported on to highlight the levers for change in the value chain and potential policy recommendations.

Figure 4/ Dummy graphs - The true costs of the two cases



3 The assumptions and limitations to this study are documented in the next section.

3.2 SCOPE, ASSUMPTIONS & LIMITATIONS AND DATA

3.2.1 Scope

In his study, we modelled two value chain of producing cotton t-shirt. Both value chains consist of five value chain steps which start at growing/farming cotton (the input product) and end at point of sales (so where the finished product will be sold). The five value chain steps are:

1. Cotton cultivation. This step comprises the farming of cotton which will be turned into yarn and fabric in the next value chain step.

2. Fabric production. This step comprises the ginning, spinning, knitting/weaving, wet-processing and finishing of cotton into fabric.

3. Transportation from fabric production site to garment factory. This is the first transportation step in our value chain. We assume steps 1 and 2 take place at near locations (in line with OECD/FOA (2019)).

4. T-shirt manufacturing. In this step the fabric is cut and sown into t-shirts.

5. Transportation from garment factory to final destination. In this final step, the finished products are transported to Spain, where they will be sold in stores.

We modelled two value chains[4]: The first value chain represents the currently dominant value chain in cotton t-shirt production: Cotton cultivation and fabric production take place in India, while t-shirt manufacturing takes place in Bangladesh. These locations were chosen because India is the world's largest producer of cotton (OECD, 2020) and Bangladesh exports the largest value of cotton t-shirts to the EU (Eurostat, 2021).

The second value chain represents an alternative value chain of cotton t-shirts set within the EU. In this value chain, cotton cultivation and fabric production take place in Greece, while t-shirt manufacturing takes place in Italy. These locations were chosen as Greece is the EU's largest producer of cotton (FAO, 2020) and Italy is the EU's greatest producer of garments (World Bank, 2018).

Moreover, the functional unit of this study is an average sized white t-shirt made of conventional, virgin (non-recycled) cotton. Notably, we chose not to measure and valuate the external costs of a t-shirt made of bio-cotton for two reasons: First, at the time of measurement, cotton in Greece was not yet marked as bio-cotton. Second, we want to compare two value chains. If we would compare the value chain of a conventional cotton t-shirt produced in Asia to a bio-cotton t-shirt produced within the EU, the value chains would have multiple varying variables making it difficult to assess where the differences stem from.

The year of measurement in this study is 2019. We chose this year (as opposed to the most recent year, 2020), since 2019 presents the most recent completed year of production in which value chains are not influenced by the global COVID-19 crisis and are most representative of 'business as usual'.

The impacts in scope[5] are listed below:

4 The value chains are visually presented in Appendix 6.2.

5 Please note that for the value chain step Transportation only the environmental impacts are in scope.

Environmental impacts	Description
Contribution to climate change	The rise of the global mean temperature cause by increased emissions of greenhouse gases (GHG) due to anthropogenic activities
Scarce water use	The use of surface or groundwater (blue water) in such a way that the water is evaporated, incorporated into products, transferred to other watersheds or disposed into the sea, in areas where water is scarce
Water pollution	The impact of emissions to water contributing to ecotoxicity and human toxicity, as well as eutrophication of marine- and freshwater
Material depletion	The reduction in future availability of non-renewable materials as the consequence of the primary extraction of scarce, non-renewable material resources excluding fossil fuels, such as gold, zinc, copper and many more
(Biodiversity loss from) Land use	The decreased availability of land for purposes other than the current one, through land occupancy (land occupation) and the effect on ecosystem services and the climate system of changes in land-cover (land transformation)
Air pollution	Emissions to air other than climate change, including ozone layer depletion, acidification, photochemical oxidant formation, particulate matter formation, nitrogen deposition from emissions to air, terrestrial and aquatic ecotoxicity and human toxicity from toxic emissions to air.
Fossil fuel depletion	The reduction in future availability of fossil fuels caused by the primary extraction of fossil fuels linked to fuel use, energy use and to produce other inputs
Social impacts	Description
Underpayment	The gap between workers' wages, the local minimum wage and the local living wage
Forced labour	Presence of forced labour in own operations and in the value chains
Child labour	Presence of child labour in own operations and in the value chains
Negative effects on employee health and safety	The occurrence of accidents in the value chain and cost of workers performing work in unsafe conditions
Gender equality	The value of the pay gap between female and male employees along the value chain

3.2.2 ASSUMPTIONS & LIMITATIONS

• Transportation from India to Bangladesh is assumed to be done by truck (to nearest harbour) and ship (from harbour to harbour). Sources state that roughly 50% of transport to Bangladesh is done by truck, but from the regions where cotton weaving is big (most notably, Gujarat, Maharashtra and Andhra Pradesh) transportation by ship is most efficient.

• Transportation from Bangladesh to Spain is assumed to be done by truck (to nearest harbour) and ship (from harbour to harbour) as this represents the most efficient and realistic way of travel.

• Transportation within the EU is assumed to take place by truck (on-land transport only).

• The cotton cultivation and fabric production steps are assumed to take place at the same location (such that there is no transportation step in between the two) (in line with OECD/FOA (2019)).

• When working on the cotton farm (for step 1. Cotton cultivation), workers are assumed to work full-time. We therefore assume the wages these workers are paid are for a full-time working week.

• Data on the yield (kg cotton/hectare) of cotton per country varies. We chose to use a source (US Department of Agriculture) which provides data for both Greece and India to ensure the results of these two yield factors are comparable. The yield for India was 483 kg/hectare in 2019 while the yield for Greece was 1280 kg/hectare in 2019.

• Regarding the final product, we assume it consists of only cotton (no buttons or other materials). Packaging material is also not included in the current study.

• Garment workers are assumed to manufacture (that is, cut and sow) 6 t-shirts per hour (Van der Velden & Vogtländer, 2017) and work full-time.

• The true cost assessment is based on secondary data and literature. This literature is selected based on completeness, plausibility and objectivity of data to ensure sufficient data quality.

Source	Date published	Description
ReCiPe	2016	ReCiPe lifecycle assessment methodology was developed by Huijbregts et al. (2016).
Principles for True Pricing	2020	True Price publication with a set of social impacts which are largely in line with existing social LCA frameworks and human/labour rights standards.
Verité	2014-2018	Non-profit organisation engaged in research and assessments on fair and responsible working conditions. Data used for child/forced labour.
IDH	2016	Study in 2016 by IDH and True Price on the true price of cotton from India. Results of the study are used for both social and environmental indicators.
Fair Wear Foundation	2018, 2019	Non-profit organisation advocating for a fairer and more ethical fashion industry. Reports used for social indicators, like forced labour and H&S.
ILO	2018	International Labour Organization. Different reports used for general and social indicators.
Clean Clothes Campaign	2014	Non-profit organisation dedicated to improving working conditions and empowering workers. Reports used for general and social indicators.
Eurostat	February 2021	The statistical office of the European Union. Data used for general model indicators.

3.3 METHODOLOGY AND COSTING

The true cost assessment of a cotton t-shirt is performed using the True Price methodology [6].

What is the true price of a product?

The true price is a way to make the external costs of producing and consuming a product explicit. External costs are the costs associated with negative externalities. These are the negative effects on external stakeholders who did not participate in the production or consumption of that product (or, if they did, did not do so sufficiently freely). Externalities include effects on the environment [7], such as climate change and water pollution, and on people, such as health and safety accidents and child labour. True price makes external costs explicit by assessing them on a per-unit basis and by monetising them—that is, expressing them in a monetary way (e.g., in euros or dollars), just as with conventional costs.

How to quantify and monetise external costs?

For each of the relevant impacts in the current study, the size of the impact in natural unit (or 'footprint') can be measured or estimated using primary or secondary sources. Examples of footprints are the emission volumes of greenhouse gases per unit product (for determining the contribution to climate change), and hours of child labour per unit product. To obtain the respective monetised value of an impact, the impact expressed in its natural units (or footprint indicators) can be multiplied by its monetisation factor.

How to determine monetisation factors?

The Principles for True Pricing defines the principle of remediation that monetisation can be based on. This is inspired by, among others, the UN Guiding Principles on Business and Human Rights and links directly to the rights-based approach (see Principles for True Pricing for more details).

The principles of remediation are implemented by identifying the four types of costs that, when appropriately combined, form the remediation cost for an impact: 1) restoration costs, 2) compensation costs, 3) prevention costs of re-occurrence, and 4) retribution costs (see Box 1).

To derive monetisation factors for a given impact, the following approach is followed:

1. Firstly, the types of damage that are associated to the impact are determined based on existing literature. Damage can be either damage to people or to the environment. In some cases, the damage has already occurred (i.e. damage in the past; it is irreversible). In other cases, the future damage might occur unless it is prevented (namely, reversible future damage), or is certain to occur (namely, irreversible future damage). The damage can also be assessed as severe or non-severe. We assess which of the four types of remediation cost must be applied (also see Monetisation Factors for True Pricing for more details). More than one type of cost might be relevant (e.g., both Compensation costs and Prevention costs of re-occurrence). In some cases, the choice of cost may vary, depending on the country or region where the impacts take place, leading to different monetisation factors in different geographies.

2. Secondly, based on economic modelling and data available in the literature, the relevant costs are quantified in a way that can be attributed linearly to one unit of impact as measured by the footprint indicators.

3. Finally, the quantified cost(s) are summed to form monetisation factors. For impacts that have only one footprint indicator, this is a single monetisation factor. For impacts that have a set of distinct footprint indicators, there are monetisation factors for each.

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6 See Appendix 6.1 for an overview of the key limitations to the True Price methodology.

7 Please note that biodiversity is both included in our methodology in the impact indicator Land use and indirectly in a variety of other impacts (air pollution, water pollution, scarce water use and contribution to climate change).

BOX 1: THE FOUR TYPES OF REMEDIATION COSTS

Restoration costs

Restoration costs are the cost of bringing people's health, wealth, circumstances, capabilities, or environmental stocks and environmental qualities to the state they would have been in the absence of the social and environmental damage associated with an impact (such as the cost of ecosystem restoration). Restoration cost is applied for impacts where restoration is feasible, or feasible and more economically efficient than compensation when the damage to people or communities is not severe.

Compensation costs

Compensation costs are the cost of compensating affected people for economic and/or non-economic damage caused by the social and environmental impacts of producing or consuming a product. In the valuation literature, this is also called damage cost (e.g. compensating for denied income, or the value of lost human health). Non-economic damage can be assessed using the best available stated and revealed preference valuation techniques. Compensation costs are part of the remediation costs for impacts where restoration is not considered feasible.

Prevention of re-occurrence costs

Prevention of re-occurrence cost represents the cost that would be incurred in the future to avoid, avert or prevent the identified social and environmental impacts of a product from occurring again (for example, the cost of introducing human rights audits in a supply chain). Prevention cost of re-occurrence is part of the remediation costs in addition to restoration or compensation when the damage is considered more severe and irreversible. Whereas the other types of costs refer to realised damage, this cost relates to the prevention of future damage. It finds its basis in, among others, the UN Guiding Principles mentioned earlier that acknowledge a responsibility to prevent reoccurrence of human rights breaches.

Retribution costs

Retribution costs are the cost associated with fines, sanctions or penalties imposed by governments for certain violations of legal or widely accepted obligations. They represent the damage to society caused by the breaking law. For impacts that correspond to the breach of a legal or a widely accepted obligation, retribution costs are part of remediation costs, over and above restoration, compensation and/or prevention of re-occurrence costs.

BOX 2: COSTING PER IMPACT

Environmental impacts	Costing
Contribution to climate change	The restoration and prevention cost of increased emissions of greenhouse gases (GHG), expressing the cost of measures to avoid additional GHG emissions (marginal abatement cost)
Scarce water use	The restoration cost of extracting water from freshwater ecosystems in areas where it is scarce, expressing the total annualised cost of desalination
Water pollution	The compensation cost of toxic emissions, expressing the health-related, social and economic loss due to pollution AND the restoration and prevention cost of eutrophication of marine- and freshwater, expressing the average marginal cost of measures to restore nutrient levels (marginal abatement cost)
Material depletion	The compensation cost of extracting non-renewable materials, expressing the future loss of economic welfare in the society, due to increased extraction costs in the future (increased scarcity)
(Biodiversity loss from) Land use	The compensation cost of land use, expressing the opportunity cost of using the land and displacing ecosystem services AND the restoration cost of land transformation, expressing the cost of ecosystem restoration projects
Air pollution	The compensation cost of toxic emissions, particulate matter formation, photochemical oxidant formation, acidification and ozone layer depletion, expressing the health-related, social and economic loss due to pollution
Fossil fuel depletion	The compensation cost of extracting non-renewable materials, expressing the future loss of economic welfare in the society, due to increased extraction costs in the future (increased scarcity)
Social impacts	**Description**
Underpayment	The restoration cost for wage gap, prevention costs to avoid future violations and compensation cost depending on the size of the wage gap
Forced labour	The restoration cost for existing debt and interest, cost of treatment in case of abuse and cost of reintegration, compensation cost depending on the severity of the violation and prevention costs to avoid future violations
Child labour	The restoration cost of missed education, compensation cost of loss in future earnings and prevention cost for avoiding future occurrence of child labour
Negative effects on employee health and safety	The restoration cost of medical costs, compensation cost for fatal and non-fatal incidents and prevention cost for avoiding future health & safety breaches.
Gender discrimination	The restoration cost of the gender wage gap and compensation cost proportional to the gender wage gap

4. RESULTS

4.1 TRUE COST OF A T-SHIRT

In this chapter we will show the external costs of a cotton t-shirt as produced in Asia and as produced in the EU. These external costs represent the social and environmental costs involved in the production of one cotton t-shirt. The results illustrate that the currently dominant way of producing cotton t-shirts is very costly. Albeit cotton t-shirts are often sold for low prices [8], the external costs of cotton t-shirts may be more than 3 times the market price.

Consequently, companies that uphold socially just and environmentally sustainable practices (and will often sell their produce for a higher price) may -in reality- be able to produce cheaper cotton t-shirts if the social and environmental costs are included than traditional t-shirt producers. This chapter will dive deeper into the external costs of producing cotton t-shirts in the value chains as outlined in chapter 3 Method. The results illustrate how neglecting to account for the social and environmental costs of cotton t-shirt production allows for unfair competition.

The main findings of this report are:

• When produced in Asia, the true cost of a t-shirt sold in Spain was €18.27 in 2019. The main contributors are the presence of forced and child labour, the use of scarce water, and land use;

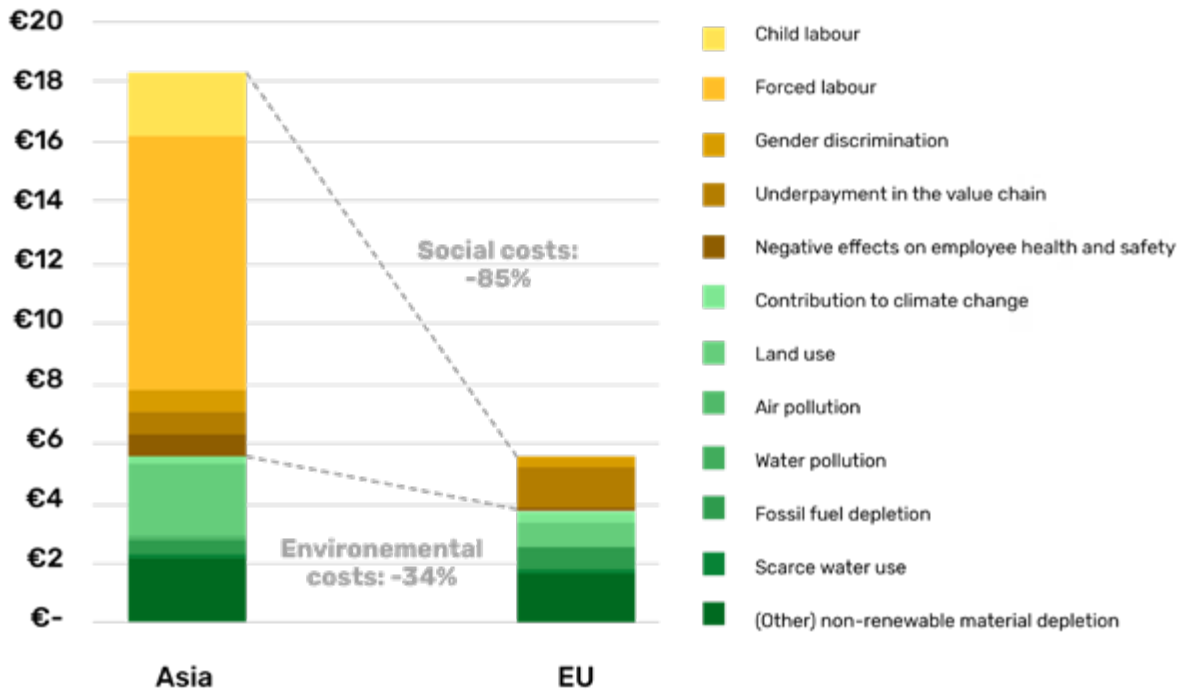
• When produced within the EU, the true cost of a t-shirt sold in Spain was €5.58 in 2019. Its main contributor the use of scarce water;

• The environmental costs of cotton t-shirts can be minimized by i) implementing organic farming practices and proper water management, ii) replacing chemical substances used for processing fabric by environmentally sustainable alternatives and iii) substituting currently dominant grey energy (sourced using -at least partially- fossil fuels) (specifically, electricity and fuel) by green energy sources;

8 Spanish fashion brand ZARA offers cotton t-shirts as low as €4.94 a piece (see https://www.zara.com/es/).

• Minimizing the external costs resulting from social issues such as the presence of forced and child labour, lack of safe and healthy working conditions and underpayment is a complex but pressing exercise. Notably, many of these issues are interlinked (such as parents being underpaid and their children having to work). Addressing social issues in the value chains of cotton t-shirts should therefore take the consequences on other social issues into account.

Figure 5: External costs of a cotton T-shirt (EUR/T-shirt)



Fiigure 5 shows the total and individual components of the external costs of t-shirt production for both value chains. It displays that the calculated true cost of a t-shirt sold in Spain in 2019 was €18.27 when produced in Asia and €5.58 when produced within the EU. Comparing the total social and environmental costs per t-shirts shows the costs are respectively 85% and 35% lower in the EU-value chain than in the Asia-value chain. The main contributors to the external costs of the Asia-value chain are the presence of forced (46%) and child labour (11%), the use of scarce water (12%), and land use (13%). Similarly, use of scarce water is the main contributor to the external costs of the EU-value chain (31% of its external costs).

Notably, the majority of the external costs of scarce water use are caused by the first step in these value chains: The cultivation of cotton. For both value chains, the cultivation of cotton is responsible for over 95% of scarce water use. In this study, we assessed the impact of a t-shirt produced with non-organic and non-recycled cotton. Replacing this unsustainable cotton by cotton which is farmed using sustainable farming practices (for example, by farming organically or proper water management (Mageshwaran, Satankar, Shukla & Kairon, 2019)) has the potential to significantly reduce the external costs of a cotton t-shirt.

Before diving into each specific value chain step, we will first discuss the total social and environmental costs of the value chain set in Asia and of the value chain set in the EU.

4.1.1 MAIN RESULTS OF THE ASIA-VALUE CHAIN

In this section we discuss the main results of each step in the Asia-value chain. The Asia-value chain comprises cotton cultivation in India, fabric production in India, transportation to Bangladesh, t-shirt manufacturing in Bangladesh, and transportation to Spain (where the garment will be sold). The results per value chain step are presented in Figure 6. In the next sections of this chapter, we will discuss the drivers of the external costs per value chain step in more detail.

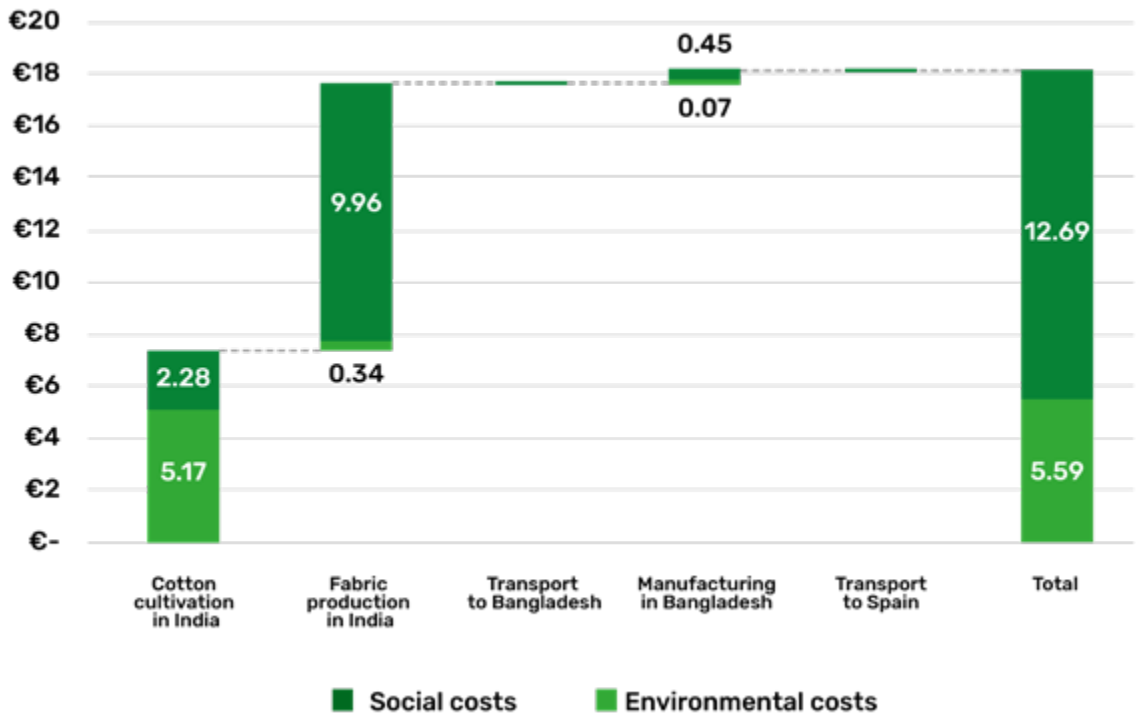
Main conclusions:

• The social cost of cotton t-shirt production in the Asia-value chain is €12.69;

• The environmental cost of cotton t-shirt production in the Asia-value chain is €5.59;

• The external costs of cotton t-shirt production in the Asia-value chain are mainly determined by the social cost of fabric production and the environmental cost of cotton cultivation in India.

Figure 6: The external costs of T-shirt production in Asia per value chain step (EUR/T-shirt)



4.1.2 MAIN RESULTS OF THE EU-VALUE CHAIN

In this section we discuss the main results of each step in the EU-value chain. The EU-value chain comprises cotton cultivation in Greece, fabric production in Greece, transportation to Italy, t-shirt manufacturing in Italy, and transportation to Spain (where the garment will be sold). The results per value chain step are presented in Figure 7. In the next sections of this chapter, we will discuss the drivers of the external costs per value chain step in more detail.

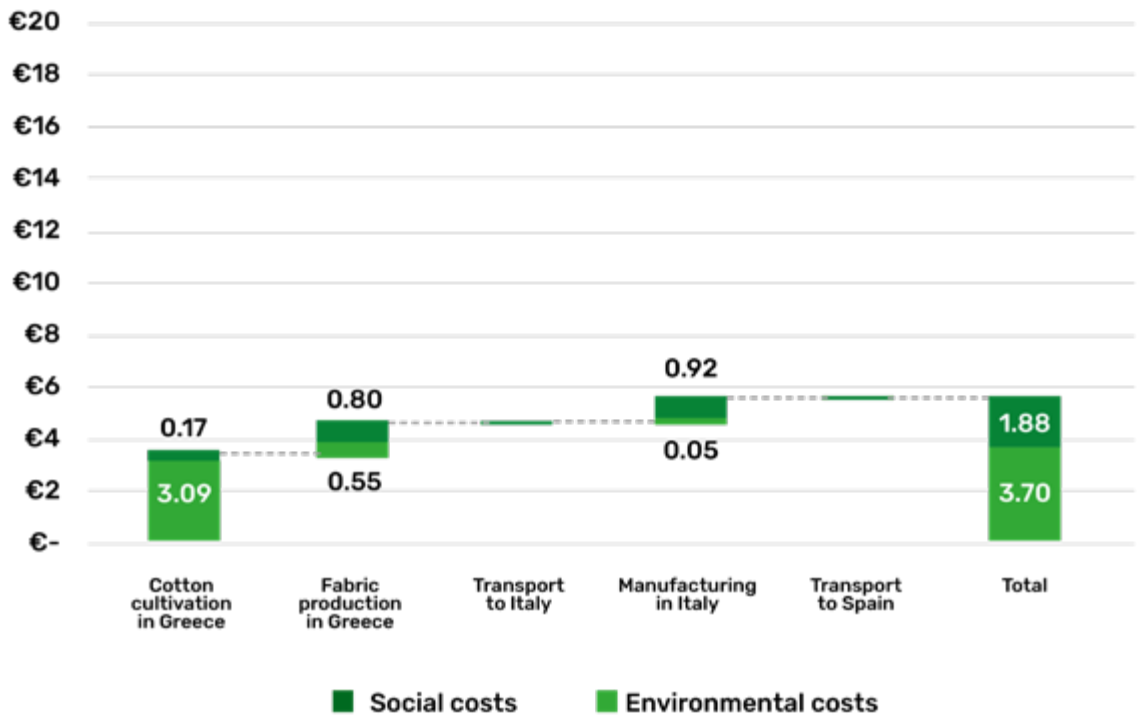
Main conclusions:

• The social cost of cotton t-shirt production in the EU-value chain is €1.88;

• The environmental cost of cotton t-shirt production in the EU-value chain is €3.70;

• The external costs of cotton t-shirt production in the EU-value chain are mainly determined by the environmental cost of cotton cultivation in Greece, the social cost of fabric production in Greece, and the social cost of t-shirt manufacturing in Italy.

Figure 7: The external costs of T-shirt production in EU per value chain step (EUR/T-shirt)



4.2 RESULTS PER VALUE CHAIN STEP

In this chapter, we will discuss each of the value chain steps and their corresponding social and environmental costs per value chain step. We will first discuss the value chain steps cotton cultivation, fabric production, and t-shirt manufacturing. Finally, we will discuss the value chain step transportation where we discuss the aggregated external costs of transportation throughout the value chains for the value chain set in Asia and the value chain set in the EU.

4.2.1 Cotton cultivation

In this report, we calculated the external costs of cotton cultivation in India and in Greece. The results of the external costs assessment indicate the main drivers of these external costs are scarce water use and land use.

Main conclusions:

• In India, the environmental costs of cotton cultivation are €5.17 per t-shirt. Land use contributes €2.30 (44%), while scarce water use contributes €2.05 (40%);

• In Greece, the environmental costs of cotton cultivation are €3.09 per t-shirt. Land use contributes €0.75 (24%), while scarce water use contributes €1.65 (53%);

• India's yield (or the share of cotton it produces per hectare) is lagging when compared to other countries resulting in relatively higher environmental costs per t-shirt;

• The social costs of cotton cultivation may be reduced by 93% by moving cotton cultivation from India to Greece due to the prevalence of child labour and forced labour and unsafe working conditions in India's cotton fields;

• To further minimize the external costs of cotton cultivation of a t-shirt, it is important to promote environmentally friendly farming practices which include, amongst others, organic farming techniques and proper water management.

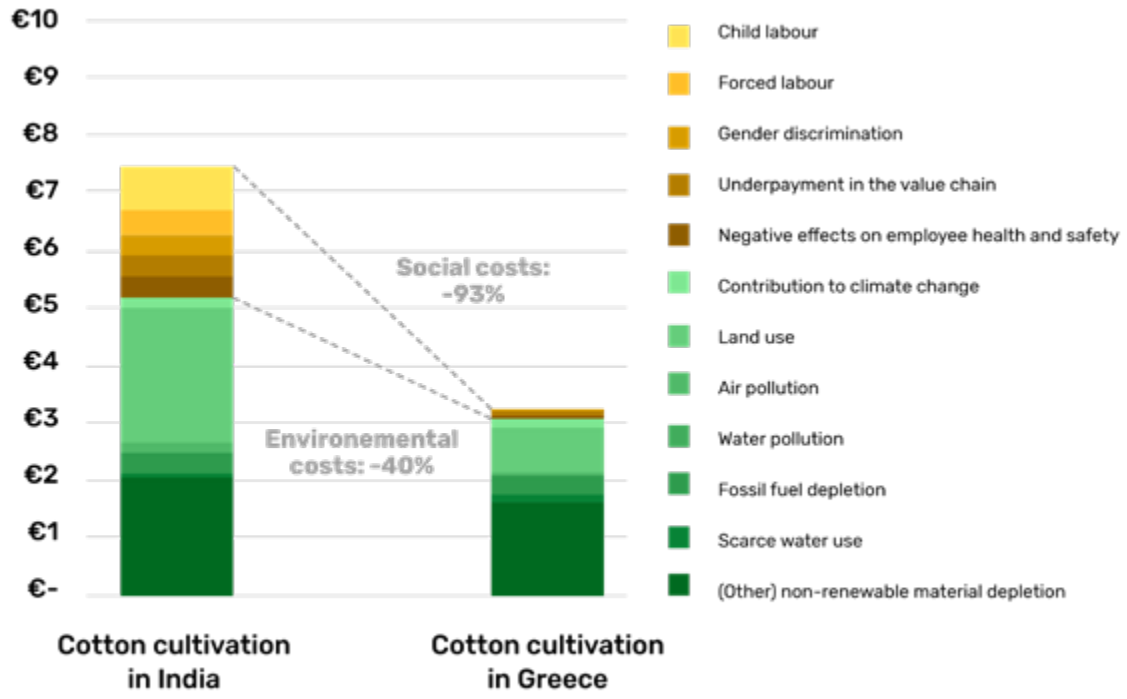
The external costs of land use contribute significantly to the external costs of a t-shirt. Land use results in environmental costs as occupying and/or transforming land (for example, to use it for agricultural practices) results in biodiversity loss. While loss in biodiversity may seem like an abstract concept to many, WWF concisely summarizes the importance of biodiversity (here, described as 'nature') and the consequences of biodiversity loss as follows:

"Nature is essential for human existence and a good quality of life, providing and sustaining the air, freshwater and soils on which we all depend. It also regulates the climate, provides pollination and pest control and reduces the impact of natural hazards. While more food, energy and materials than ever before are being supplied to people in most parts of the world, the overexploitation of plants and animals is increasingly eroding nature's ability to provide them in the future" - Living Planet Report 2020 (WWF, 2020)

The external costs of land use in this report are mainly driven by the quantity of land used for cotton cultivation, the type of land that was transformed into farming land and yield (the efficiency level with which the land is used to grow cotton). To elaborate, the more efficient land may be used, the less land is needed to grow a certain amount of cotton. Although India has the largest cotton plantation area, it lags in terms of yield (Sahay, 2019). To optimize land use efficiency, it is common practice for many farmers to treat their lands with fertilizers and/or pesticides (Sahay, 2019). In addition to many of these chemicals being toxic and damaging the environment, they are often also managed improperly (Water Footprint Network, 2017). All these factors result in India's cotton farmers (who are often living in poverty (Sravanth & Sundaram, 2019) being stuck in a situation where their land is managed improperly, their yields may be decreasing and they have little access to knowledge on or investments to improve the situation, potentially resulting in a vicious cycle of increasing biodiversity loss.

The second component contributing significantly to the external costs of t-shirt production in the cotton cultivation step is: Scarce water use. The beginning of this chapter mentioned the significant size of scarce water use is caused by cultivation of (non-organic) cotton. Conventional cotton cultivation requires particularly large quantities of water (Water Footprint Network, 2017). It adds to severe uncertainty faced by people in India regarding access to fresh water. If water management does not rapidly change, water may become a scarce commodity in India because of population growth and neglect and over-exploitation of water (Kumar, 2019). Given the availability of alternatives to conventionally cultivated cotton (such as organic farming and water management practices prescribed by Mageshwaran, Satankar, Shukla & Kairon (2019)), and the severity of the current water exploitation (Water Footprint Network, 2017), reducing the use of scarce water in this first step of a t-shirt value chain must be a priority.

Figure 8: The external costs of cotton cultivation per region



In addition to external costs of land use and scarce water use, the external costs of cotton cultivation per t-shirt in India result from:

• The presence of child labour (€0.76). About 25% of the workers in the Indian cotton fields are children who are too young to work and/or work too many hours resulting in child labour (Sekhon, 2017; Stop Child Labour Coalition, 2015);

• The presence of forced labour (€0.42). An estimated 15% workers in the Indian cotton fields are forced to work there as they are financially restricted: Workers are paid in advance for a certain term and are then forced to work for the rest of the year (DaCorta, 2009);

• Negative effects on employee health and safety (€0.38) caused mainly by lack of (training on) use of personal protective equipment (PPE) such as protective clothing when applying chemical substances: An estimated 88% of farmers involved in such application do not use precaution. The main reasons for not using protective clothing are stated to be the high cost of inputs, the non-availability of these materials, and their discomfort due to hot weather (Pandey, Joshi & Kumar, 2020). Additionally, many people may simply not be aware of the hazardous effects of improper use of pesticides and the importance of PPE. In 2009, a study reported only 19%

of farmers was trained in proper use of agrochemicals (Pandey, Joshi & Kumar, 2020). Of course, if the farmer who owns the farm is not aware of the hazardous effects of agrochemicals use, it is likely that the workers hired to work on the farm are also not aware of these negative health effects;

• Gender discrimination (or the gender wage difference paid for equal work) (€0.37). In India, women account for 70% of workers in the cotton sector. However, regardless of their role or contribution, women's income is only 78% of men's income (Cotton Connect, n.d.);

• Underpayment (€0.35) mainly resulting from workers being paid wages that are below the local living wage;

• Water pollution (€0.36), air pollution (€0.18), contribution to climate change (€0.18), fossil fuel depletion (€0.09) and other non-renewable material depletion (€0.02) mainly caused by fertilizer application and manufacturing.

The additional external costs of cotton cultivation per t-shirt in Greece result from:

• Water pollution (€0.36), air pollution (€0.05), contribution to climate change (€0.18), fossil fuel depletion (€0.11) mainly caused by fertilizer application and manufacturing;

• Underpayment (€0.10) resulting from (temporary) workers who are paid below the local minimum wage. This result is based on average wage paid to workers in the agricultural sector in Greece (so it is specific to the Greek agricultural sector as opposed to the Greek cotton production);

• Gender discrimination (€0.04) caused by a small difference in the wages paid to female workers compared to wages paid to male workers in Greece's agricultural sector.

For both cotton cultivation in India and Greece, the application and manufacturing of agrochemicals results in a variety of environmental impacts. Consequently, limiting the use of toxic agrochemicals or substituting them for environmentally friendly alternatives will help reduce the environmental costs of cotton cultivation. Environmentally friendly cotton farming practices go beyond replacing toxic fertilizers and pesticides with organic matter. Rather, environmentally friendly cotton farming also includes proper water, input and post-harvest management (see, for example, Mageshwaran, Satankar, Shukla & Kairon (2019)).

4.2.2 FABRIC PRODUCTION

In this report, we calculated the external costs of (cotton) fabric production in India and in Greece. For fabric production in India, the results of the external costs assessment indicate the main drivers are child labour and forced labour. In contrast, in Greece there is no child or forced labour. Rather, the external costs of fabric production in Greece is driven by underpayment and water pollution.

Main conclusions:

• For India, the social costs of fabric production are €9.96 per t-shirt. The presence of forced labour contributes the largest share, namely €8.03, while another important share is caused by child labour (€1.25). Gender discrimination causes €0.23/t-shirt while underpayment and lack of safe and healthy working conditions both cause €0.22;

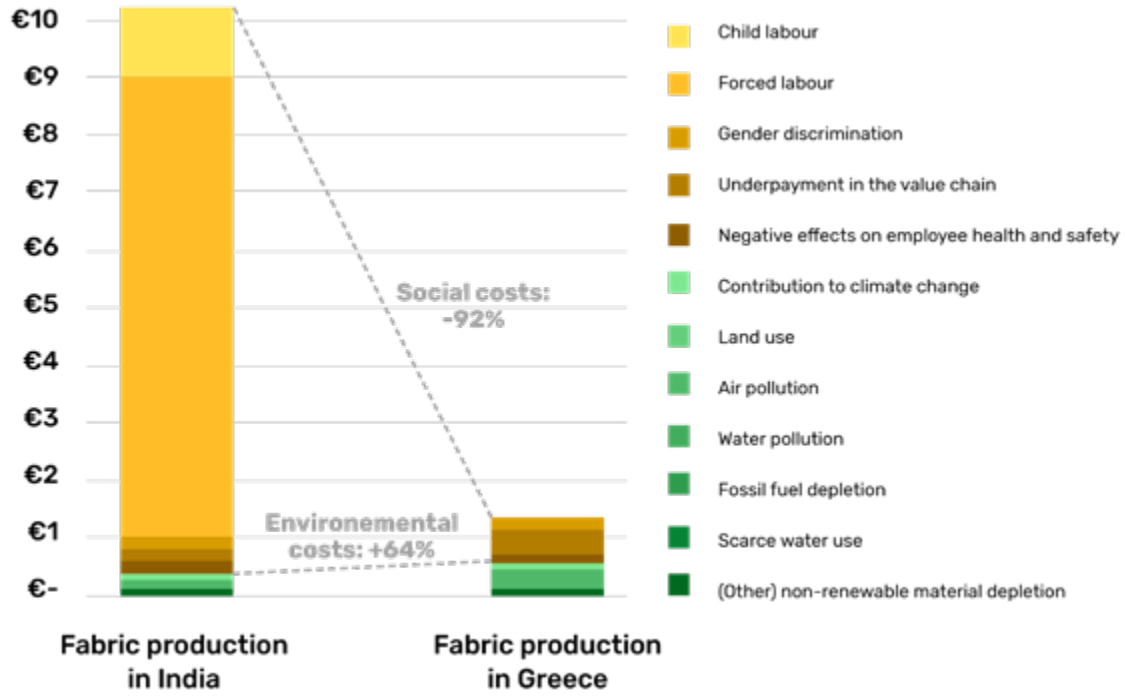
• For Greece, the social costs of fabric production are €0.80 per t-shirt. It is built up of €0.45 due to underpayment, €0.20 due to gender discrimination and €0.16 due to negative effects on employee health and safety (caused by lack of (knowledge of) proper use of protective equipment);

• The environmental costs of fabric production are €0.34 per t-shirt in India and €0.55 per t-shirt in Greece. The main drivers of these costs are water pollution (mostly due to toxic substances used for dying and processing fabric), use of scarce water and contribution to climate change caused by (grey) electricity use;

• To minimize the external costs of fabric production for a cotton t-shirt, it is important to eliminate the

existence of forced and child labour from the production sites, to make sure workers receive a living wage (and equal pay) for their work, to ensure health and safety standards at production sites, to optimize use of renewable energy (for power use) and to minimize the amount of toxic materials used for dying and processing fabrics.

Figure 9: The external costs of frabric production (EUR/T-shirt)



For both India and Greece, the external costs of fabric production are primarily composed of social costs. The environmental costs contribute relatively small amounts: €0.34 for India and €0.55 for Greece. The main drivers of these environmental costs are water pollution (mainly due to chemical materials used for dying (Berradi et al., 2019)), use of scarce water and contribution to climate change (caused by electricity use at the production sites). Replacing the current electricity mix (which is largely generated using fossil fuels in both India and Greece) by electricity sourced from green energy sources (such as wind and solar energy) has the potential to reduce the environmental costs by ~€0.10 per t-shirt.

The environmental costs of scarce water use and water pollution are caused by the amount of water and the toxic chemicals mainly used for dying fabrics. In Greece, slightly less water is used in fabric production than in India (673 liters versus 707 litres of water per kg fabric) (Chapagain, et al., 2005). The environmental costs of scarce water use are therefore €0.09 for India and €0.08 for Greece. Regarding the use of toxic chemicals for processing fabric, this causes €0.14 for India and €0.33 for Greece in water pollution. The difference between these values is mainly caused by Greece's eutrophication risk factor [9] (or the amount of toxic substance which leaches into water) is slightly higher than India's risk factor (Huijbregts, et al, 2017).

9 The eutrophication risk factor indicates how much of an applied toxic substance leaches into the water and is dependent on several factors such as soil properties, how the water flows and how long toxic substances remain in the water. In the current study, we used the country average factors for Greece (0.500) and India (0.210) as provided by ReCiPe (Huijbregts, et. al, 2017).

In India, the social cost of fabric production is mainly driven by forced labour (€8.03) and child labour (€1.12). A relatively large share of workers work under light, medium or severe forced labour conditions [10] (Sekhon, 2017). Forced labour can occur in different forms and the type of forced labour differs per value chain process. Fabric production namely consists of multiple processes, including spinning, ginning, knitting and wet-processing or finishing. In ginning processes, forced labour exists in the form of migrant workers doing most night shifts, or sometimes even double shifts in case of labour shortage (Prayas Centre for Labour Research and Action, n.d.). Children are among those exposed to forced labour. A large share of children works most of the week and experiences both physical and emotional abuse (FoSBT, n.d.). Severe forced labour mainly takes shape in the exploitation of adult workers that are bonded through the Sumangali Scheme: Workers from a lower caste are recruited with the promise of a decent wage and comfortable accommodation. However, money is only paid out after full completion of the contract period, thereby tying workers to the factory. Some workers are even tied more strictly as they are not allowed to leave their accommodation and are prohibited from having contact with friends or relatives. This is mostly the case for girls and young women. This type of severe forced labour is most common in spinning processes (SOMO, 2013). In stark contrast, there is no reported forced labour or child labour in fabric production in Greece (Verité, n.d.).

Regarding workers employed at the fabric production site, many are underpaid in both Greece and India[11]. In India, the minimum wage and living wage lie far apart (Datta, 2021). Therefore, the minimum wage is not representative of what one should earn for decent living conditions. We estimated that 98% of workers in fabric production in India are paid below the living wage[12] which stresses the issue of underpayment. In Greece, the minimum wage was €9,096/year in 2019 (Eurofound, 2019) whereas the living wage of a typical family is about €10,000/year (WageIndicator, 2019). An estimated 64% of workers were paid below the minimum wage.

At both production sites in Greece and India, there is gender discrimination resulting from women being paid less than men (for the same work). This contributes €0.20 for Greece and €0.23 for India to social costs. In both countries, not all workers received health & safety training and/or used PPE. This negative effect on employee health and safety causes €0.16 for Greece and €0.22 for India to social costs. The main drivers behind these costs are, firstly, workers not being trained or informed about the proper use of PPE, methods to handle (chemical) dyes and the disposal of contaminated packaging used for dyes (Paramasivam, 2010) and, secondly, what share of workers actually uses PPE. To illustrate, a study on workers' use of PPE in India showed only 34% of workers used PPE (such as rubber gloves) during work (Paramasivam, 2010) meaning the remaining 66% was likely to expose itself to developing dermatological problems.

10 At least 38% of workers are classified as (a type of) forced workers (IDH & True Price, 2016)

11 Please note that underpayment is defined in absolute terms as it is location specific. Underpayment is defined as the gap between the living wage or minimum wage (depending on the type of underpayment discussed) and the (average) actual wage. To illustrate, if in country A the living wage is €1000 and a person is paid €600, this person is underpaid (€1000 – €600 =) €400. To compare, in country B, where the living wage is €500, a person is paid €300, such that the underpayment equals (€500 – €300 =) €200. While relatively, both people experience the same underpayment (20%), the absolute underpayment of the person in country A is greater than the underpayment of the person in country B (because €400 > €200). Regarding conclusions drawn from the resulting external costs of underpayment, it is therefore important to assess underpayment with reference to the local living or minimum wage level. See Box 3 for more details.

12 According to Fairwear (2019), the living wage in India in 2018 was 14670 INR/month. Inflating this amount to a 2019 living wage tells us India's living wage was about 190,000 INR/year (or about € 2,400/year) in 2019.

4.2.3 T-SHIRT MANUFACTURING

In this report, we calculated the external costs of (cotton) t-shirt manufacturing in Bangladesh and Italy. For t-shirt manufacturing in Italy, the results of the external costs assessment indicate the main drivers are underpayment to workers and gender discrimination (resulting from women being paid less than men for the same work). For t-shirt manufacturing in Bangladesh, there is also underpayment and gender discrimination. In addition, there is child labour and there are issues with health and safety in garment factories in Bangladesh. Notably, both the social and environmental costs of t-shirt manufacturing are low compared to the external costs presented for the previous two value chain steps.

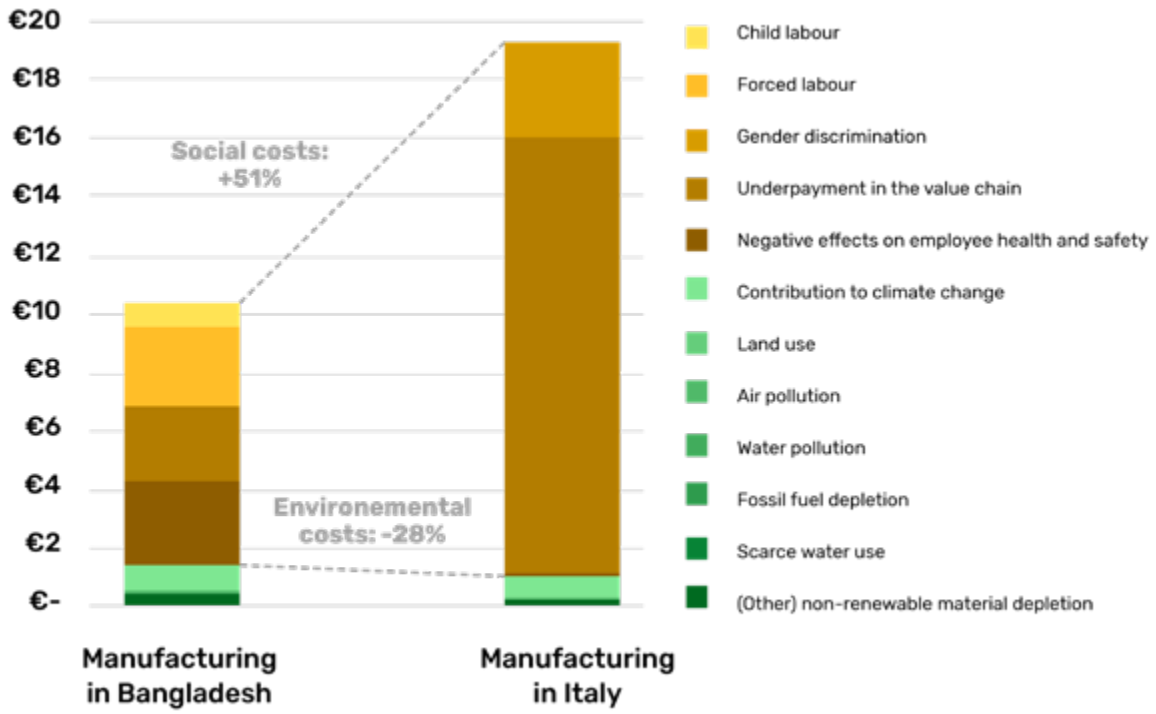
Main conclusions [13]:

• For t-shirt manufacturing in Bangladesh, the report finds the social costs are €0.45 per t-shirt. These costs are driven by the prevalence of unsafe and unhealthy working conditions, gender discrimination in wages, underpayment and the prevalence of child labour;

• For t-shirt manufacturing in Italy, the social costs are €0.97 per t-shirt. These social costs are driven by workers being paid too little (below the local living wage) which accounts for €0.75 of the social costs and by gender discrimination which accounts for €0.16 of the social costs;

• In contrast, the environmental costs are only €0.05 per t-shirt in Italy and €0.07 per t-shirt in Bangladesh. The environmental costs are caused by grey electricity use.

Figure 10: The external costs of T-shirt manufacturing per region (EUR/T-shirt)



13 Please note the change in the vertical axis of the figure presenting the external costs of t-shirt manufacturing (running from €0 to €1) compared to the vertical axes of the figures of the previous two value chain steps (which ran from €0 to €10).

BOX 3: IMPACT OF UNDERPAYMENT

Definition of underpayment

This report defines underpayment as the gap between the living wage or minimum wage (depending on the type of underpayment discussed) and the actual wage. Living wage and minimum wage levels differ per country or region. In one country, the cost of living and the respective living wage level may be a lot higher than in another country. As a result, a certain wage level may be sufficient in one country whereas it may be insufficient in another. Valuing the impact of underpayment is therefore location specific.

Interpretation of the impact of underpayment

In the methodology used for the current study, the impact of underpayment is measured in absolute terms. This means the impact of underpayment represents the (absolute) amount of money required to remediate for the damages caused by the respective underpayment. This amount of money is in part dependent on the cost of living in a country. Consequently, the impact attributed to a certain wage level which constitutes underpayment in both country A and B may differ for these countries if their minimum wage and/or living wage levels differ. Comparing the impacts of underpayment from multiple countries should therefore be treated with care. Observing that the impact of underpayment in country A is 50% greater than the impact of underpayment in country B does not automatically imply country A's issue of underpayment is more severe in relative terms. While this may indeed explain the larger impact of underpayment, this difference may also be explained by country A's higher minimum wage and/or living wage level. In contrast, within country comparisons (given equal minimum wage and living wage levels) is possible and are more likely to reflect relative severity.

Comparing impacts across countries

All impacts are monetised using monetisation factors which represent the costs required to remediate the social or environmental damages created in the value chain. The costs to remediate for damages consist of country-specific restoration costs, compensation costs, prevention costs and/or retribution costs (see 3.3 Methodology and costing). To illustrate, the costs of providing a worker who has been trapped in forced labour with required medical care or psychological support may differ across countries. It is therefore important to treat across-country comparisons with care.

The environmental costs of t-shirt manufacturing in both Bangladesh (€0.07/t-shirt) and Italy (€0.05/t-shirt) are driven by grey electricity use which results in multiple forms of environmental damage: Contribution to climate change, air pollution and fossil fuel depletion. To minimize these environmental costs, t-shirt manufacturers should replace its grey electricity with green electricity (generated using only renewable sources).

The social costs of t-shirt manufacturing are, amongst others, driven by underpayment (€0.13/t-shirt in Bangladesh and €0.75/t-shirt in Italy). In Italy, the estimated average actual wage was €15,120/year in 2019 (Clean Clothes Campaign, 2014). In contrast, the minimum wage was €10,311/year while the living wage was €18,756 (Clean Clothes Campaign, 2014). Therefore, the actual wage of workers was lower than the local living wage but higher than the minimum wage. To remediate the underpayment caused by workers being paid

below the living wage, €0.75/t-shirts is needed. In Bangladesh, the estimated average actual wage was €871/year in 2019[14]. In contrast, the minimum wage was €1,075/year while the living wage was €2,251/year (Global Living Wage Coalition, 2018). Conclusively, the average actual wage of workers was lower than both the local living wage and the minimum wage. To remediate the underpayment caused by workers being paid below the living wage and below the minimum wage, €0.13/t-shirts is needed. Another driver of the social costs of t-shirt manufacturing in both Italy and Bangladesh is the gender pay gap resulting from men being paid more than women for equal work. This form of gender discrimination results in social costs of €0.14/t-shirt for Bangladesh and €0.16/t-shirt for Italy.

For Bangladesh, additional social issues which result in social costs of t-shirt manufacturing are child labour and lack of safe and healthy working conditions for workers. In previous studies we found that harassment, denied freedom of association, (unpaid) overtime and insufficient social security are also common in the garment industry in Bangladesh (Impact Institute, 2019). While these factors are not in scope for the current study, they may be expected to increase the social costs of t-shirt manufacturing in Bangladesh.

Regarding child labour, an estimated 75,000 [15] children work in the garment factories in Bangladesh (Reja, 2017), meaning these children do not go to school (full-time). Child labour prevalent in t-shirt manufacturing factories in Bangladesh result in a social cost of €0.04/t-shirt. Regarding the lack of safe and healthy working conditions, after the 2013 collapse of the Rana Plaza building in Dhaka in which over 1100 people were killed, building and safety regulations have become stricter. However, there is still a long way to go for garment worker to be working in fully safe and healthy working conditions (Fair Wear Foundation, 2015). The lack of proper health and safety conditions for garment workers in Bangladesh results in €0.14/t-shirt in 2019.

4.2.4 TRANSPORT

In this report, we calculated the external costs of transportation within the two value chains. For the first value chain (set in Asia), the transportation that is included in this study is the transportation of fabric from India to Bangladesh and the transportation of t-shirts from Bangladesh to Spain (by truck and ship). For the second value chain (set in the EU), the studied transportation includes the transportation of fabric from Greece to Italy and the transportation of t-shirts from Italy to Spain (by truck). For this respective value chain step, the social impacts are not in scope.

Main conclusions [16]:

• Transportation in the value chain set in Asia results in €0.009/t-shirts of environmental costs. This is driven by contribution to climate change (60%), air pollution (21%) and fossil fuel depletion (19%) resulting from (fossil) fuel use;

• Transportation in the value chain set in the EU results in €0.006/t-shirts of environmental costs. This is driven by contribution to climate change (73%), air pollution (49%) and fossil fuel depletion (22%) resulting from (fossil) fuel use;

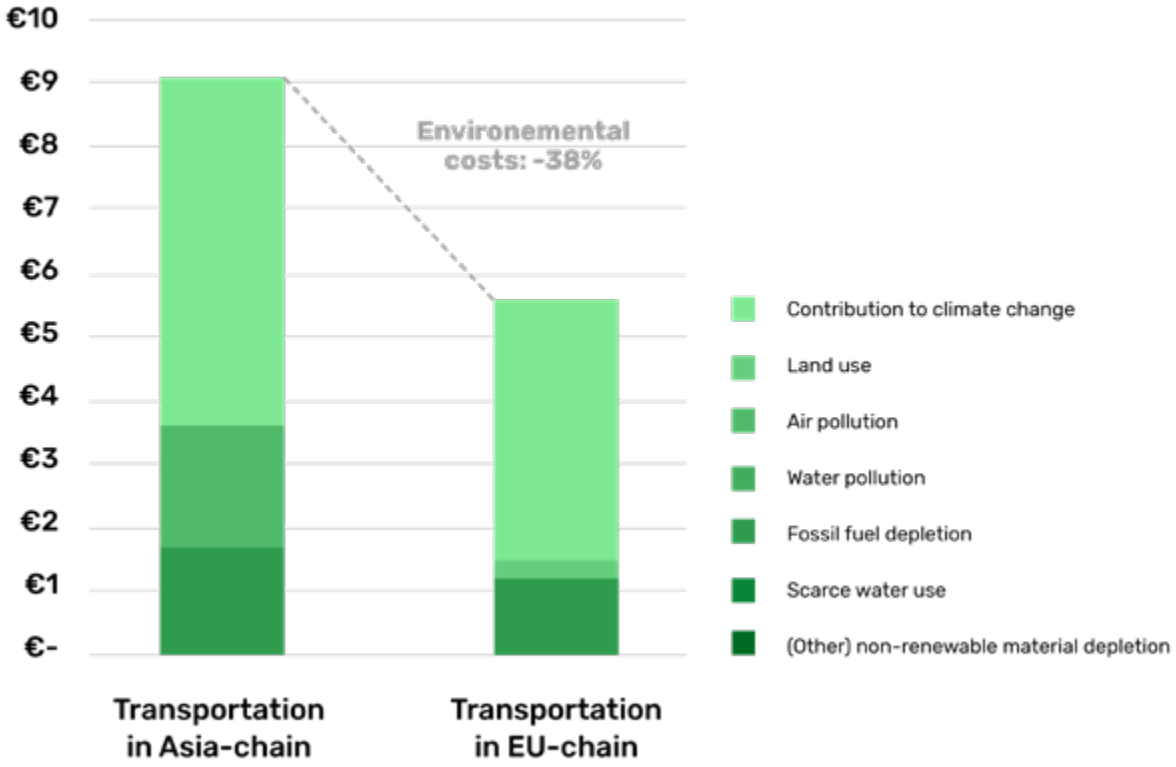
• To minimize the environmental costs of transportation, it is recommended to replace polluting modes of transportation using fossil fuels with environmentally friendly fuel alternatives.

14 There is limited data available on the actual wages of workers in the Bangladeshi garment sector as many workers do not have formal contracts (Rahman, Bhattacharya & Al-Hasan, 2018). Therefore, we used data provided by news outlet The Daily Star (2019) to estimate the average actual wage of Bangladeshi garment factory workers.

15 Please note this is an estimation of the actual number of children who work in the garment industry in Bangladesh. Since this industry in part consists of an informal sector (in which data on, for example, the number and type of employees is not well documented) it is difficult to collect reliable employee data for this industry.

16 Please note the change in the vertical axis of the figure presenting the external costs of transportation (running from €0 to €0.01).

Figure 11: The external costs of transportation per value chain (EUR/T-shirt)



Please note that the external costs of transportation appear small because they are presented as environmental costs per t-shirt. The vehicles or ships used to transport goods globally carry large volumes of goods. Therefore, when presented per ship as opposed to per t-shirt, the environmental costs of transportation will be substantive.

5. RECOMMENDATIONS

In this chapter we will summarize and discuss the recommendations resulting from the results of this study. Whereas we will discuss the recommendations per value chain step, there are some recommendations which apply to multiple steps (for example: Minimize energy consumption and replace grey energy with green energy).

5.1.1 COTTON CULTIVATION

Cotton cultivation is the step in the value chain with the largest environmental costs. These environmental are mainly driven by scarce water use and land use (in both India and Greece). To avoid using large quantities of scarce water, farmers should use their water efficiently and may optimize use of alternative water sources such as captured rain. Cultivation of cotton according to the Better Cotton Initiative (BCI) principles is another way to optimise water use. BCI has set up a Water Stewardship Plan containing different components that stimulate responsible, sustainable water use (Better Cotton Initiative, 2018b).

The external costs of land use in this report are mainly driven by the quantity of land used for cotton cultivation, the type of land that was transformed into farming land and yield (the efficiency level with which the land is used to grow cotton). In India, farmers attempt to improve their yields by (improper) use of fertilizers and pesticides. This is both damaging to the environment and creates unsafe working conditions as few people working on the farms wear protective clothing. Many farmers either do not know about the damaging effects of toxic agrochemicals, do not know how to use them properly or do not know about other ways to farm cotton. Additionally, if using agrochemical, proper use of PPE must be promoted to protect both farmers and their workers from the negative health effects resulting from treating crops with agrochemicals. Ideally, farmers and their workers are not exposed to toxic chemicals. Farmers must gain access to (information on) alternative farming practices which are both environmentally friendly and safe to work with such that they can make a living while protecting the environment, their workers and themselves. To further minimize the environmental costs of cotton cultivation, farmers must be stimulated to replace any fossil fuel-based energy used at the farm (for example, for machinery) by green energy.

In both India and Greece, there is underpayment among workers employed in cotton fields. Underpayment is an important indicator of a variety of social issues. To illustrate, workers who are underpaid, may be more susceptible to working in poor working conditions (as they have little choice but to accept them) and may more quickly take their children out of school and have them work to contribute to the household income. Conclusively, one of the main priorities in addressing social issues (which holds for cotton field workers but also for workers who produce fabric of manufacture t-shirts) is to address the issue of underpayment.

5.1.2 FABRIC PRODUCTION

The external costs resulting from fabric production in India primarily comprise child labour and forced labour. As previously mentioned, these social issues are often interlinked with other social issues as strongly correlated with underpayment. To reduce the social costs of child labour and forced labour, auditing systems should be put in place to monitor whether there is forced labour or child labour at production sites. Premiums or higher prices may be paid to production sites where forced labour or child labour is not present, to allow for hiring voluntary, adult labour (and paying them living wages).

Regarding the social issues gender wage discrimination and lack of safe and healthy working conditions, these must be registered, monitored and addressed accordingly. Moreover, workers must be informed on the importance and proper use of PPE. To further minimize social costs, workers' right to unionize and have collected bargaining power must be stimulated to empower them to improve working conditions.

To minimize environmental costs, the use of toxic (dying or printing) substances must be limited and replaced by materials which are both environmentally friendly and do not result in health problems. Furthermore, grey electricity use must be replaced by green electricity use to reduce contribution to climate change, air pollution and fossil fuel depletion. This recommendation holds for all value chain steps.

5.1.3 T-SHIRT MANUFACTURING

The social costs of t-shirt manufacturing are driven by underpayment and gender discrimination in both Bangladesh and Italy. Additionally, garment factories in Bangladesh face lack of safe and healthy working conditions and child labour. To address the issue of underpayment, it is important to allow for monitoring actual wages paid to workers. Currently, in Bangladesh, many workers do not have formal contracts which makes it difficult to assess whether they are paid a fair wage. Installing a system in which workers report on their wages (and other employment related data) might improve the availability of data on social issues. Transparency on this type of information would stimulate accountability among the value chain.

Albeit the environmental costs of t-shirt manufacturing are relatively low in both Italy and Bangladesh, they are present and are mainly caused by grey electricity use (for example, used for lighting and machinery). Replacing grey electricity by green electricity would therefore minimize the environmental costs of t-shirt manufacturing.

5.1.4 TRANSPORTATION

The transport steps resulted in the lowest calculated external costs for both value chains. However, when assessing the environmental costs per vehicle or ship (instead of per t-shirt), the costs will likely be significant. To reduce the environmental costs of transportation (via land or sea), it is important to optimize efficiency, limit the travel distance and replace fossil fuels by environmentally friendly alternatives.

6. APPENDIX

6.1 KEY LIMITATIONS TO THE TRUE PRICE METHODOLOGY

1. The current monetisation factors are not complete with respect to all impacts mentioned in the True Price Principles. The coverage of the current impacts is more complete for impacts related to environmental rights and worker rights. Impacts related to rights of local and indigenous communities and society at large have not yet been covered. There are also some (partial) gaps for environmental impacts, particularly for impacts not commonly assessed in LCA, such as biodiversity loss. In this study, biodiversity loss is defined as losses due to land use change (which -amongst others- leads to reduction of living space and food resources for species) and pollution. The methodology excludes the impact of introducing invasive species (which are non-native to the respective area) and overexploitation (which implies overfishing or harvesting of animals beyond the capacity rate at which these animals can reproduce resulting in extinction) (Rafferty, 2019).

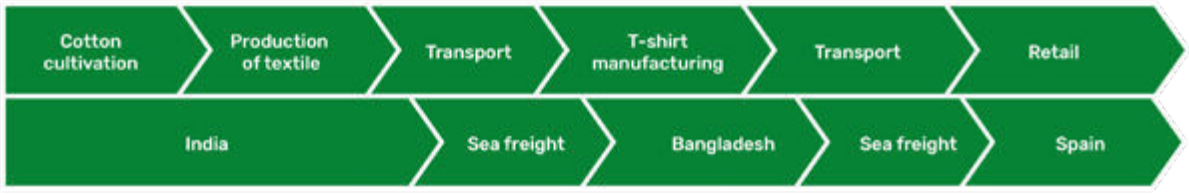
2. The methodology is new and contains various normative assumptions. Translating principles into measurable targets and remediation categories requires interpretation.

3. There are significant model and data uncertainties regarding the estimates of restoration, compensation (damage), prevention and retribution costs. Retribution cost is an innovation in valuation and damage cost is not always available. When necessary, a best estimate based on proxy data was used which may lead to possible underestimate of the remediation cost.

4. When developing a method that aims to be useful to many types of businesses and is applied to many types of products, aligning with the many existing standards and methods for sustainability reporting and impact measurement is demanding.

6.2 SCOPE OF VALUE CHAINS

Common value chain



India is the world's largest cultivator of cotton

Source: OECD & FAO

Production of textile out of cotton likely occurs near cotton cultivation location

Source: OECD & FAO

Bangladesh is the greatest exporter of cotton t-shirts to the EU

Source : Eurostat

Alternative value chain

Greece is the EU's largest cultivator of cotton

Source: FAO

Italy produces 45% of all EU produced clothes

Source : Eurostat

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