The True Price of Cotton from India

Joint report by IDH and True Price

True Price™

idh the sustainable trade initiative

"By painting a picture of the major issues in the sector and their severity, IDH is able to quantify the impact of the issues now and over time, developing a targeted strategy that generates the most change."

Dave Boselie

Senior Expert Learning & Innovation at IDH

About True Price

True Price is a social enterprise that aims to contribute to a circular and inclusive economy that creates value for all people by providing the information needed for such an economy. True Price helps organizations – multinationals, SMEs, NGOs, governments – quantify, value and improve their economic, environmental and social impacts. True Price works directly with organizations by providing research services. In addition, True Price enables organizations to measure their impact through a multi-stakeholder platform that develops open source methods for impact measurement that are relevant, sound and inclusive.

For more information visit:
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About IDH

IDH, the Sustainable Trade Initiative, accelerates and up-scales sustainable trade by building impact oriented coalitions of front running multinationals, civil society organizations, governments and other stakeholders. Through convening public and private interests, strengths and knowledge, IDH programs help create shared value for all partners. This will help make sustainability the new norm and will deliver impact on the Millennium Development goals.

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Preface IDH: Why this study?

The mission of IDH, the Sustainable Trade Initiative (IDH)

IDH, the Sustainable Trade Initiative (IDH), is a public private partnership facility, which co-invests into value chains with private sector companies. These investments address threats to environmental and social sustainability, such as; deforestation, water pollution, low income of farmers, underpayment of workers, lack of decent work practices, health & safety problems for producers and consumers. As continual improvement of the monitoring of our investments is a top priority for IDH, we are on the look-out for innovative methodologies, which provide meaningful measurements.

About the True Price Methodology

We feel the True Price methodology does just that, quantifying the externalities we strive to address and providing a tool for comparison across sectors. It provides the analytical tools to understand the key externalities in a sector and evaluate the severity of those externalities in simple, monetized terms. The methodology shows how external costs are divided over the supply chain, creating a uniform language and perspective for quantifying issues that are almost ethically impossible to significantly compare or aggregate. For example, how to compare the impact of child labor versus deforestation in the cocoa sector in West Africa (representing subsequently an estimated 11% and 13% as share of the total external costs of cultivation – see cocoa report)

Benefits of the Methodology

The True Price analysis also allows for cross-sector comparisons, for example, by expressing the gap between the price associated with the impact of the externality and end-market prices. In situations where the True Price gap is only 1 or 2% of the consumer facing price, a real price increase could be one of the feasible strategies to successfully address the externality. In the case a True Price gap is 30% of the consumer price, a more systemic change to the value chain may be required.

These types of insights can help us set the investment agenda and facilitate collaboration with the private sector. By painting a picture of the major issues in the sector and their severity, IDH is able to quantify the impact of the issues now and over time, developing a targeted strategy that generates the most change. The results are also highly relevant for the other stakeholders in our partnership, including public sector and civil society organizations, who play a role developing the enabling environment for sustainable commodity production.

Limitations and Next Steps

We are optimistic with the findings of these reports and the methodology used to develop them. Four analysis have been prepared for the sectors– cotton, cocoa, tea and coffee. As will be explained in the following sections, the first analyses have had many constraints in terms of data availability and data quality, and therefore did not allow for a robust statistical difference-in-difference (DID) analysis.

Nevertheless, the findings have shown us eye-opening details and dilemmas in our programs. Through publishing these first results, we invite our partners and key stakeholders to connect with us, and join the discussion.

Enjoy reading!
Dave Boselie
Senior Expert Learning & Innovation at IDH

Executive Summary

- In this study the external costs of the cotton supply chain (smallholder cultivation in India) were investigated to inform decision making for IDH's cotton program. The external costs of conventional seed cotton were compared to certified seed cotton. Attribution of impacts to the standard-setting organisations was out of scope.

- External costs are costs caused by **economic activities which are not reflected in the prices** charged for the goods and services being provided. External costs can be classified as environmental costs if they have a direct effect on the environment and as social costs if they have a direct effect on the well-being of people.

- The cultivation of smallholder cotton in India has total **external costs of €3.65/kg seed cotton**. By summing up the external costs with the farm gate price (€0.55/kg seed cotton), a true price of €4.20/kg seed cotton is obtained.

- 74% of the total external costs of cultivation are environmental costs, **35% are caused by water** use. The other largest external cost drivers are water pollution and underpayment.

- Compared to other sectors, the external costs of cultivation are relatively higher for seed cotton than for green coffee beans (Vietnam) and green leaf (Kenya), but relatively lower than for cocoa beans (Ivory Coast).

- The total external costs of cultivation, transportation and processing are €11.55/kg seed cotton.

- The **cultivation phase accounts for 32% of the total external costs** of the cotton supply chain.

- **Certified cotton has 35% lower external costs** of cultivation than conventional cotton. 70% of this change is caused by higher productivity of certified farms, 20% by better environmental conditions and 10% by better social conditions. There are demonstrably lower rates of underpayment and gender discrimination on certified farms. Also, water use and application rates of pesticides and fertilizers are demonstrably lower on certified farms.

- Certified farms are on average **52% more profitable than conventional farms**, with a yearly profit of € 365/ha vs. €240/ha.

- Interventions that **reduce scarce water use by 30%** have the potential to further decrease the external costs of certified cotton cultivation by around 7% (€0.16/kg seed cotton). Additionally, **eliminating income discrimination** has the potential to reduce external costs of certified cotton cultivation by 5% (€0.13/kg seed cotton).

- **Future impact research is needed** for certified and conventional farms, especially on wages, child labour, bonded labour, occupational incidences and fertilizer and pesticide application rates. This would improve the robustness of the results of this study and enhance future decision making around interventions and investments.

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Chapter 1
Introduction

1.1 Context and challenge

About 26% of global cotton production comes from India (USDA, 2015a), making India the second largest producer of cotton lint. In 2014/2015 India produced an annual 6,423,000 tonnes, compared to leading country China which produced 6,532,000 tonnes (USDA, 2015a). The main importers of raw cotton from India are China, Bangladesh, Egypt, Taiwan and Hong Kong (IBEF, 2015). 76% of raw cotton is produced in three states: Gujarat, Andra Pradesh and Maharashtra (USDA, 2014).

This large scale cultivation of cotton in India poses a threat to the environment, more specifically by its impact on water use, biodiversity and pollution. The use of water for cotton cultivation depends on whether production is rain fed or irrigated, the amount of pesticides used and the quality of the soil. Research indicates that on average water consumption for Indian cotton cultivation is inefficient (Mekonnen & Hoekstra, 2010). This can be partly explained by the fact that 35% of the cotton is still grown in the drier regions of India, which requires more irrigation water than regions that are largely rain fed (Sharma et al. 2010). Also, irrigation techniques are often inefficient, as farmers use flood irrigation (Maxwell, McAndrew & Ryan, 2015). The inefficient irrigation of cotton crops puts pressure on the water resources in India, where 54% of the available water reserves are already under high to extremely high water stress (WRI, 2015).

Aside from the impact cotton cultivation has on scarce water resources in India, the country also ranks 12th globally in terms of pesticide use (Chitra et al. 2006). Cotton cultivation consumes almost 54% of the pesticides produced in India even though it only covers 5% of cultivated area (Gandhi & Namboodri, 2006). Average application rates of pesticides are relatively low compared to other countries, but highly dependent on regions, e.g. in Punjab where pesticide use was up to eight times higher compared to other countries. A part from the water needed to disperse the pesticides, some of the pesticides used in cotton cultivation are highly hazardous and cause significant pollution as large amounts of chemicals leach and run off into ground and surface water (SEEP, 2010). For example in Punjab this is an issue, where a silty soil texture results in less water holding capacity and easy leaching of pesticides into the groundwater. The presence of these pesticide residues in the water, as well as the often unsafe application of pesticides, causes adverse human health effects (Mittal et al. 2013).

Cotton in India is grown by around 5.8 mln farmers – predominantly smallholders – and 50 mln people indirectly depend on the cotton sector for their livelihood (CUTS, 2013). Therefore, the cultivation of this crop also has a large social impact, both negative and positive. The national poverty rate among cotton-producing households is estimated to be 12.8 percent, with the highest poverty levels among the nine main cotton-producing states in Madhya Pradesh and Andhra Pradesh (Bedi & Cororaton, 2008). One of the reasons why cotton farmers have difficulties to earn a living income that can provide a sustainable livelihood, is the relatively low yield in India; 514 kg seed cotton per hectare[1] compared to a global average yield of 761 kg seed cotton per hectare (USDA, 2014; Ministry of Textiles, 2010).

The last decade showed an improvement in the livelihood of some farmers due to the introduction of Bt cotton[2] in India (CUTS, 2013). It has helped farmers to increase yields and adopt more sustainable farming practices, as this type of cotton requires less pesticides than traditionally used Desi varieties in some regions. Consequently, some farmers experienced a reduction in the cost of cultivation. However, the effect of Bt cotton on the livelihood of farmers is still controversial, as in some other cases, especially in rainfed areas, it comes with a high cost of production and requires specific farming practices, such as irrigation and fertilizer application at specific times. With lower than expected yields, high seed, fertilizer and insecticide costs and a lack of agroeconomic knowledge, this can lead to indebtness and challenges its positive effect on the socio-economic situation of smallholder farmers (CUTS, 2013; Forster et al. 2013; Gutierrez et al. 2015).

Many labour rights issues and working conditions are related to the underearning of smallholder farmers and the nature of the work in cotton cultivation. Although so far, many research reports focussed on incidences of child and bonded labour in hybrid cottonseed production, there are also studies that show that labour rights issues occur during seed cotton cultivation (Venkateswarlu, 2010; Da Corta, 2009).

The environmental and social issues occurring during cotton cultivation and production also lead to reputational risks for retailers and brands in the apparel sector. For example, the collapse of the Rana Plaza garment factory in Bangladesh due to poor safety standards has been costly to the sector (The Atlantic, 2013). Plus, consumers are increasingly getting informed about the circumstances in which their clothes are being produced, causing them to make more critical choices when buying clothes (Guardian Sustainable Business, 2015).

Efforts to improve the situation of farmers in India are being made, amongst others by the Government of India. One example of this is the decreased customs duty on cotton fibre exports as of 2009 (Ministry of Textiles, 2010). Also, the state-run Cotton Corporation of India procures cotton bales when market prices drop below the minimum support price (MSP) so as to stabilize cotton prices and prevent farmer distress. The MSP was increased by Rs.50 (€0.64) per quintal to Rs. 3,750 (€47.94) for medium staple and Rs. 4,050 (€51.77) for long staple cotton for 2014-2015 (CCEA, 2015). Additionally, the government initiated the Technology Mission on Cotton in 2000 to enhance the productivity and quality of cotton. Finally, there are several programs to reduce synthetic pesticide use and associated input costs, like the Central Integrated Pest Management Centre, and to educate farmers on reducing pesticide and fertilizer use.

Apart from institutional reforms, NGOs and standard-setting organisations active in the Indian cotton sector are making progress as well. According to The State of Sustainability Initiatives Review 2014, 3.3% of the seed cotton produced in India in 2012 complied with a voluntary sustainability standard, which was either BCI (1.6%), Organic (1.7%) or Fairtrade (0.03%). At global level, 3.4% of produced cotton in compliance with voluntary sustainability standards is 3.4%, which is relatively low compared to other commodity chains. The main reason for this is that voluntary sustainability standards only recently emerged in the cotton sector (Potts, et al. 2014). Research shows that participating in programs for sustainable cotton production seem to influence farmers' knowledge and implementation of good agricultural practices (Da Corta, 2009). Farmers note numerous benefits of their producer groups such as marketing their seed cotton at a good price, access to information and training, providing a forum for exchange and building social capital (Da Corta, 2009).

Despite research on the qualitative effects of sustainable farming practices in cotton cultivation, few studies to date measure the actual social, environmental and economic impact of sustainability initiatives. Important steps are being taken to improve measurement and evaluation of sustainability practices in cotton cultivation. The ICAC Expert Panel on Social, Environmental and Economic Performance of Cotton Production (SEEP) has for example built a preliminary framework with recommended indicators to measure and track improvements on sustainability practices that is applicable across countries (SEEP, 2015). Monetizing can help in the discussion on sustainability in the cotton sector, by assessing and improving indicators currently identified in the framework. Also, it can enhance the sustainable performance of the global cotton sector, as it enables countries to track, compare and improve performance over time.

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1 Five year average

2 Bacillus Thuringiensis – a bacterium that paralyzes the larvae of the cotton bollworm

1.2 Goal and scope of research

One barrier to reducing social and environmental costs effectively in a market system is the lack of quantitative assessments of the size and materiality of the various environmental and social externalities of cotton production. Such information is needed to make well informed decisions and steer future interventions. Moreover, it is valuable to know to what extent certification improves the externalities of cotton cultivation, and how standard-setting organisations can allocate their resources most efficiently.

This study aims to contribute to these challenges by measuring and valuing the environmental and social externalities of the cotton supply chain and by comparing conventional to certified cotton. Certified cotton is produced on a farm that holds one or more certifications from a voluntary standard system. Conventional cotton is produced on a farm that does not hold any certification from a voluntary standard system.

The goal of the present study is to provide the information needed with which IDH and other supply chain actors in the cotton sector (smallholder farmers, businesses, NGOs, standard-setting organisations, governments) can make informed decisions about sustainability. Identifying solutions or assessing the impact of certification are out of scope in this study.

This report will provide an answer to the following research questions:

1. What is the size of the external costs[3] of cotton production in India?
2. What are the most material externalities?
3. How are external costs divided over the cotton supply chain?
4. Is there a difference between certified vs. non-certified cotton?

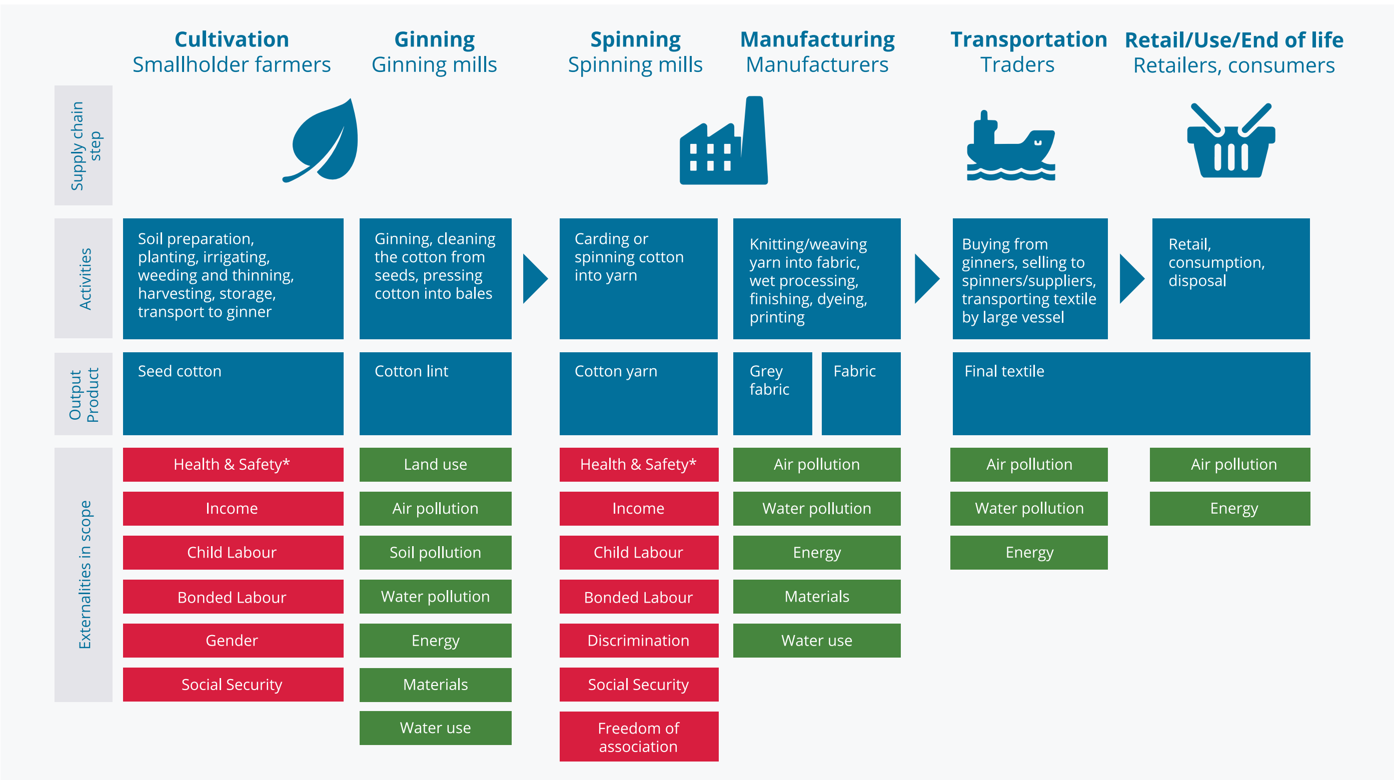

*Figure 1 scope of the True Price study (*in this study health & safety includes overtime)[4]*

The scope of this research is presented in Figure 1. It includes all environmental and social externalities that were considered material and for which data was available. For the cultivation phase, both conventional and certified[5] cotton production was investigated. The study focuses on smallholders, as they account for 80 to 90% of cotton production (Greenpeace Research Laboratories, 2010).

A highly in-depth research was executed for the cultivation phase, as this is the main focus of IDH's commodity programs and, as such, future interventions can be most easily realized. The transportation, processing and consumption phases have a less rigorous nature and were included in this study to place the external costs of the cultivation phase into perspective. Indirect players that also contribute to the external costs of the end product, such as financial institutions and suppliers of equipment, were excluded from the scope.

In this study, possible benefits of the cotton supply chain – such as consumer pleasure, job creation and infrastructure – were not taken into account. Priority was given to provide a comprehensive overview of the external costs instead of mapping costs and benefits on a more coarse level. The main reasons for this choice is that most challenges in the cotton sector relate to external costs. Benefits (such as consumer satisfaction) are expected to be internalized in prices to a much higher degree than costs, as economic actors have an incentive to do so. In addition, the data requirements and assumptions necessary to measure external benefits are higher than for external costs.

It is important to note that this study does not attribute differences in external costs to the intervention, such as the standard-setting organisations. The difference in external costs between conventional and certified cotton presented in this report can be liable to selection effects. For example, farms with better social conditions might choose to become certified more easily than farms with less favourable social conditions. This means that differences in external costs between certified and non-certified farms need not be caused by the actions of the standard-setting organisation. Similarly, a lack of difference does not necessarily imply that a standard-setting organisation has no impact.

This study is part of a series of four studies with a similar goal and scope, but focusing on different commodity groups: coffee from Vietnam, tea from Kenya and cocoa from Ivory Coast. The results of these studies are useful to place the cotton supply chain into perspective.

1.3 Roadmap of the report

The aim of this report is to provide a condensed overview of the true pricing study conducted for cotton from India. Following this introduction, a brief explanation on concepts such as externalities and true pricing is provided. Afterwards, the main results and insights of the study will be presented. These results will be placed into a larger perspective by looking at the retail level and by comparing the results of cotton to three other country-specific commodity supply chains: coffee from Vietnam, tea from Kenya and cocoa from Ivory Coast. In addition, this section presents the main limitations and assumptions of this study. The final section concludes with an overview of how these results can be used to improve social and environmental externalities of the cotton supply chain.

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3 Results of external costs in this study are rounded off to €0.05

4 The externalities in scope refer to the entire supply chain step, of which there are four, and not to the activities

5 In this report, no specification of the investigated certification mechanism is provided for confidentiality reasons

Chapter 2
What is a true price?

2.1 What are externalities?

External costs are costs caused by economic activities which are not reflected in the prices charged for the goods and services being provided. External costs can be classified as environmental costs if they have a direct effect on the environment and as social costs if they have a direct effect on the well-being of people.

In this study, we define externalities as the effects of economic activities on others, expressed in an array of different units and footprints. When externalities are valued and monetized, they are called external costs.

An overview of externalities taken into account in this study are presented in Figure 2. Each externality (such as land use or health and safety) typically contains several indicators that are considered when monetizing the externality.

Category	Externalities	Specification
Resource use	Land use	Land conversion and land occupation
	Water use	Use of scarce water
	Energy	Use of non-renewable energy
	Materials	Use of scarce materials
Pollution	Water pollution	Eutrophication, acidification, marine ecotoxicity and freshwater ecotoxicity
	Air pollution	Greenhouse gas emissions and other hazardous air pollutants
	Soil pollution	Terrestrial ecotoxicity and human toxicity
	Waste	Waste and type of treatment
Workers	Health & Safety	Occupational accidents and breaches of H&S standards
	Income	Underpayment of hired labour (living wage) and family labour (living income)
	Child labour	Hazardous and non-hazardous child labour
	Forced labour	Forced adult and child labour
	Discrimination	Subdivided into gender and other types of discrimination (religion, race...)
	Harrassment	Sexual and non-sexual harrassment
	Social security	Social security provision, including annual, sick, maternity and paternity leave
	Freedom of association	Freedom for workers to form and/or join unions
	Overtime	Excessive working hours
Society	All social externalities that have an impact on society at large (dependant on scope)	

Figure 2 Overview of social and environmental externalities[6]

6 In this study, overtime is classified under health & safety

2.2 What is a true price?

The true price of a product reflects the visible as well as the hidden costs of its production. It is defined as the sum of the retail price and the unpaid environmental and social costs.

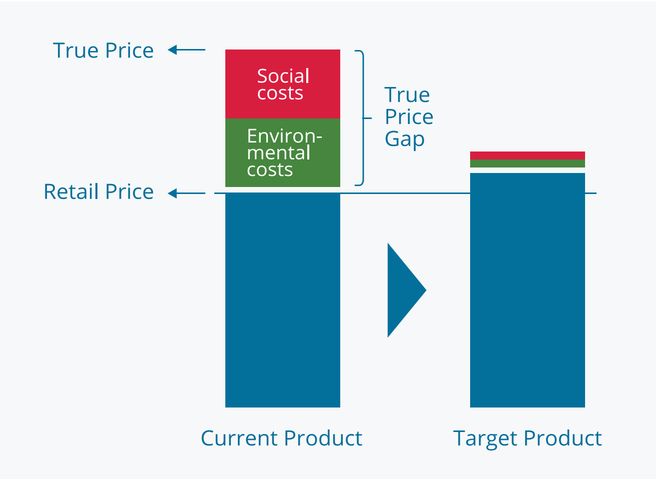


Figure 3 Reducing the true price of a product

These environmental and social costs are monetized in various ways. The main techniques can be separated into damage costs approaches (monetizing the welfare effects of an externality) and abatement costs approaches (monetizing the costs to prevent or restore a negative externality).

For environmental costs, one can mostly use existing approaches. For example, the impact of greenhouse gas emissions on society is often monetized by multiplying the kg of CO_2 equivalent emissions by a Social Cost of Carbon (SCC). The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. Recent SCC estimates can be found predominantly in a range from $43 to $220 per tonne of CO_2 equivalents (US IAWG 2013, Moore & Diaz, 2015). This range can be explained by the variation in complexity of calculation models (and included effects on society) and the applied time frames and discount rates. This study uses a cost of $110 per tonne of CO_2 equivalents, which is around the average of the range.

Social costs are usually more challenging to monetize, although the techniques used to value social costs follow the same logic as those used to value environmental costs. For example, if occupational accidents occur, the damage costs of these accidents can be monetized by taking into account loss of life quality and lost time. Abatement costs would also include medical expenses needed to treat the person.

In this study, the true price method for monetizing external costs, which uses a combination of damage and abatement costs techniques, was employed.

In order to calculate a true price, three steps are needed:

1. Make an inventory of relevant environmental and social data
    - Examples of environmental data: energy use per ha, fertilizer application per ha, types of fertilizers used…
    - Examples of social data: hourly wage of workers, % of child workers…

2. Measure environmental and social externalities of production
    - Convert all gathered input data to actual environmental and social footprints

3. Calculate the costs of each externality to society
    - Multiply all environmental and social footprints with their corresponding costs to society

For an overview of the principles underlying the true price method, we refer to the Principles on Impact Measurement and Valuation (True Price, forthcoming).

2.3 Why calculate a true price?

The aim of calculating a true price is to manage risks, steer innovations and reduce social and environmental costs by improving transparency throughout the entire supply chain of a product.

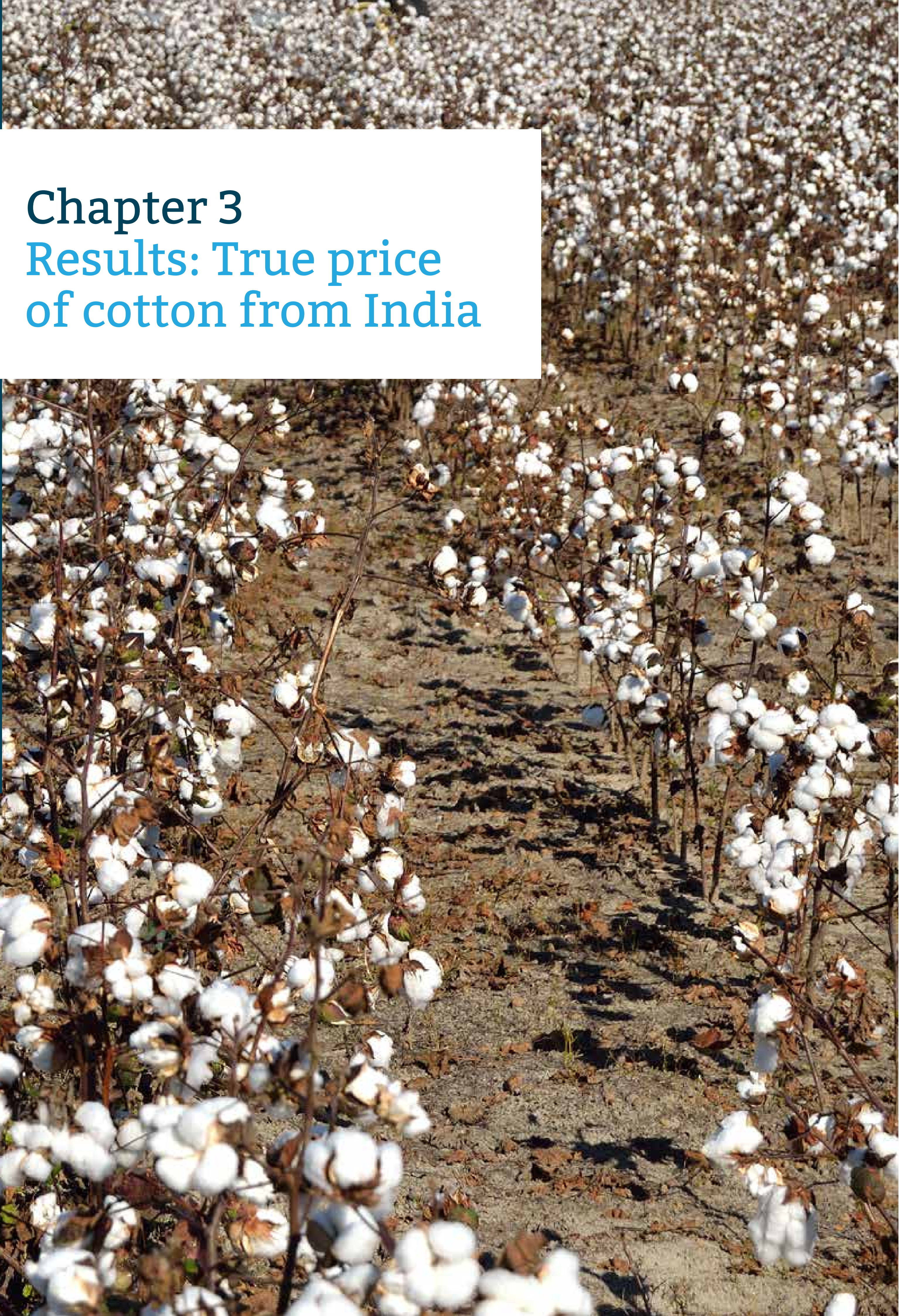
By using information on external costs, businesses can improve the social and environmental impacts of their own operations and their supply chain. In addition, for businesses, externalities are becoming revenue and cost drivers as they are increasingly getting a price. The underlying driver of this trend is that externalities are being internalized at increasingly higher rates due to lower transaction costs[7], consumer demand for sustainable products and more effective regulation (True Price, Deloitte, EY, PwC, 2014).

There are various bottom-line benefits for producers from information that a true price provides:

1. **Risk management:** control and reduce risks in the supply chain due to future cost increase and regulation
2. **Cost reduction**: identify projects that are both sustainable and increase resource efficiency to reduce costs
3. **Innovation:** Identify alternative modes of production, that are more sustainable and cost-effective
4. **Branding:** communicate superior social and environmental performance of a product

7 Transaction costs are the costs of providing for some good or service through the market rather than having it provided from within the firm.

Chapter 3
Results: True price of cotton from India



3.1 Size of external costs of cotton cultivation

The calculated true price of conventional seed cotton is €4.20/kg seed cotton. This is the sum of the farm gate price (€0.55/kg seed cotton) and the external costs of cultivation (€3.65/kg seed cotton). The latter is also called the true price gap.

The true price gap is more than six times as large as the farm gate price of seed cotton. This shows that at farm level there are substantial hidden costs relative to the market price. Environmental costs account for 74% of total external costs of cultivation. Social costs are lower than environmental costs. Nonetheless, family and hired workers face material social issues.

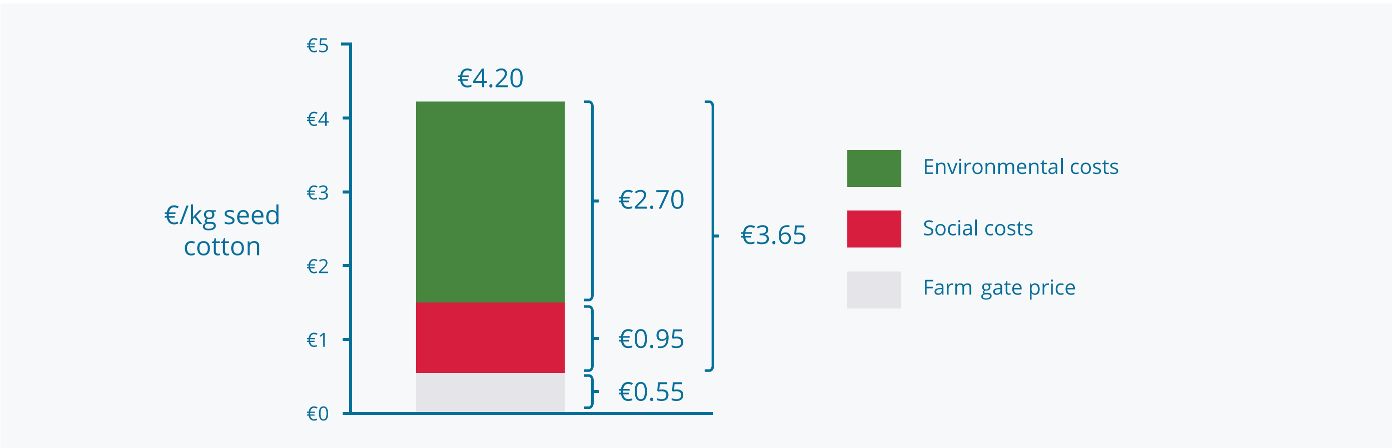


Figure 4 True price of 1 kg seed cotton

3.2 Most material externalities of cotton cultivation

The most material externalities during the cultivation of conventional cotton in India are water use, water pollution and income of family and hired workers.

- **Water use (35%)**: a large amount of irrigation water is used during the cultivation of cotton. This relatively high water intensity of cotton, combined with water scarcity in many regions in India, makes water use the highest environmental cost.
- **Water pollution (17%)**: the use of N and P synthetic fertilizers and subsequent runoff in rivers and oceans, negatively affects freshwater and marine eutrophication.
- **Income (12%)**: underpayment of hired workers as well as underearning of family workers is the largest social issue during cultivation.

3.2.1 Water Use

Even though the cotton crop is drought tolerant, it does require significant amounts of water at specific points in its lifecycle in order to grow well (Potts, et al., 2014). Both the water intensity of cotton and the fact that water is extracted from water-scarce regions, make water use the highest environmental cost. On average, water use for cotton cultivation in India is 1,800 m3/ha. Plus, water in India is scarce 8-10 months per year (Hoekstra et al. 2012). Water use varies widely across regions in India, where especially the drier Northern regions require a higher use of irrigation water than some of the more rain-fed regions. In turn, these regions depend heavily on the monsoon for their yields. For example, in 2014/2015 India's yield was estimated to be 9% lower than last year due to rainfall deficits (USDA, 2015b).

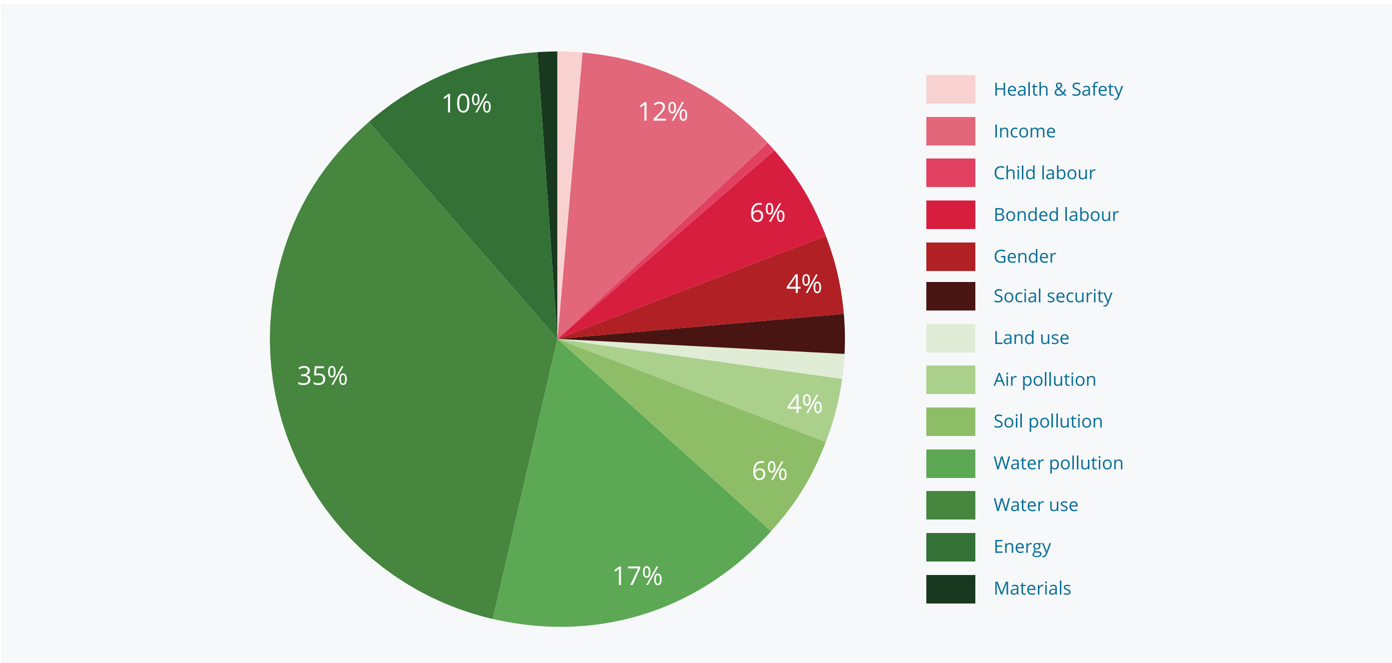


Figure 5 Share of each externality in the total external costs of cultivation

3.2.2 Water Pollution

The use of N- and P- synthetic fertilizer causes freshwater and marine eutrophication. On average, farmers in India apply 100 kg/ha N-synthetic fertilizer and 60 kg/ha of P-synthetic fertilizer (Eyhorn et al. 2005; Directorate of Economics and Statistics, 2013; Babu & Selvadass, 2013; Water Footprint Network, 2013). Also pesticide use (1.5 kg/ha) causes freshwater and marine water ecotoxicity, which contributes to further water pollution and loss of biodiversity (True Price database). In total, water pollution is the second largest external cost of cotton cultivation in India.

3.2.3 Income

Income (underpayment and underearning) is by far the largest social cost in cotton cultivation in India. Hired workers receive on average €1.8/day, which is only 41% of the living wage. Family workers receive on average €3.5/day, almost half of the living income[8]. The average yearly wage of workers is €510, while the legal minimum wage is €515. The yearly living wage for an Indian worker, as calculated by True Price, is €1,235. Underpayment and underearning are not only problematic for the livelihoods of workers and their families, but also trigger other social issues, such as child and bonded labour (Da Corta, 2009).

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8 Both the living wage and the living income were calculated by True Price, based on a living wage basket, adjusted for taxes, insurance and other contributions.

The data mentioned in this chapter are extracted from the True Price literature database (see Key data Sources for an overview of the main literature sources used)

3.3 Division of external costs over the cotton supply chain

In the cotton supply chain, 32% of the researched external costs take place during the cultivation phase. The manufacturing phases consist of the ginning, spinning, knitting and/or weaving, wet-processing and finishing of cotton products. The spinning phase has the largest contribution to the total external costs (27%), mainly resulting from the energy used by spinning mills to produce cotton yarn. Also for the knitting/weaving phase, energy use is by far the largest external cost. During the wet-processing phase, water pollution is the largest external cost, caused by the use of chemicals (Cotton Incorporated, 2012). The transportation phase – transporting the seed cotton to the gin in India and shipping the final textile to Europe – only causes 2% of the overall external costs in the supply chain.

The environmental costs account for 78% of the total external costs across the supply chain. Social costs mainly play a role in the spinning and knitting/weaving phase, where bonded labour, underpayment and child labour contribute between 60-90% to the total social external costs in those phases.

3.4 Difference between certified and conventional cotton

In this research conventional cotton was compared to certified cotton on those externalities for which data was available. When no distinctive data for certified farms was available, the same situation as for conventional farms was assumed. As such, the outcomes of this comparison should be interpreted with care. It is plausible that certified cotton might even have lower external costs than what this research suggests. Also, it is important to realize that these results do not show the impact of the standard-setting organisation, as they are not corrected for selection effects. For this an analysis is needed with a difference-in-difference (DID) research design[9]. This requires specific impact data for two groups of certified and conventional (control) farms over multiple periods in time.

The external costs of certified cotton cultivation are about 35% lower than those of conventional cotton cultivation. 70% of this change is caused by increased productivity of certified cotton farms, which results in lower external costs per kg of seed cotton. 20% is a direct result of better

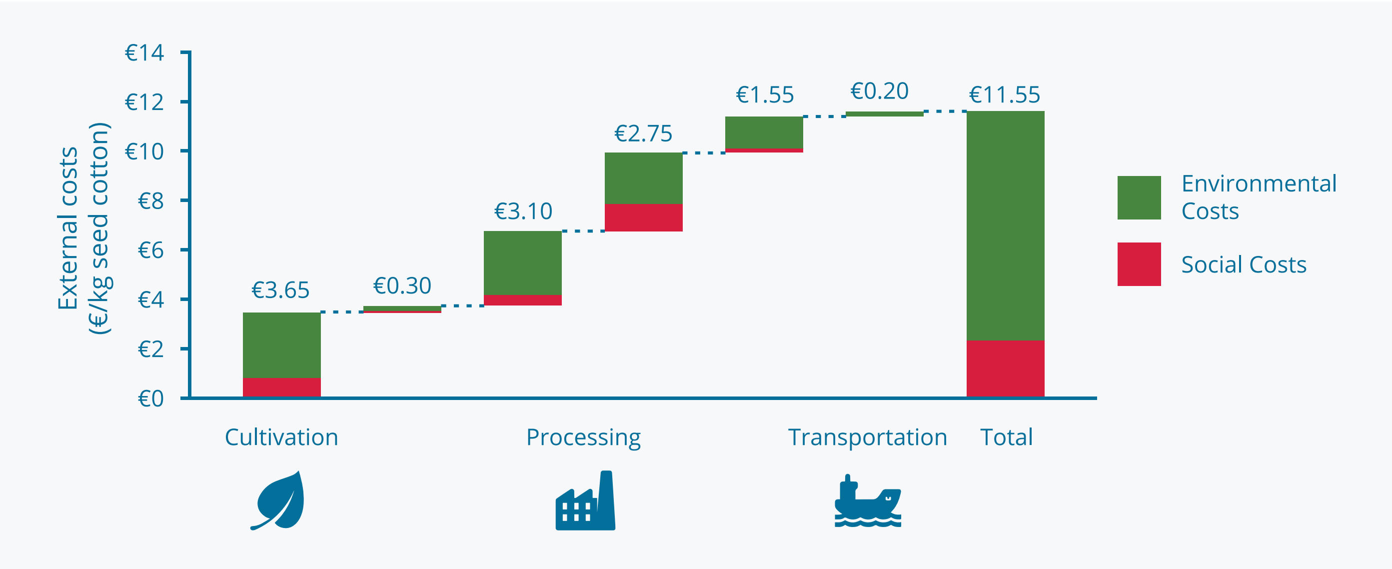

Figure 6 Division of external costs over the cotton supply chain consisting of (FLTR): cultivation, ginning, spinning, knitting/weaving, wet-processing and transportation

environmental conditions. For example, certified farms have demonstrably lower rates of water, pesticide and fertilizer use. The remaining 10% of the lower external costs is due to better social conditions on certified farms, such as lower rates of underpayment and income discrimination.

Although certified farms use less water for irrigation, water use remains the most material externality (23% of total external costs), as the cultivation of certified cotton still requires a substantial amount of water extracted from water-scarce regions. Also, despite a lower use of synthetic fertilizers, water pollution remains the second largest externality on certified farms (18% of total external costs). In terms of income, underpayment remains a highly material externality on certified farms (13% of total external costs).

Certified farms are on average more profitable than conventional cotton farms. This can for a large part be attributed to higher yields, likely due to Good Agricultural Practices (GAP). The increased farmer income results in a decreased external cost of underearning (income) for family labour. It was found that on conventional farms a family worker has a yearly income of €1,000, whereas a family worker on a certified farm earns €1,560 per year. Figure 8 represents the revenues, costs and net income for the average conventional and certified farm.

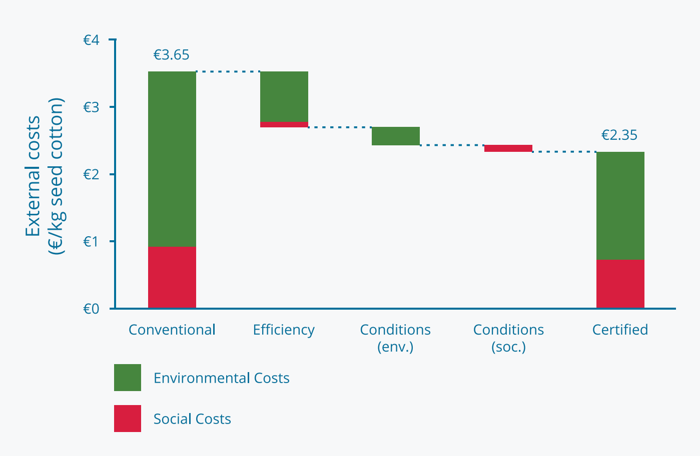

Figure 7 Reduction of external costs for certified cotton

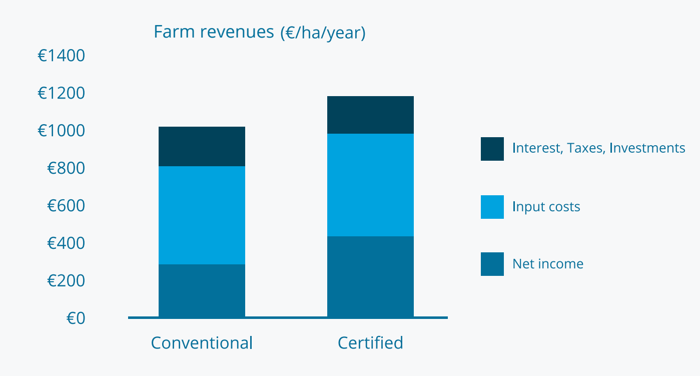

Figure 8 Revenues (split up in costs and net income) for the average conventional and certified farm

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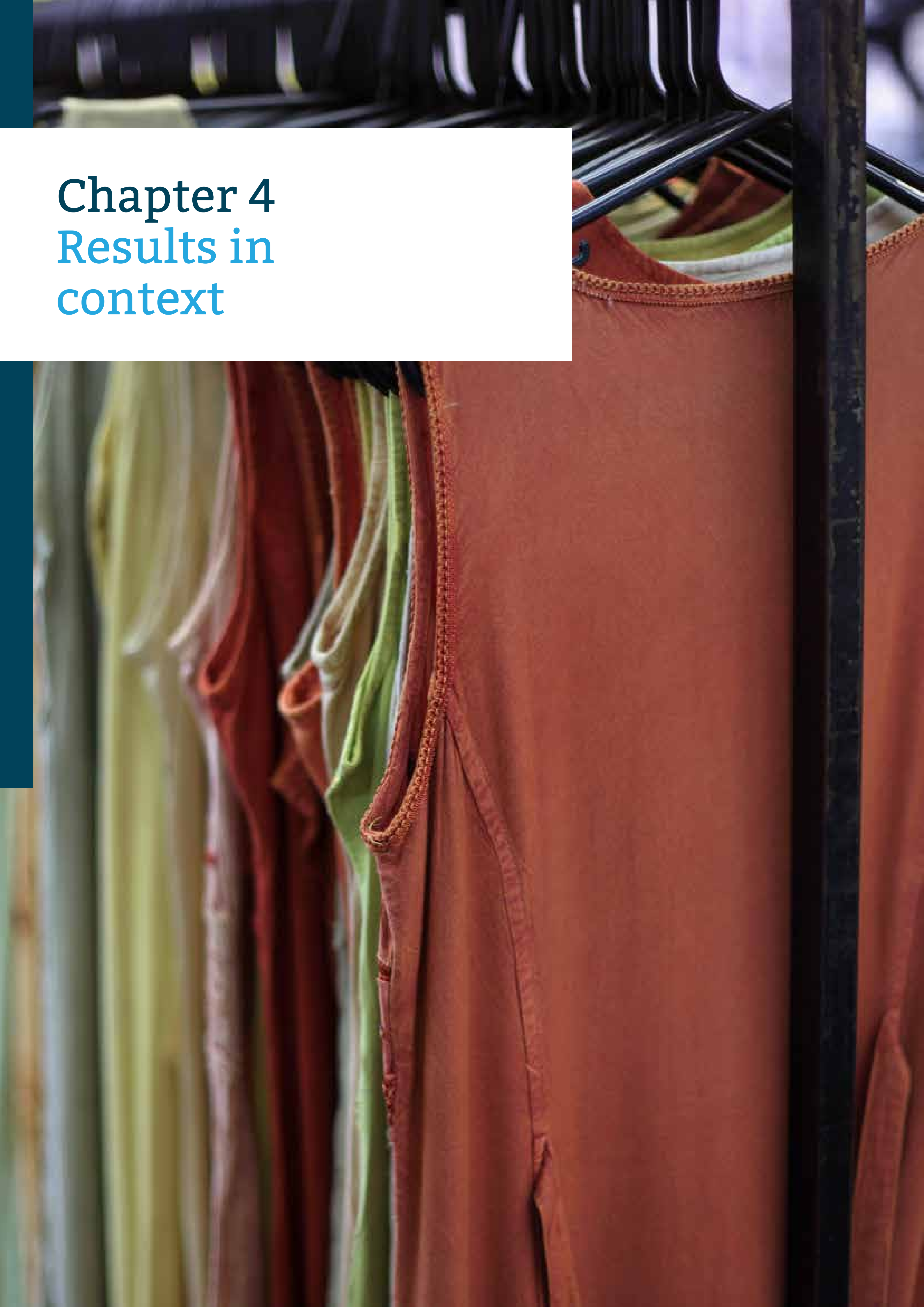
9 A randomized experiment would be the best approach from a scientific perspective but this does not seem feasible in practice in this context

Chapter 4
Results in context



4.1 What is the true price of a T-shirt?

An interesting perspective arises, when considering the true price at retail level, in addition to farm level. The average retail price of a cotton T-shirt is estimated at around €15 for a conventional T-shirt[10]. As a T-shirt on average weighs 200g, this translates into an average retail price for a kilogram of T-shirts of €75 (5 x €15 p. T-shirt). The total external costs of cultivation, manufacturing and transportation of seed cotton and textile manufacturing required for a T-shirt are around €7.30 (or €36.60 per kg of T-shirts).

During the consumption phase, the washing and drying of a T-shirt causes external costs linked to energy use and air pollution. When not taking into account water pollution (discharge of soap water) and water use – as water is not scarce in the average European country – the true price of a T-shirt increases with €0.7 during consumption. These external costs were calculated over the lifecycle of a T-shirt, which is on average 3.2 years (Cotton Incorporated, 2012).

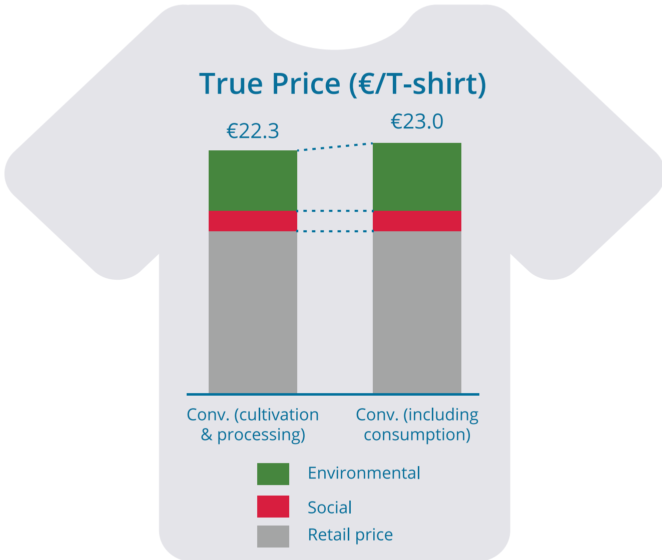


Figure 9 True price of a T-shirt

10 It is assumed that a conventional T-shirt of 100% cotton sold in a European supermarket weighs on average 200g (Chapagain et al. 2006; Cotton Incorporated, 2012; Sule, 2012; ICAC, 2015). Such a t-shirt contains 633g of seed cotton, based on a ratio of 316 g of final textile per 1 kg of seed cotton (FAO, 2003)

4.2 How does cotton compare to other sectors?

As a part of this study, the true price of three other commodities were researched: coffee from Vietnam, tea from Kenya and cocoa from Ivory Coast. This allows for a comparison of external costs between sectors.

4.2.1 Farm level

Compared to other sectors, the external costs of smallholder cotton cultivation are about 3 to 5 times higher for seed cotton than for green coffee beans (Vietnam) and green leaf (Kenya) respectively, but about 1.5 times lower than for cocoa beans (Ivory Coast). Cocoa cultivation in Ivory Coast has the highest ratio of social to environmental costs. For coffee cultivation in Vietnam and cotton cultivation in India, environmental issues predominate.

Figure 10 shows how farm gate prices for Vietnamese green beans (coffee) and Kenyan green leaf (tea) are closer to their respective true farm gate prices. Ivorian cocoa beans and Indian seed cotton clearly have substantial hidden costs. The cultivation of Kenyan green leaf appears to be the most lucrative of the four commodities, with profits climbing up to €2,000 per hectare of certified farm land. This is linked to the fact that tea from the Kenyan Rift Valley has high quality and relatively high yields, which are more than 5 times higher than for Indian seed cotton. The high yields in this sector are largely responsible for the low external costs per kg green leaf.

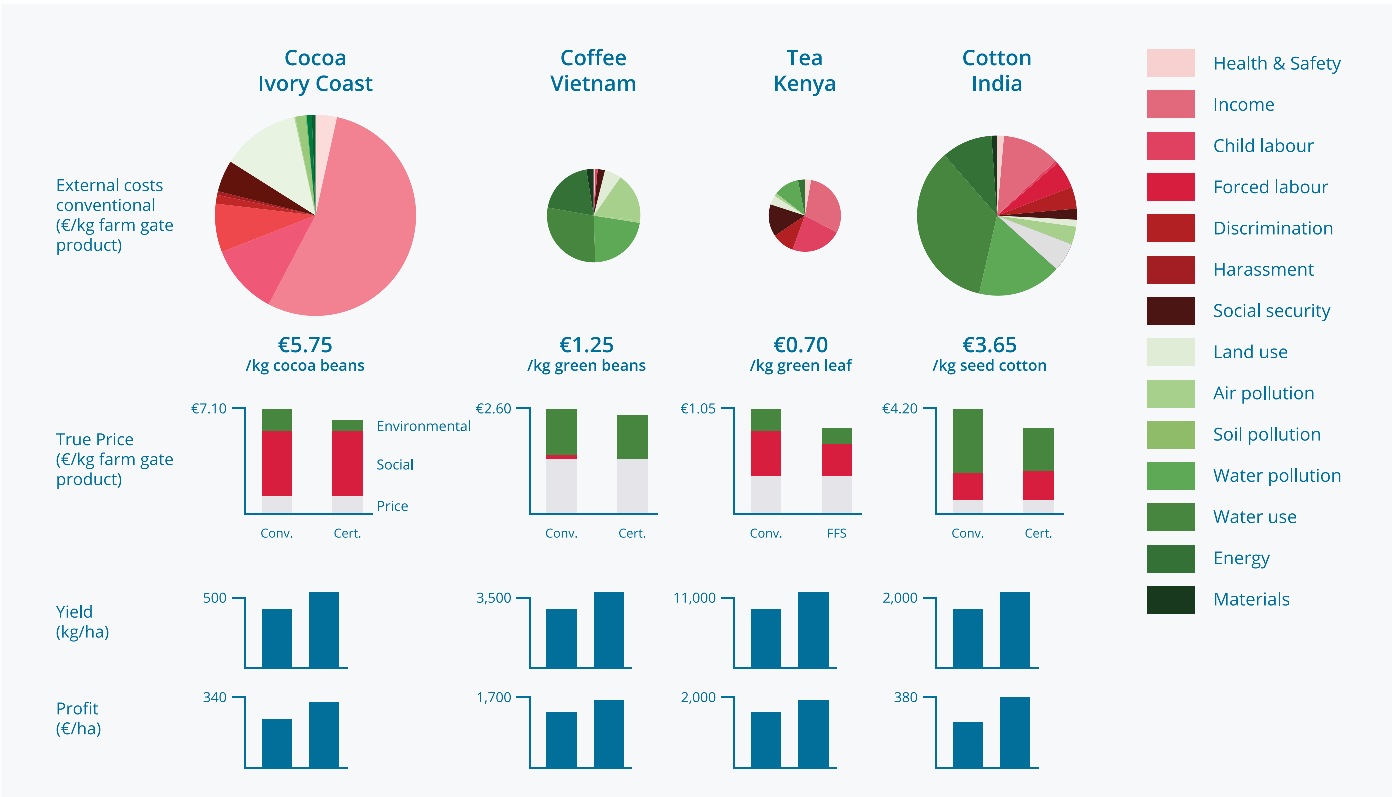


Figure 10 True farm gate prices of four country-specific commodities (conventional and certified) and their corresponding yields and profit values

4.2.2 End product level

The total external costs of cultivation, manufacturing and transportation are €11.55/kg seed cotton, which is 2, 5 and 10 times higher than for Ivorian cocoa beans, Vietnamese green coffee beans and Kenyan green leaf respectively. This is mainly due to the high external costs of cotton manufacturing.

Figure 11 shows how the retail prices of chocolate, roasted coffee, tea and cotton T-shirts relate to their corresponding true retail prices. It is important to note that the graphs only partially reflect the true price of chocolate as only the respective ingredient cocoa beans was taken into account. For example, the external costs of sugar and milk powder production and processing are not included in the true price gap of chocolate. However, it is clear that tea has a low true price gap compared to the other sectors, and chocolate and cotton T-shirts have a relatively high true price gap.

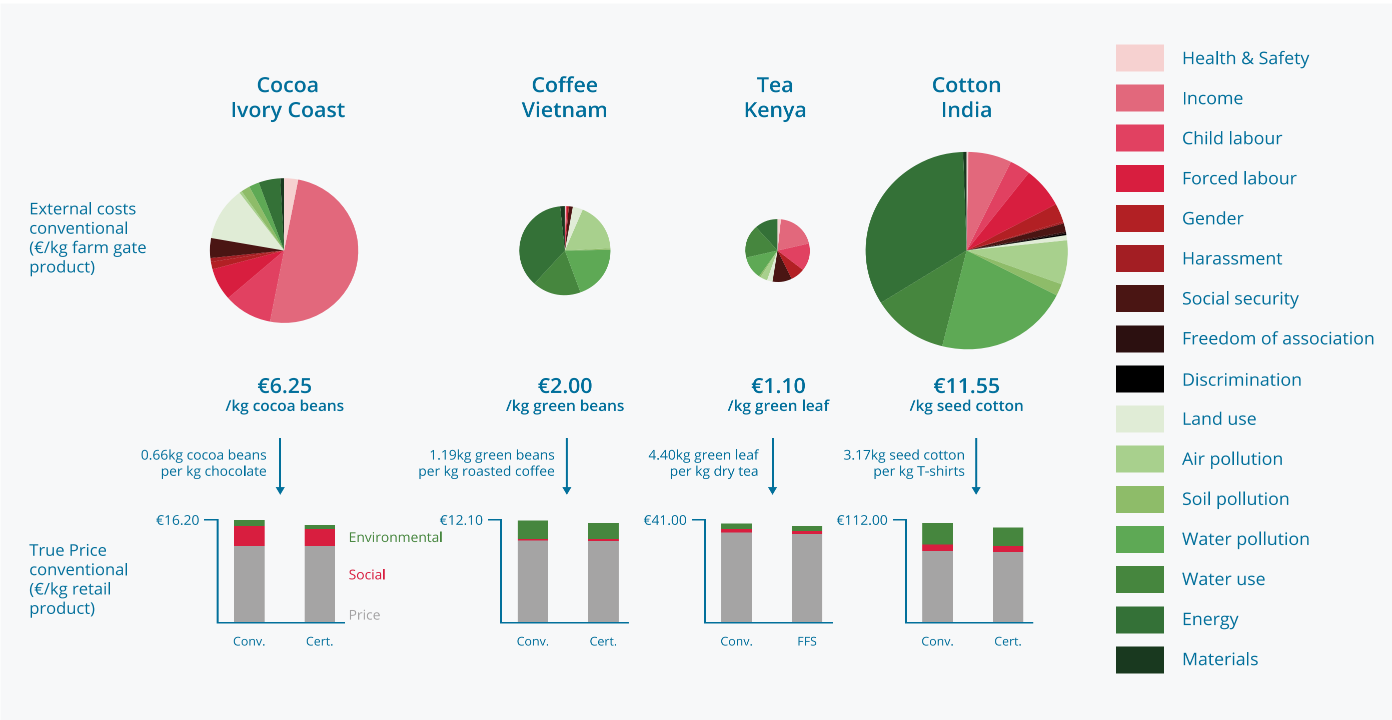


Figure 11 True retail prices of four country-specific commodities (conventional and certified). External costs on this slide include cultivation, transportation and processing, but exclude retail, consumption and end-of-life treatment.

4.3 Limitations of study

The results of this study are robust enough to be used in decision making. However, due to the data intensive and pioneering nature of this study, there are some limitations:

Limitations in scope

Due to data availability issues, some externalities were left out of scope. However, based on an initial materiality analysis, the size of the external costs linked to these externalities was expected to be relatively low compared to the externalities in scope (see Figure 1 for a detailed overview of the externalities in scope).

The cultivation phase was the main focus of this study and has been investigated in-depth. The manufacturing and transportation phase had a less rigorous nature, but still provide a robust estimate. The retail phase was excluded from this study, due to low materiality. Indirect players that also contribute to the external costs of coffee, such as financial institutions and suppliers of equipment, were as well excluded from this study.

Finally, it is important to realize that the results in this report only apply to seed cotton produced by smallholders in India, manufactured in India and transported to Europe.

Conventional versus certified cultivation

As mentioned earlier, this study does not attribute external cost reduction to the standard-setting organisation, as the analysis does not correct for selection effects. In order to do this, an analysis is needed with a DID research design, which requires specific impact data for two groups of certified and conventional (control) farms over multiple periods in time.

Moreover, it is important to note that when no data for certified farms was found, equal values as for conventional farms were used. This may have resulted in an overestimation of the external costs for certified seed cotton.

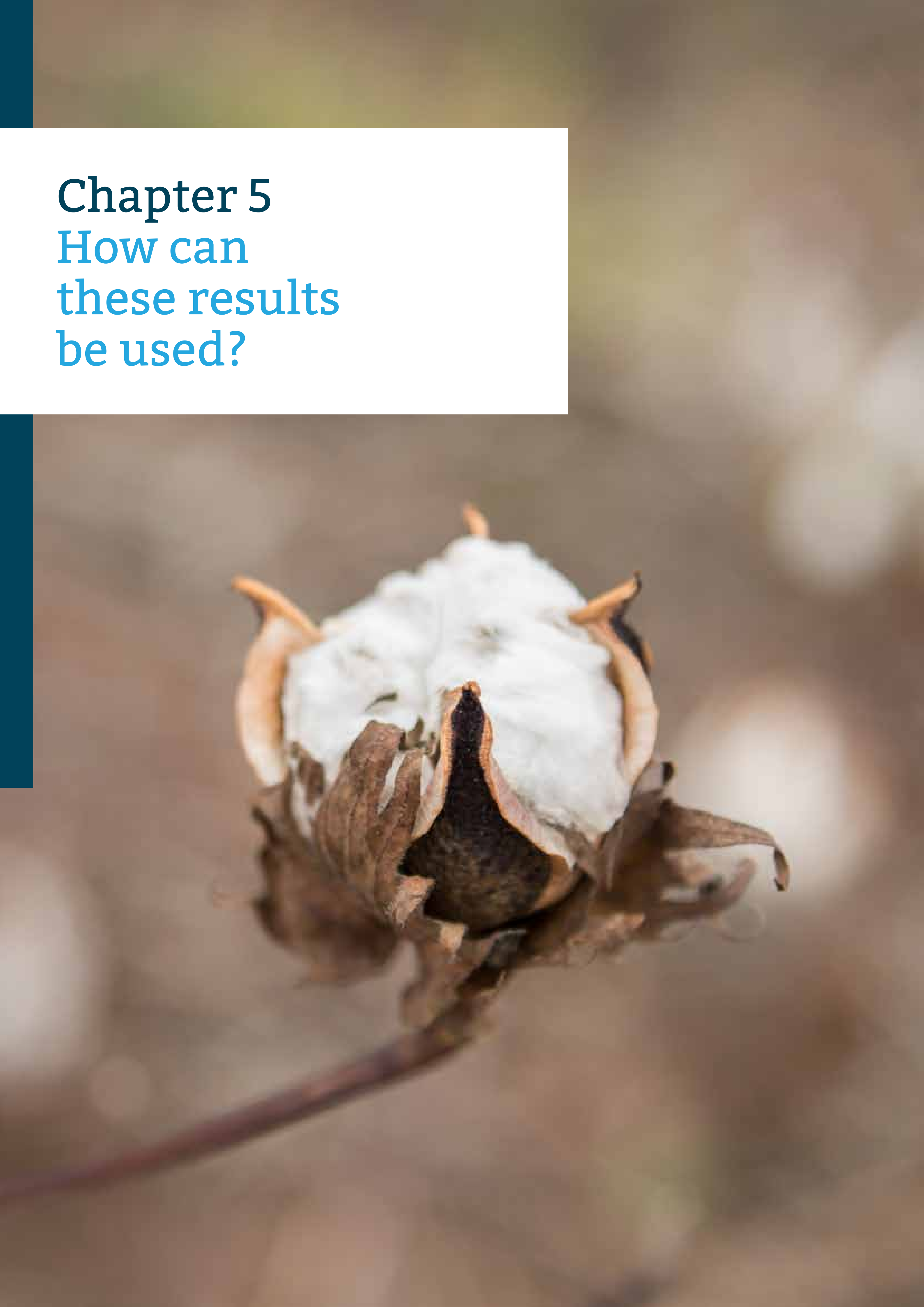
Data availability and quality

Averages were used to represent the data. However, there often was a high variability across sources and regions for key indicators (i.e. yields, water use, fertilizer and pesticide use). This causes uncertainty on the end results. Besides, there is a large informal cotton sector, which also has consequences for the data reliability. In this study, a formal uncertainty analysis was out of scope.

Many specific assumptions were made throughout the analysis, in order to solve data quality constraints. To give an example, it was assumed that Gujarat, Maharashtra and Punjab are representative for cotton production in the whole of India.

Finally, it should be kept in mind that the results in this study are susceptible to the limitations of all studies from which data were extracted. These limitations can concern research design or unclear representation of results, amongst others.

Chapter 5
How can these results be used?



The results of this study can be used in various ways. First they can be used to identify and assess interventions with the highest impact and return on investment. Second, they can be used to measure the effect of interventions over time.

5.1 Ex-ante: Identify and assess interventions with highest return on investment

The True Price analysis has uncovered the most material social and environmental externalities of cotton production in India. These are the areas where interventions are of highest need. With this knowledge in mind, the most promising interventions can be identified and assessed on impact as well as return on investment (Figure 12).

In this study it was found that 32% of all external costs throughout the cotton supply chain occur during the cultivation phase. It is, as such, sensible to focus future interventions on this phase, as there are significant improvements to be made. Furthermore, this study showed that in order to reduce the external costs of cotton cultivation in India, most impact can be realized by focusing interventions on (i) reducing water use (ii) reducing fertilizer use (iii) reducing pesticide use (iv) increasing income and wages for farmers and workers, and (v) improving worker's rights. Since the study also indicates that the manufacturing phase has substantial external costs, it is advisable to further focus sustainability efforts in that area as well.

There are various approaches to tackle these challenges. For example, by implementing good agricultural practices farmers can learn how to increase their yields and reduce their water use. A specific intervention for water use is integrated

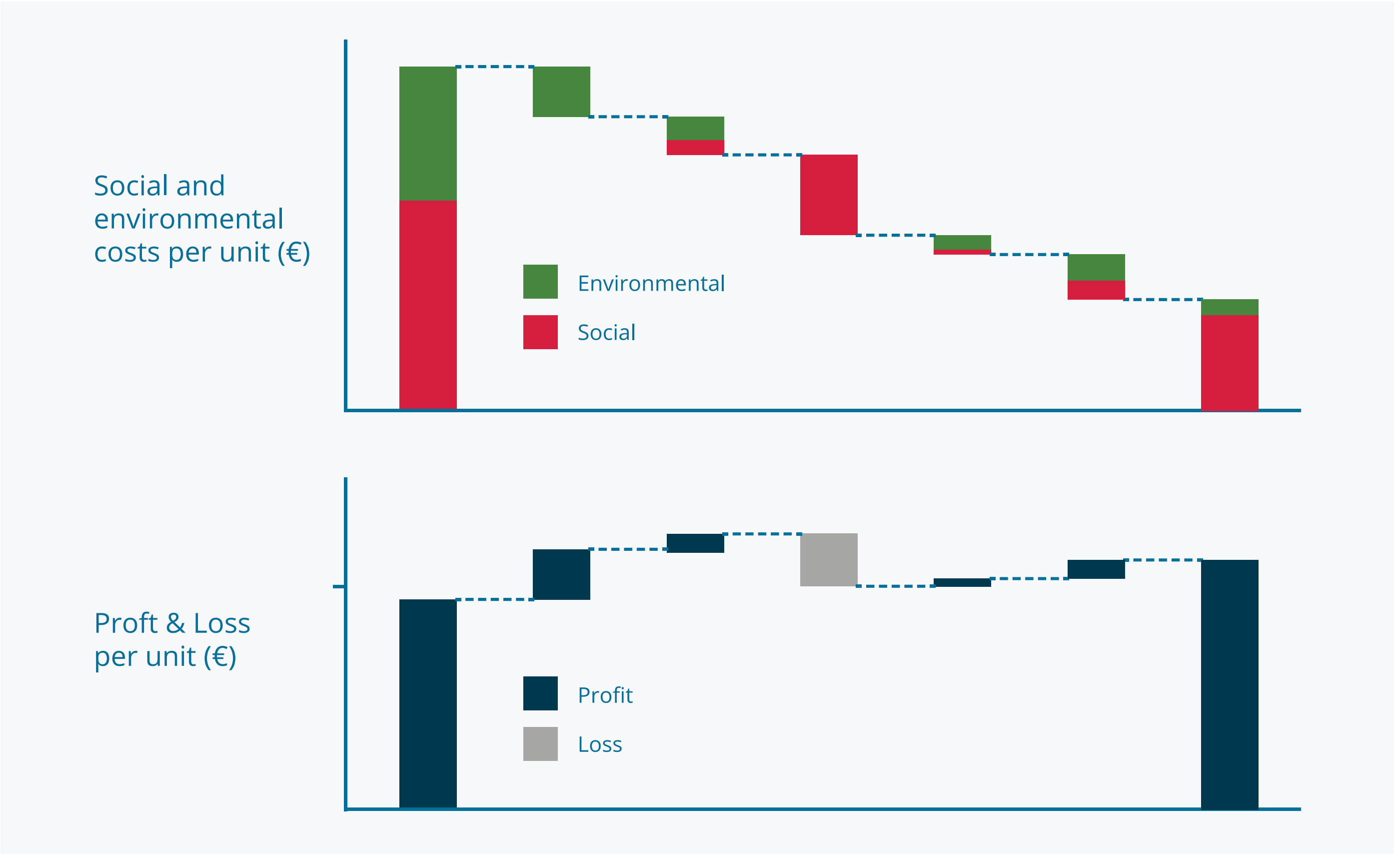


Figure 12 Hypothetical business case analysis of possible interventions

water management. In India it was found that interventions such as burrow irrigation, green mulching, plastic mulching and soil conservation can reduce water use by 30% (CottonConnect, 2014). Such reduction in the use of irrigation water can potentially reduce external costs by 7% (€0.16/kg of seed cotton). Another approach in reducing external costs is to improve the social conditions on farms, by training farmers on gender equality which results in fairer payment of wages to female labourers. If income discrimination would be effectively reduced to zero, this would result in a 5% (€0.13/kg of seed cotton) reduction in external costs of certified farms. Figure 13 shows how these interventions potentially result in a reduction of the external costs to €2.10. In order to select the most 'profitable' interventions, the social or environmental return on investment can be calculated for each intervention. This shows the reduced external costs for each euro invested in the intervention.

5.2 Ex-post: measure impact interventions

True pricing can be used to measure the impact of an intervention by comparing the external costs of farmers with those of a real or a modelled control group (the option scenario vs the reference scenario). Depending on data quality, claims can be made as to whether and how the intervention creates value by increasing benefits or reducing costs. The total effect of the alternative scenario can be broken down into sub-effects. Based on this knowledge, the alternative scenario can be evaluated and improved. As mentioned before, measuring impact of interventions requires a specific data set to be available.

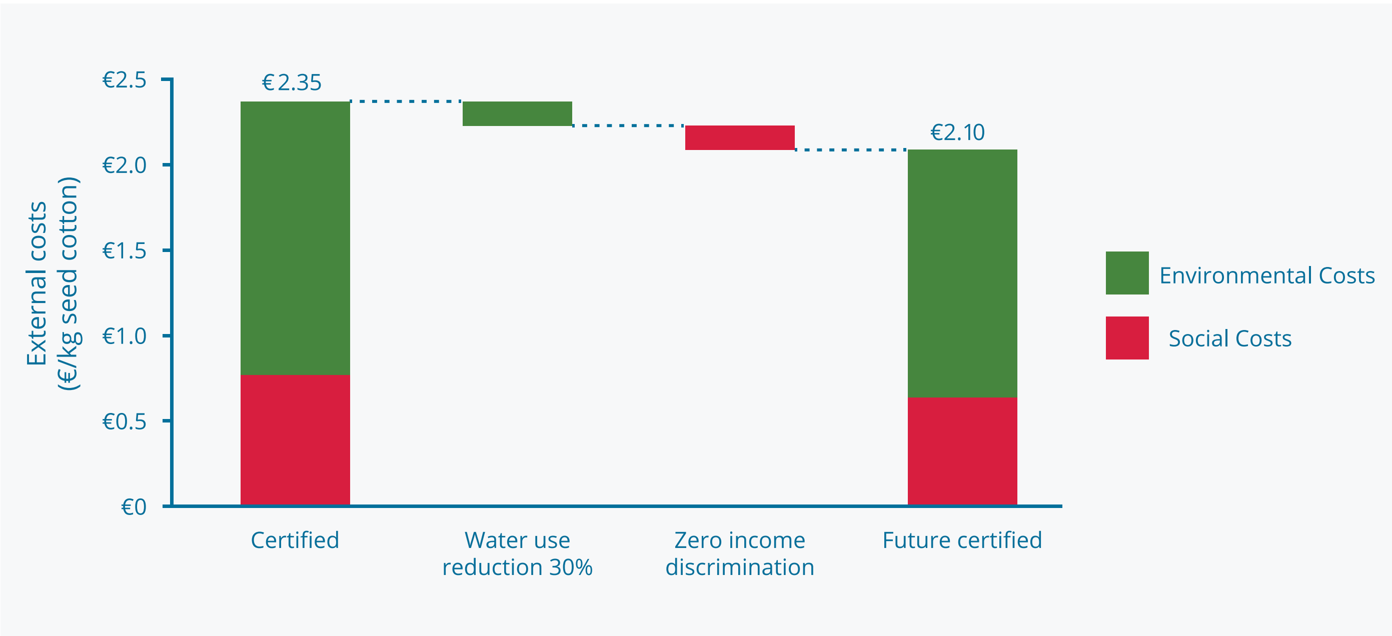
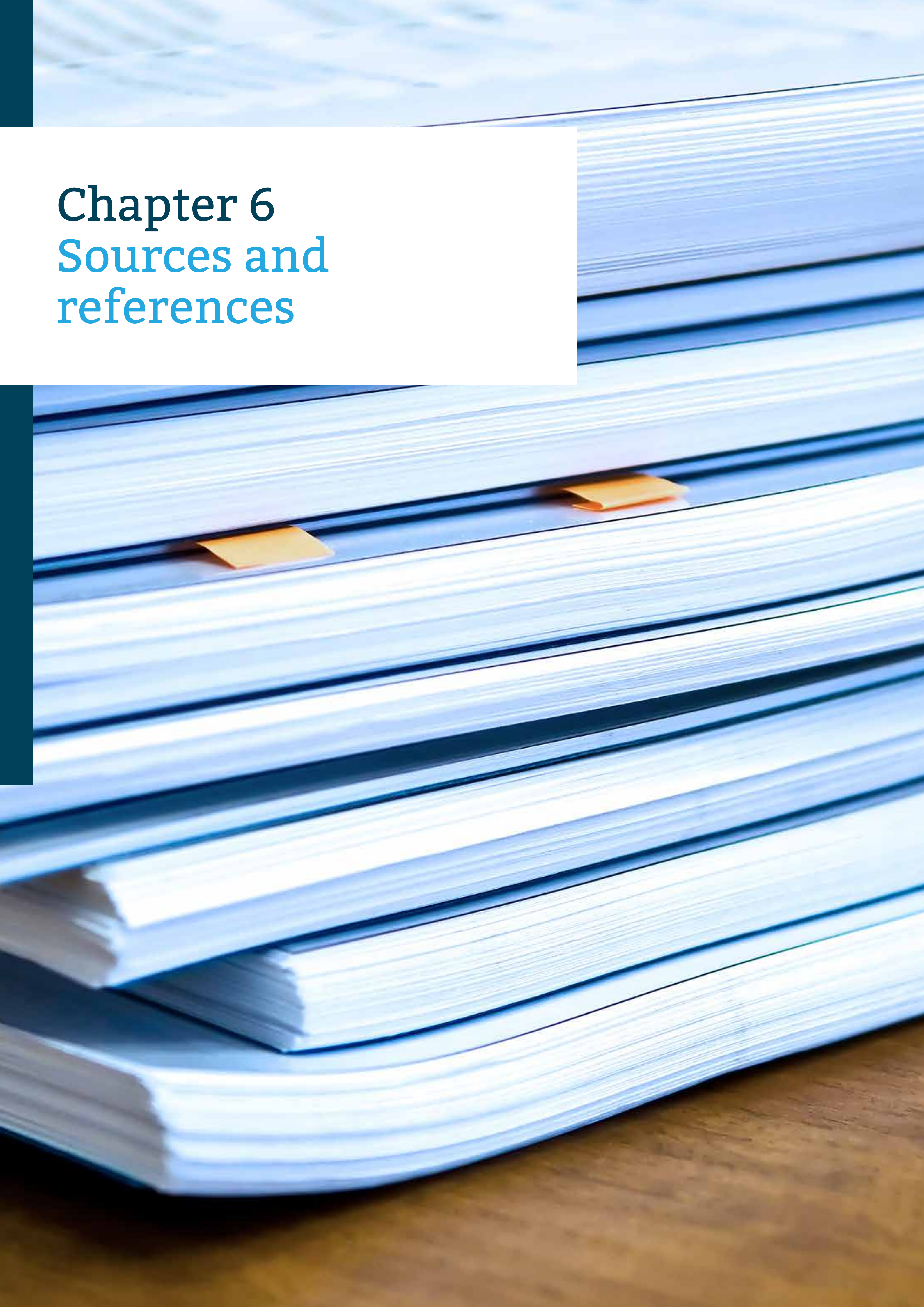


Figure 13 Effect of possible interventions on the external costs of cotton cultivation

Chapter 6
Sources and references



Key data Sources

The calculations in this study are based on a database of over 50 reports, articles and studies, including data from IDH. Figure 14 provides an overview of the key literature sources used in the study.

Key Literature (Cultivation)	
General (Includes environmental and social)	Directorate of Economics and Statistics (2013). *Cost of Cultivation, Production and Related Data 2010-2011 and 2011-2012*. India. Retrieved from: http://eands.dacnet.nic.in/Cost_of_Cultivation.htm.
Social	L. Da Corta & D. Venkateswarlu (2009). *Transition to Decent Work in Sustainable Cotton Farming in India. Challenges and Solutions*. India: Glocal Research. Venkateswarlu, D. (2010). *Signs of hope. Child and adult labour in cottonseed production in India*. Retrieved from. http://www.dol.gov/ilab/submissions/pdf/20100601.pdf. D. Venketeswarlu & J. Kalle (2012). *Wages of Inequality Wage Discrimination and Underpayment in Hybrid Seed Production in India.* Study commissioned by Fair Labor Association (FLA) and India Committee of the Netherlands (ICN). Retrieved from: http://www.indianet.nl/pdf/WagesOfInequality.pdf.
Environmental	M.K. Babu & M. Selvadass (2013). Life Cycle Assessment for Cultivation of Conventional and Organic Seed Cotton fibres. *International Journal of Research in Environmental Science and Technology*, 3(1). 39-45. Chapagain et al. (2005). *The Water Footprint of Cotton Consumption*. Value of Water Research Report Series No. 18, Delft: UNESCO-IHE. Retrieved from. www.waterfootprint.org. N. Franke & R. Mathews (2013). *C&A's Water Footprint Strategy. Cotton Clothing Supply Chain*. Water Footprint Network. Retrieved from. www.waterfootprint.org.

Key Literature (Manufacturing)	
General (Includes environmental and social)	Ministry of Textiles (2012). *Annual Report 2012/2013*. Government of India. Retrieved from: http://texmin.nic.in. Welspun India (2013). *Sustainability Report 2012-2013*. Retrieved from: www.welspun.com. Kandagiri Spinning Mills Ltd. (2014). *Annual Report 2013*. Retrieved from: www.kandagirimills.com. CIRCOT (2013). *Annual Report 2012-2013*. Retrieved from: www.circot.res.in. USDA (2012). *India Cotton and Products Annual*. GAIN Report Number IN2047. Global Agricultural Information Network. 3/30/2012. Retrieved from: http://gain.fas.usda.gov.
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Environmental	Chapagain, A., Hoekstra, A., Saveni, H., & Gautam, R. (2006). The water footprint of cotton consumption: An assessment of the impact of worldwide consumption of cotton products on the water resources in the cotton producing countries. *Ecological Economics*, 186-203. PE International (2014). *Life Cycle Assessment (LCA) of Organic Cotton – A global average*. November. Germany: Textile Exchange. Cotton Incorporated. (2012). *Life Cycle Assessment of Cotton Fibre & Fabric*. Retrieved from: http://cottontoday.cottoninc.com. J.M. Allwood et al. (2006). *Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom*. UK: University of Cambridge Institute for Manufacturing. Retrieved from: www.ifm.eng.cam.ac.uk. N. Franke & R. Mathews (2013). *C&A's Water Footprint Strategy. Cotton Clothing Supply Chain*. Water Footprint Network. Retrieved from. www.waterfootprint.org. WRAP (2012). *Review of Data on Embodied Water in Clothing Summary Report*. UK, Manchester: URS Infrastructure & Environment UK Limited Retrieved from: www.wrap.org.uk. Van der Velden et al. (2014). LCA benchmarking study on textiles made of cotton, polyester, nylon, acryl, or elastane. *The International Journal of Life Cycle Assessment*. February 2014, 19 (2), 331-356.

Figure 14 Overview of key literature

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