The True Price of Coffee from Vietnam

Joint report by IDH and True Price

True Price™

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:
www.trueprice.org

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 coffee supply chain** (smallholder cultivation in Vietnam) were investigated, as to inform decision making for IDH's coffee program. The external costs of conventional coffee beans were compared to certified coffee beans. 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 coffee in Vietnam has total **external costs of €1.25/ kg green coffee beans**. By summing up the external costs with the farm gate price (€1.35/ kg green beans), a true price of €2.60/kg green beans is obtained.

- 95% of the total external costs of cultivation are environmental costs, **28% are caused by scarce water use** from over-irrigation. The other largest external cost drivers are water pollution, energy use, air pollution and land use.

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

- The total external costs of cultivation, transportation and processing are **€2.00/kg green coffee beans**.

- The **cultivation phase accounts for 63% of the total external costs** of the coffee supply chain.

- **Certified coffee has 20% lower external costs** of cultivation than conventional coffee. 84% of this change is caused by lower water usage, 15% by higher productivity of certified farms and 1% by better social conditions. Lower water usage in certified farms also reduces energy use and air pollution. The application rates of fertilizers are slightly higher on certified farms, yet this does not change the external costs per kg green beans significantly.

- Certified farms are on average **13% more profitable than conventional farms**, with a yearly profit of € 1,695/ha vs. €1,472/ha.

- Interventions that **lower fertilizer application** by 34% have the potential to reduce the external costs of certified coffee by around 15% (€0.15/kg green beans). **Reducing scarce water use** by 32% has the potential to further decrease the external costs of certified coffee by around by 10% (€0.10/kg green beans). In total, environmental costs of certified coffee would be 25% lower.

- **Future impact research is needed** for certified and conventional farms, especially on water use, fertilizer application rates and energy use in order to improve the robustness of the results and better steer future interventions.

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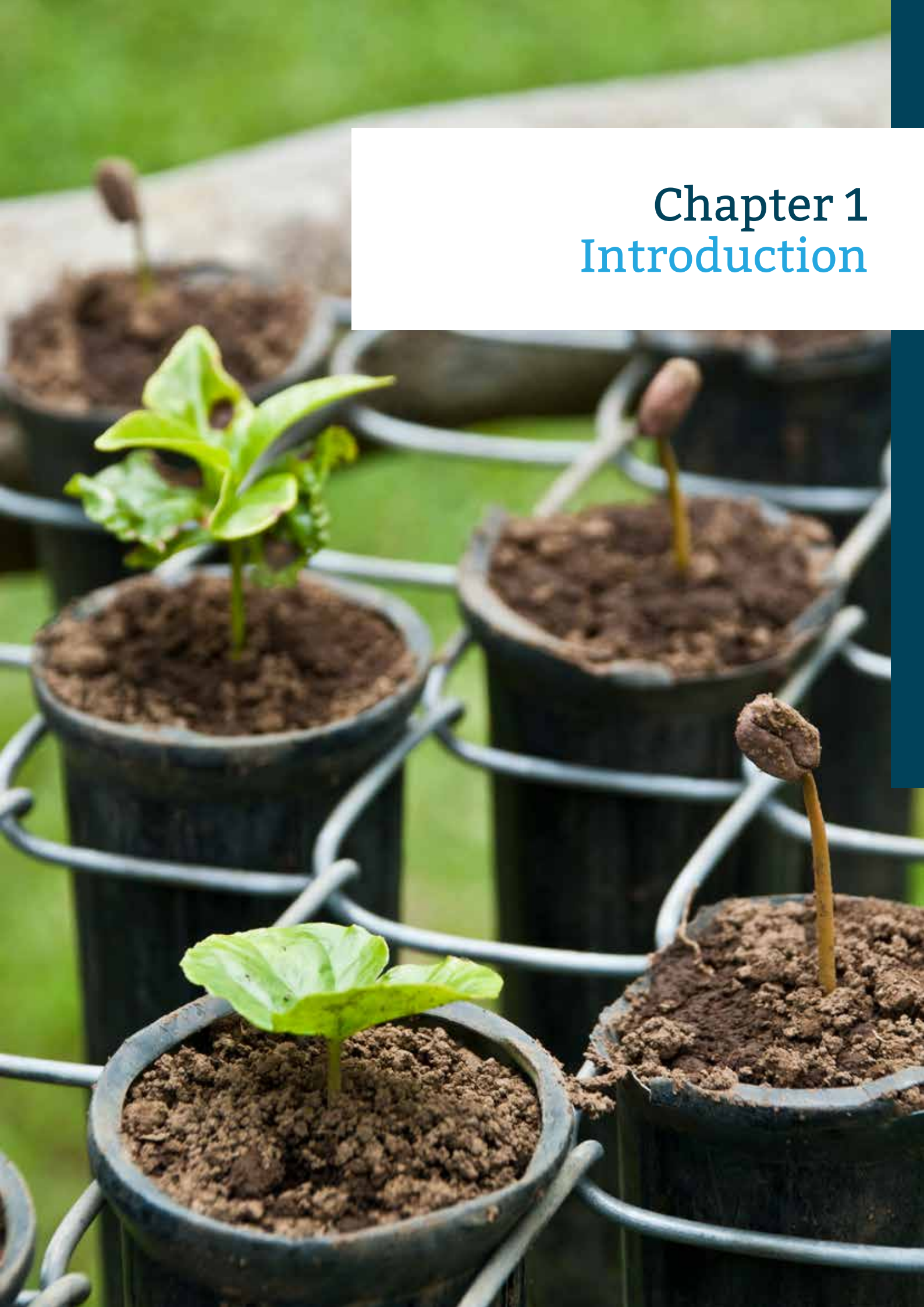

Chapter 1
Introduction

1.1 Context and challenge

In a market where the global demand for coffee is steadily growing 2.5% annually, Vietnam holds a key position. Production in Vietnam has increased strongly since the 1980s, making Vietnam the second largest producer of coffee by volume (18% of global market share), and the second largest coffee exporter (22% of global market share) (Potts, et al., 2014). Moreover, Vietnam is the world's leading producer of Robusta coffee, with 60% of global production originating from Vietnam (IDH, 2013; Panhuysen & Pierrot, 2014).

Coffee cultivation is concentrated in Vietnam's Central Highlands and grown by around 500,000 smallholder farmers, accounting for over 95% of the total production (IDH, 2013). Vietnam remains the world's most competitive coffee producer with the lowest global production cost (labour and input costs) and highest yields, meaning that coffee is highly profitable for smallholder farmers (IDH, 2013). This is due to an enabling environment where government policy support and a transparent and competitive Robusta marketing system promotes efficiency (FAO, 2007). One outcome of such an environment is that most of the export price of the exported coffee goes to the farmer (FAO, 2007).

The success of this large-scale cultivation of coffee in Vietnam, however, poses a threat to the environment. The most pressing issues in coffee cultivation are related to the environment, with over-fertilizing and over-irrigation being common practice among farmers. To give an example, conventional irrigation applies almost double the amount of water (1,700 cubic meters per hectare) than best practice irrigation methods (730 cubic meters per hectare) (IWMI, 2013). Farmers over-fertilize by applying almost a ton of fertilizers per hectare in a year (COSA, 2013; KUIT, 2013). Additionally, the cultivation system of unshaded monoculture, where canopy layers are completely removed to provide maximum exposure to the sun and increase yields, is popular in Vietnam (FAO, 2007; Panhuysen & Pierrot, 2014). The combination of these practices has negative impacts on water use, water pollution, land degradation and deforestation.

There is growing evidence that coffee cultivation is being increasingly affected by climate change due to high temperatures, dry weather and heavy rains (Panhuysen & Pierrot, 2014). According to some models, climate change threatens to impact Vietnamese coffee production by reducing the suitability of areas available for coffee (Bunn, Läderach, Rivera, & Kirschke, 2014). This could have an effect on farmer's livelihoods, whose yields would be affected and possibly put additional pressure on the environment with farmers seeking more suitable coffee growing areas.

Currently coffee roasters are strengthening their sustainable procurement criteria and many have committed to source coffee that comply with voluntary certification standards (Panhuysen & Pierrot, 2014). This rise in demand is helping voluntary coffee standard systems to make progress. According to The State of Sustainability Initiatives Review 2014, about 33% of the coffee beans produced in Vietnam in 2012 were certified, either 4C (20%), UTZ (11%) or Rainforest Alliance (1%) (Potts, et al., 2014). This share is set to grow during the coming years, especially because verification costs in Vietnam are among the lowest in the world (IDH, 2013). This will allow Vietnamese farmers to become certified without investing significant amounts of resources. Research shows that certification seems to contribute to influence farmers' knowledge and implementation of good agricultural practices (COSA, 2013; KUIT, 2013).

Many reports have been written about the coffee sector in general and the Vietnamese coffee sector specifically. However, many studies to date fail to quantitatively measure the social and environmental externalities throughout the value chain and make the comparison between conventional coffee cultivation and alternatives.

1.2 Goal and scope of research

One barrier to reducing social and environmental costs effectively in the coffee market system, like any other market system, is the lack of quantitative assessments of the size and materiality of the various environmental and social externalities of coffee 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 coffee 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 coffee supply chain and by comparing conventional to certified coffee. Certified coffee is produced on a farm that holds one or more certifications from a voluntary standard system. Conventional coffee 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 coffee 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[1] of coffee production in Vietnam?
2. What are the most material externalities?
3. How are external costs divided over the coffee supply chain?
4. Is there a difference between certified vs. non-certified coffee?

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[2] coffee production were investigated. The study focuses on smallholders, as they account for 95% of coffee production (IDH, 2013).

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 analysis for the transportation, processing and consumption phases were of 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 coffee 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 coffee 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 needed 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 coffee 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: cocoa from Ivory Coast, tea from Kenya and cotton from India. The results of these studies are useful to place the coffee 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 coffee from Vietnam. 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 ('What is the true price of a cup of coffee?') and by comparing the results of coffee to three other country-specific commodity supply chains: cocoa from Ivory Coast, tea from Kenya and cotton from India. 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 coffee supply chain.

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

2 In this report, no specification of the investigated certification mechanism is provided due to confidentiality reasons

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

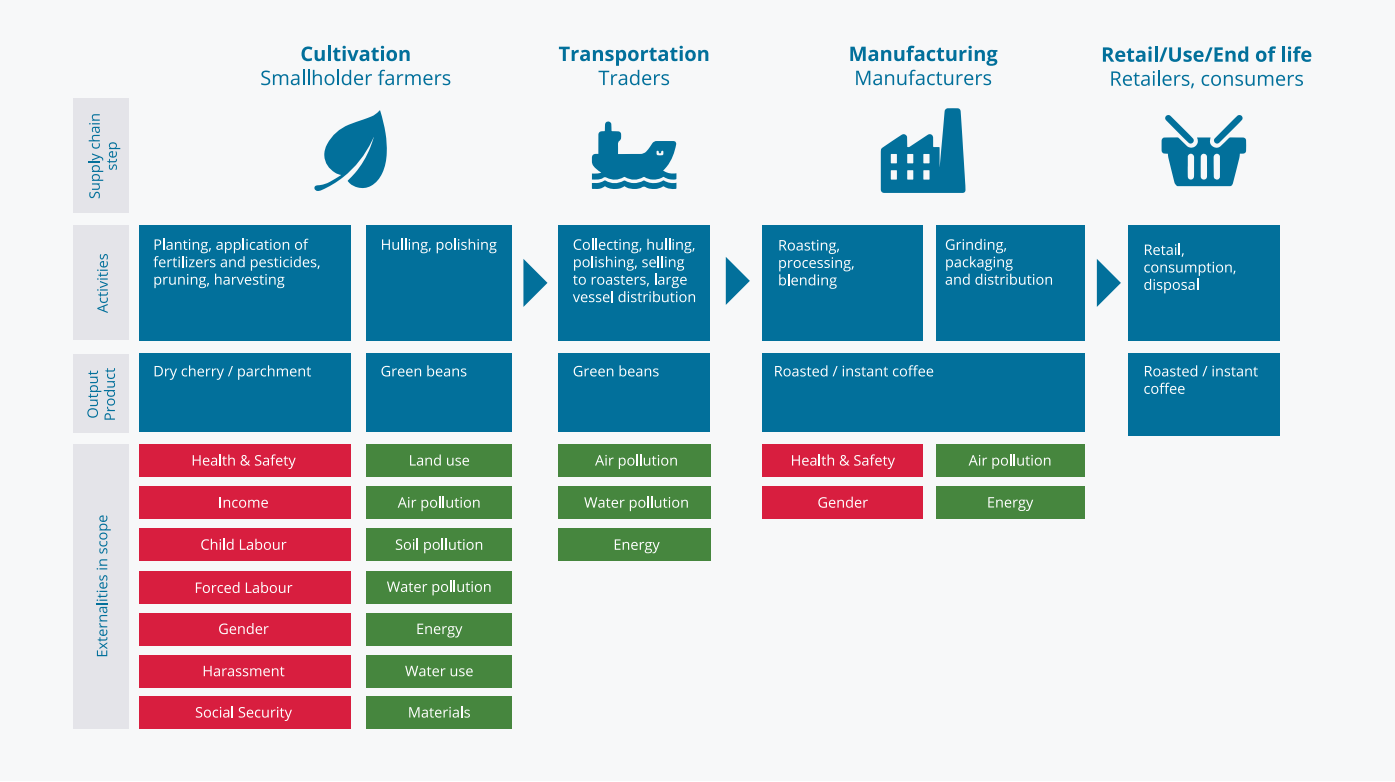

Figure 1 scope of the True Price study [3]


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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 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

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.

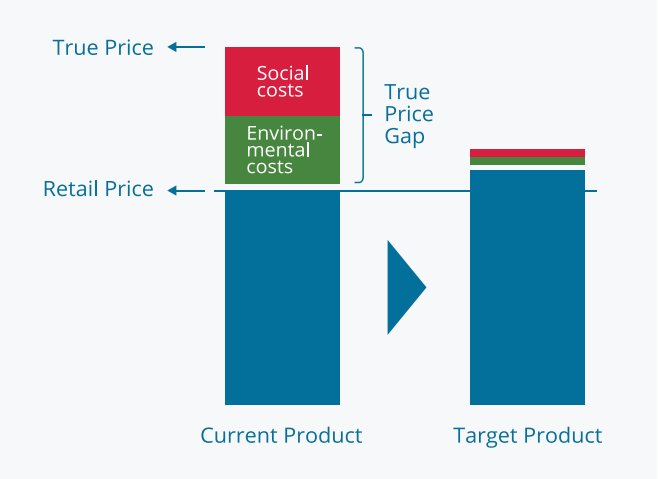


Figure 3 Reducing the true price of a product

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[4], 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

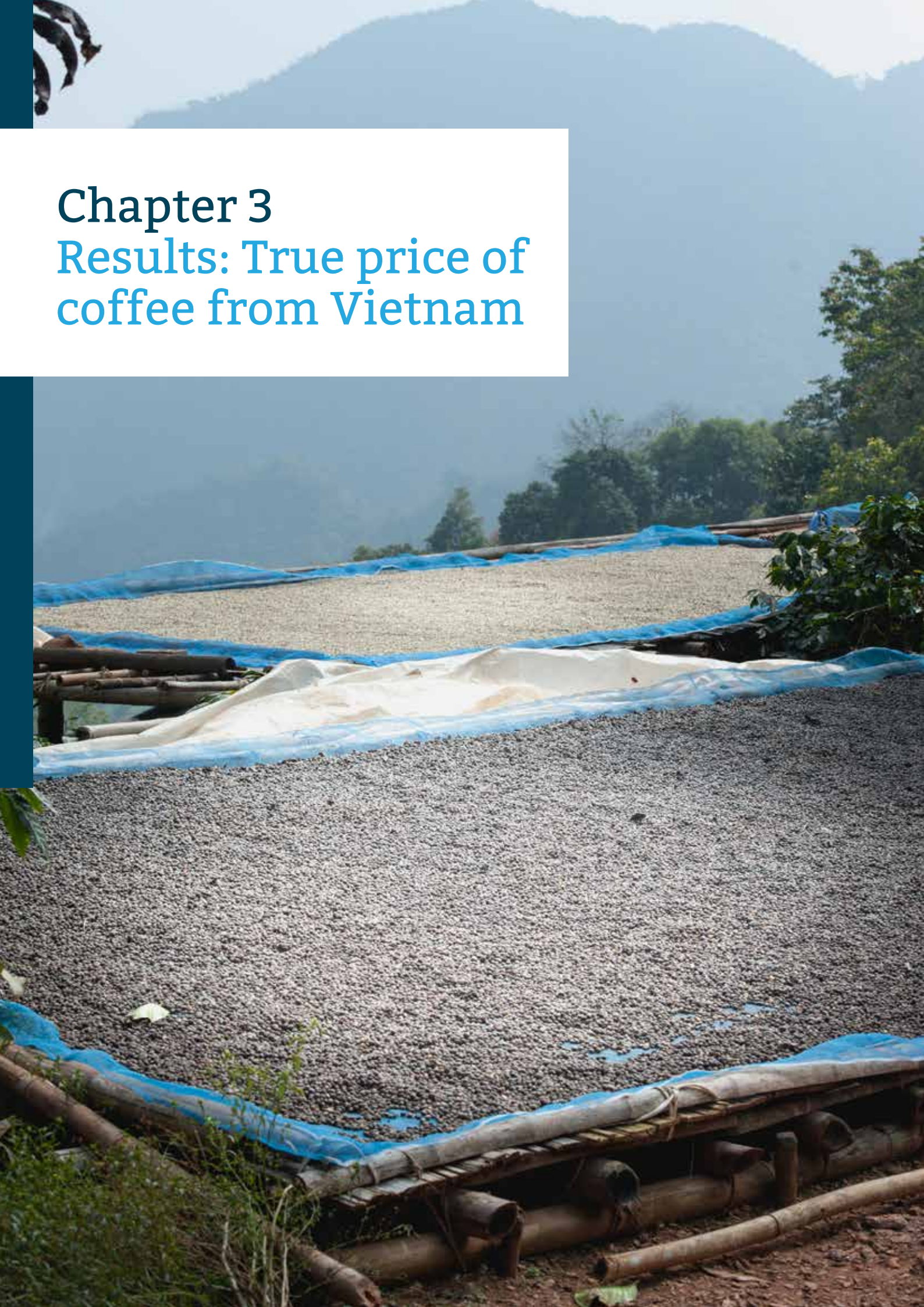
2. **Cost reduction**: identify projects that are both sustainable and increase resource efficiency to reduce costs

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

4 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 coffee from Vietnam



3.1 Size of external costs of coffee cultivation

The calculated true price of conventional green coffee beans is €2.60/kg green beans. This is the sum of the farm gate price (€1.35/kg green beans) and the external costs of cultivation (€1.25/kg green beans). The latter is also called the true price gap.

The true price gap is only slightly smaller than the farm gate price of green beans. This shows that at farm level there are substantial hidden costs relative to the market price. Environmental costs account for 95% of total external costs of cultivation. Social costs are relatively low as most farmers have a decent income and there are minor health and safety and child labour issues during cultivation.

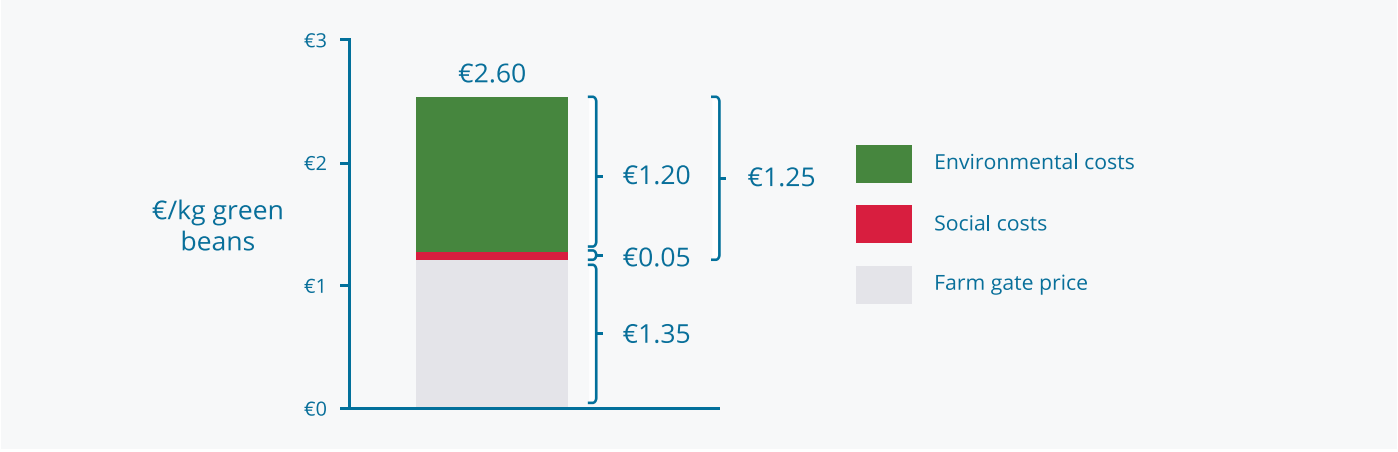


Figure 4 True price of 1 kg green (coffee) beans

3.2 Most material externalities of coffee cultivation

The most material externalities during the cultivation of conventional coffee in Vietnam are water use, water pollution and energy use.

- **Water use (28%):** over-irrigation is a common practice among Vietnamese coffee farmers. In some cases, farmers use more than double the amount of water than what is required by best practice irrigation methods.

- **Water pollution (22%):** over-application of fertilizers is a common practice among Vietnamese coffee farmers to increase yields. Water is polluted when excessive fertilizers run into water bodies, causing eutrophication.

- **Energy use (19%):** there are two main drivers of energy use; the production of fertilizers, which requires large amounts of energy, and the water pumps used for irrigation.

Additionally, air pollution (17% of total external costs) is also significant, caused mainly by greenhouse gas emissions from the production of fertilizers, the decomposition of the coffee husks and from coffee washing. Finally, land use (6% of total external costs) and social security (3% of total external costs) are smaller impacts but still significant. It should be noted that while deforestation is considered a crucial issue in the Vietnamese coffee sector by many NGOs, surprisingly, when compared against all other impacts, the external costs of land use are relatively low. An explanation for this is that even though the area of coffee cultivation has expanded considerably over the last 30 years, accounting for 6% of total arable land in Vietnam, most of this expansion happened in existing agricultural lands (Meyfroidt, Phuong, & Anh, 2013). It is also important to keep in mind that the other drivers of deforestation are illegal logging, together with pressure from the two other main agricultural crops including cashews and rubber trees (Dollette, 2013; Meyfroidt, Phuong, & Anh, 2013; SNV & IIED, 2010; WWF, 2015) These factors have also been taken into account in the calculations.

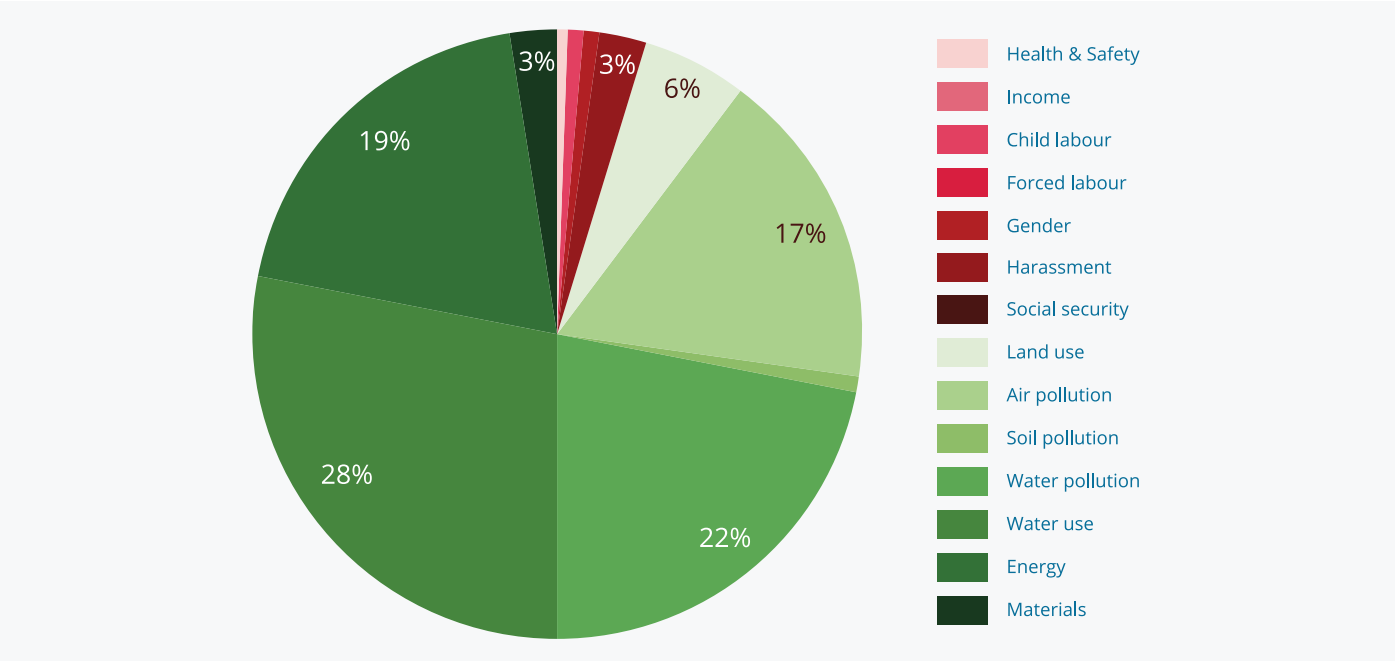


Figure 5 Share of each externality in the total external costs of cultivation

The following sections give a more detailed description of the most material externalities of coffee cultivation.

3.2.1 Water Use

Water use represents one of the largest external costs of coffee cultivation in Vietnam. On average, conventional farms use about 1,700 cubic meters of water per hectare, compared to about 1,050 cubic meters of water per hectare for certified farms. A study by the International Water Management Institute found that best practice methods require 730 cubic meters of water per hectare (IWMI, 2013). Approximately 87% of Vietnamese coffee cultivation is irrigated. This leads to declining water tables in coffee areas due to excessive water use and prolonged droughts (World Bank, 2011). In addition, blue water availability in Vietnam is scarce for about 6 months per year, which further increases the external cost of water use (Hoekstra, Mekonnen, Chapagain, Mathew, & Richter, 2012).

3.2.2 Water Pollution

Another significant external cost in coffee cultivation is water pollution due to fertilizer run off, caused by over-application of fertilizers. Non-certified farmers apply on average 890 kilograms of NPK (Nitrogen, Phosphorus and Potassium) per hectare while certified farmers apply on average 966 kg per hectare (COSA, 2013; KUIT, 2013). Literature indicates that the optimal level of fertilizer application for coffee trees in Vietnam is around 640 kilograms of NPK per hectare (KUIT, 2013).

3.2.3 Energy use

The two previous externalities are drivers for the third largest externality in the cultivation of coffee in Vietnam; energy use. The production of fertilizers is an energy intensive process, accounting for a significant part of total energy use. On the other hand, since most coffee is irrigated, electrical and diesel pumps are used to pump water from the ground, contributing as well to energy use (World Bank, 2011). Additionally, the use of hulling and polishing machines by farmers or national traders also contributes to the overall energy use.

3.3 Division of external costs over the coffee supply chain

In the coffee supply chain, 63% of the researched external costs take place during the cultivation phase. This analysis is based on a highly simplified representation of the coffee supply chain. Moreover, indirect players that also contribute to the external costs of the end product, such as financial institutions and suppliers of equipment, are excluded from the scope. Transportation of coffee beans – within Vietnam and to Europe and the United States for processing – accounts for 25% of total external costs and processing of green coffee beans to roast and instant coffee has a share of 13%. As processing takes place in Europe and the United States, where social conditions are usually better and roasters process large quantities of coffee with low number of employees, social costs per kilogram of roasted coffee are almost negligible. Therefore, 99.7% of the external costs made during processing are environmental costs.

3.4 Difference between certified and conventional coffee

In this research conventional coffee was compared to certified coffee 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 coffee 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. This requires specific impact data for two groups of certified and conventional (control) farms over multiple periods in time.

The external costs of cultivation of certified coffee are about 20% lower than those of conventional coffee. 84% of this change is caused by lower water usage. Lower water usage in certified farms reduces scarce water use, but also avoids energy use for irrigation pumps and in return also reduces air pollution. 15% of the reduction

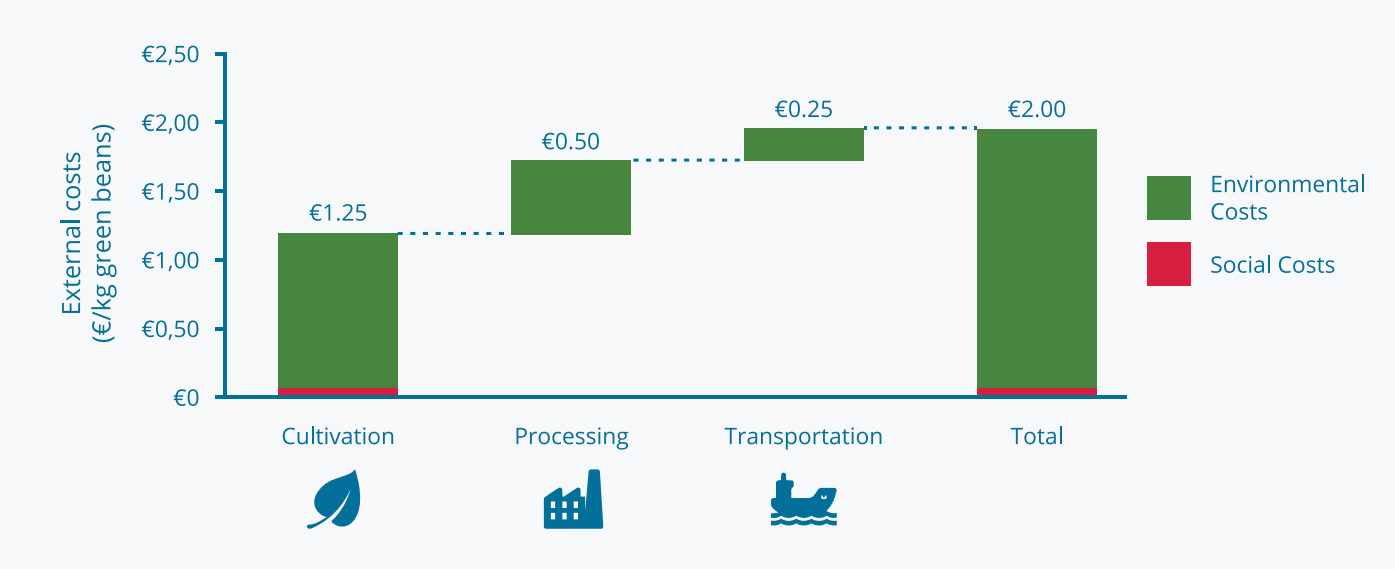


Figure 6 Division of external costs over the coffee supply chain

of external costs can be explained by the higher productivity (efficiency) of certified farms and the remaining 1% due to improved social conditions on certified farms. Application rates of fertilizers are, on average, higher on certified farms, which increases the cost of water pollution. However, as yields on certified farms are also higher, the rise in water pollution cost per kg green beans is limited[5].

The most material externalities for certified farms are similar to those for conventional farms. Water pollution remains the largest externality due to the high use of fertilizers. Although certified farms use less water, this still remains the second largest externality due to the relatively high amounts of water applied. However, because less energy is required to pump less water, energy use drops, making air pollution the third largest externality. Air pollution is caused by a combination of on-farm coffee processing of coffee cherries, which produces methane and carbon dioxide, the decomposition of husks and the emissions caused by the production and application of fertilizers.

Certified farms appear slightly more profitable than conventional coffee farms. This is caused by higher yields, likely due to Good Agricultural Practices (GAP) and less irrigation. The higher farmer income results in a slightly lower external cost of income (under-earning) for family labour in conventional farms. It was found that on conventional farms the average income per family per year is €2,380, whereas the average income on a certified farm is €2,800 per family per year. Figure 8 represents the revenues, costs and net income for the average conventional and certified farm. This was calculated using data from two representative studies and shows that while interest, tax and investment costs are higher for certified farms, they do earn a higher net income. The reason for this is that certified farms have higher yields (and, as such, revenues) as well as lower input costs (COSA, 2013; KUIT, 2013).

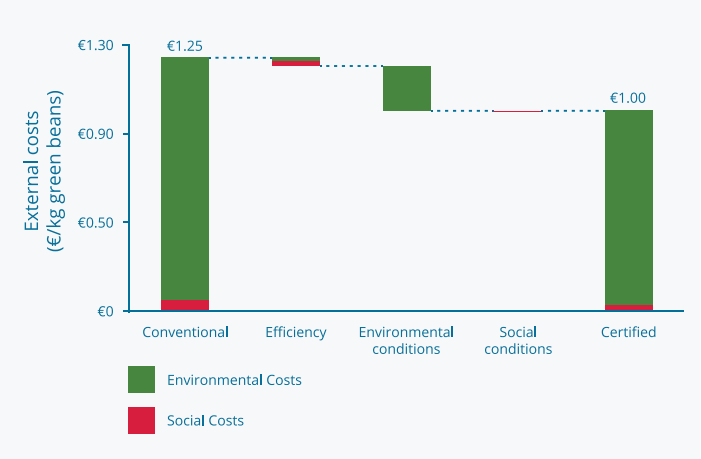


Figure 7 Reduction of external costs for certified coffee

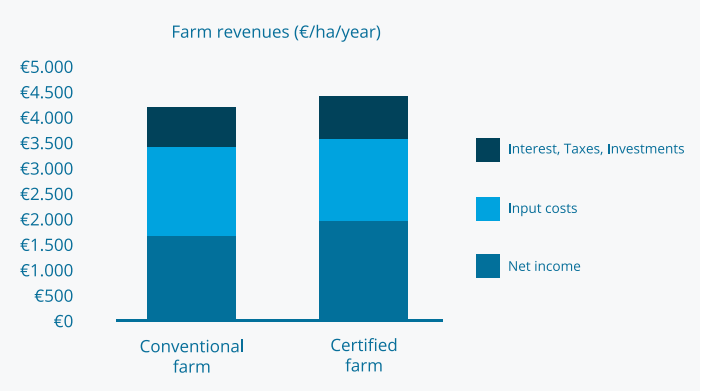


Figure 8 Revenues (split up in costs and net income) for the average conventional and certified farm

5 It is important to note that the choice of the type of fertilizers and pesticides is highly relevant to the size of the environmental costs.

Chapter 4
Results in context

4.1 What is the true price of a cup of coffee?

An interesting perspective arises, when considering the true price at retail level, in addition to farm level. The average true price of a conventional cup of homebrew coffee is €0.12, which consists of the retail price of a cup of coffee (€0.10) and the true price gap (€0.02). The retail price reflects the cost of 10 grams of roasted coffee beans from a large pack (€10/kg), sold in a European supermarket. The cost of water is negligible and not accounted for in this calculation. The true price gap reflects the external costs of cultivation, transportation and processing of coffee. The consumption phase contributes an additional 10% to the true price gap; about €0.01 per cup. Consumption of coffee is assumed to occur in Europe by using an average coffee machine[6]. Energy use by coffee machines, coffee grinding and boiling water makes up the largest share of environmental impacts during coffee consumption.

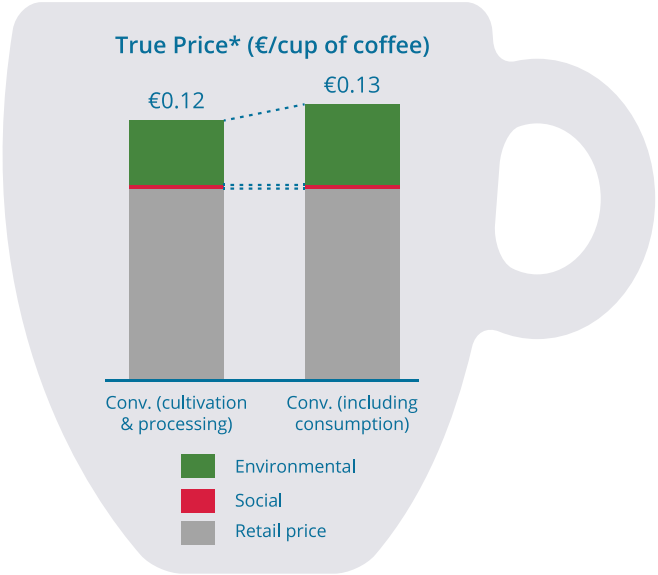


Figure 9 True price of a cup of coffee

The true price per cup of coffee as previously discussed and depicted in figure 9 is based on a cup of coffee prepared and consumed at home. Taking a closer look at the relative size of the externalities compared to the retail price this comes down to about 35% of the retail price. When considering a cup of coffee ordered in a restaurant or bar, the retail price will be around €2.50. Relatively to this retail price the external costs associated with the actual coffee production will be about 5%[7].

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6 Data combines three types of brewing: French press, filter drip and automatic coffee machine

7 Only externalities associated with coffee cultivation, processing, and consumption are included. The externalities associated with the activities of the restaurant or bar itself are not included.

4.2 How does coffee compare to other sectors?

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

4.2.1 Farm level

Compared to other sectors, the external costs of smallholder coffee cultivation in Vietnam are about 4.5 and 3 times lower than for cocoa beans (Ivory Coast) and seed cotton (India) respectively, and about 2 times higher than for green leaf (Kenya). Cocoa cultivation in Ivory Coast has the highest share of social costs compared to environmental costs. For coffee cultivation in Vietnam and cotton cultivation in India environmental issues predominate.

Figure 10 also shows how farm gate prices for Vietnamese green coffee beans and Kenyan green leaf are closer to their respective true farm gate prices. Ivorian cocoa beans and Indian seed cotton clearly have the highest hidden costs per kg of farm gate product.

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 3 times higher than for Vietnamese coffee beans. The high yields in this sector are largely responsible for the low external costs per kg green leaf.

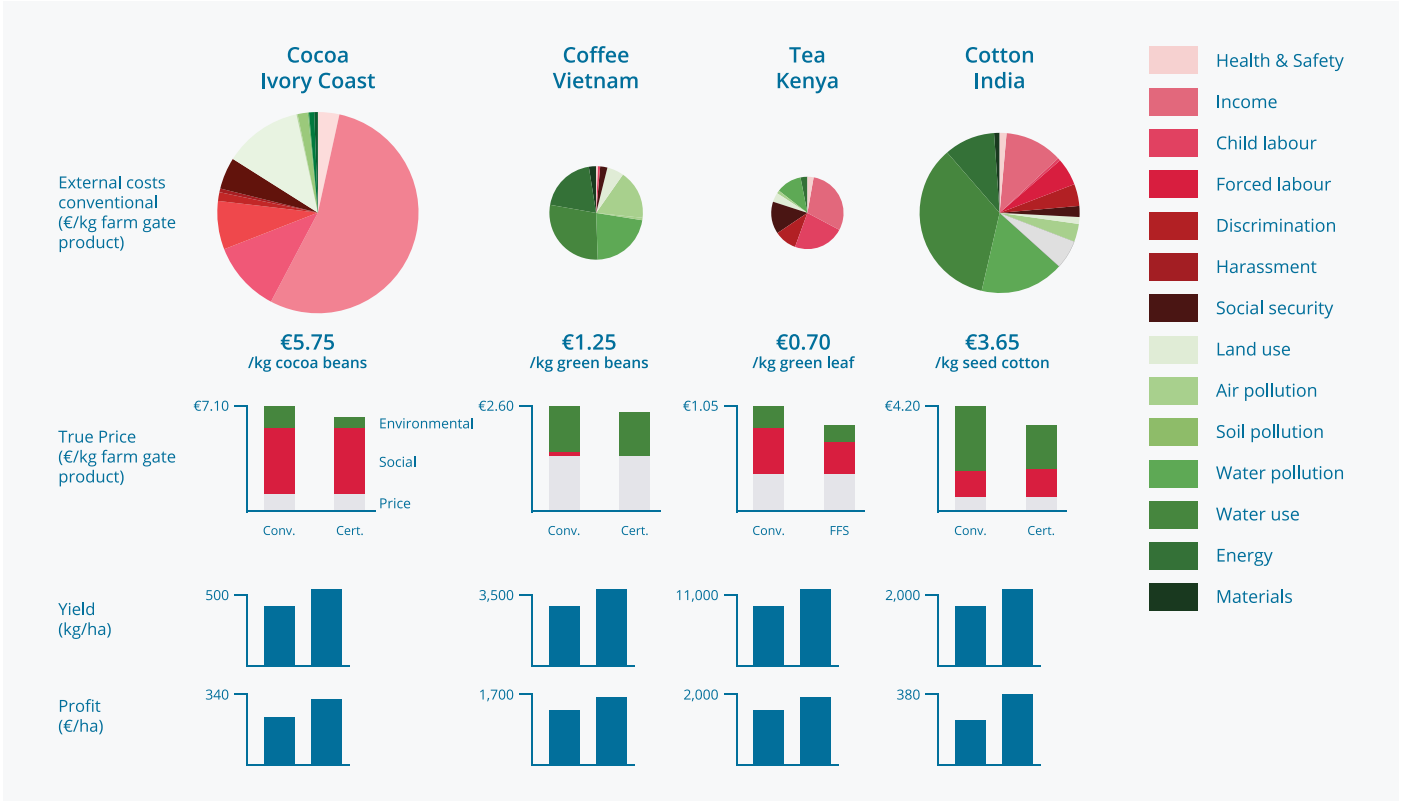


Figure 10 True farm gate prices of four country-specific commodities (conventional and certified) and their corresponding yields and profit values

4.2.2 End product level

The total external costs of cultivation, transportation and processing are €2.00/kg green coffee beans, which is about 2 times higher than for Kenyan tea, but about 3 and 5.5 times lower than for Ivorian cocoa beans and Indian cotton respectively. This is due to the high external costs of cotton processing and high social external costs of cocoa cultivation.

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 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 has a relatively high true price gap.

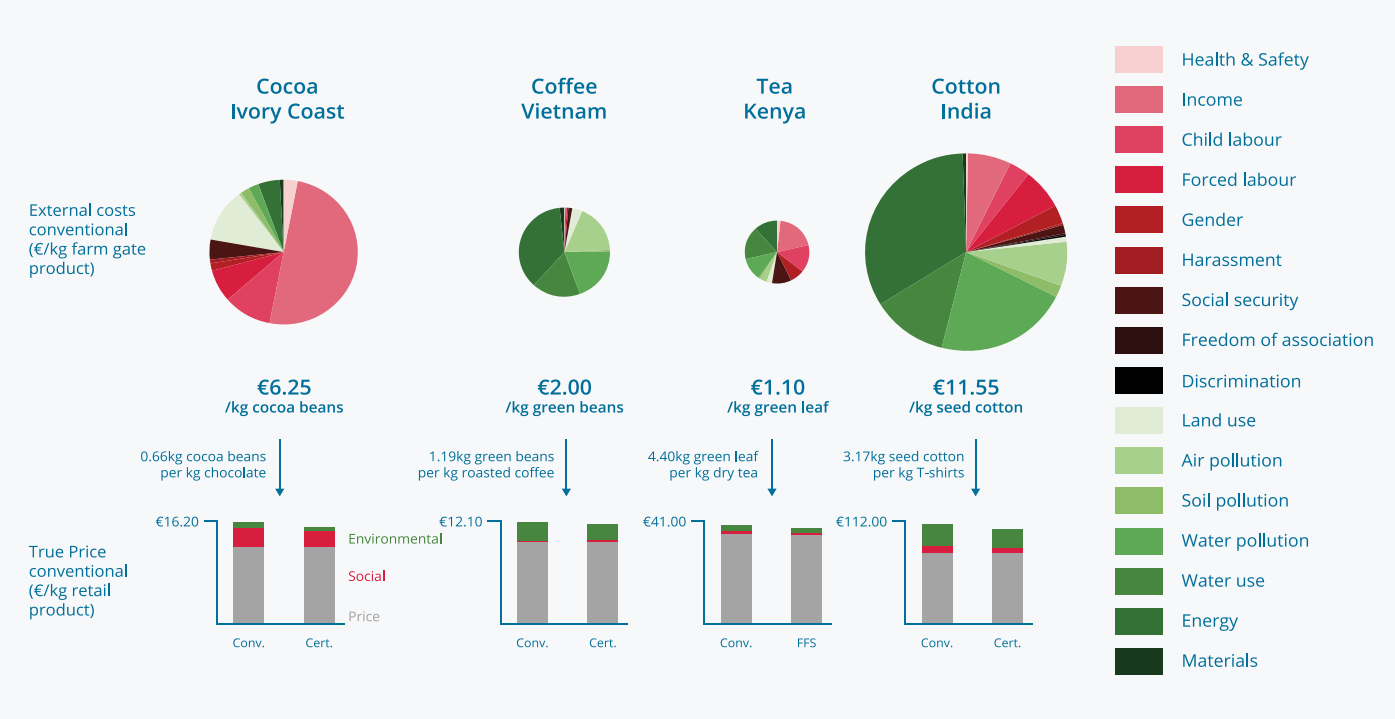


Figure 11 True retail prices of four country-specific commodities (conventional and certified). External costs on this slide include cultivation, transportation and processing, but exclude retail, consumption and end-of-life treatment.

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 transportation and processing phase had a less rigorous nature, but still provide a robust estimate. The retail phase, while possibly significant in terms of environmental externalities, was excluded from this study, due to low relevance for the IDH program. 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 coffee beans produced by smallholders in Vietnam, transported to Europe and the United States and processed in Europe and the United States.

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 coffee beans.

Data availability and quality

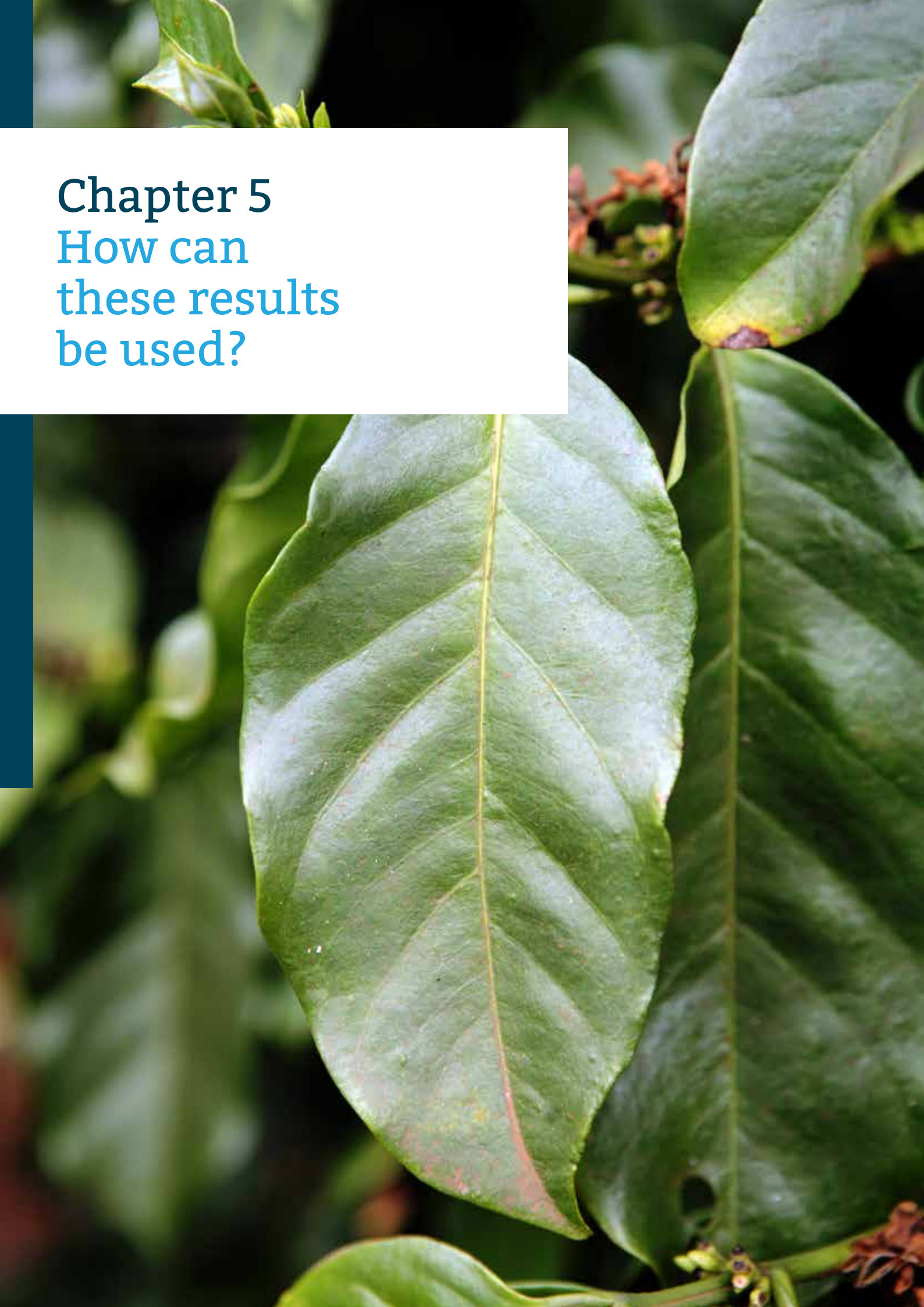
The majority of data was based on two large academic studies that are representative of the main coffee producing regions. These studies have different ways of grouping data, which made it difficult to disaggregate some indicators. To compensate, data was complemented by additional studies that considered individual impacts separately.

Averages were used to represent the data. However, there often was a high variability across sources and regions for key indicators (i.e. fertilizer application rates, hired labour wages). This causes uncertainty on the end results. 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 all processing takes place in Germany (in reality 20% of Vietnamese coffee is exported to Germany), to keep the analysis manageable, and that energy used in irrigation is provided by diesel.

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 impact 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 coffee production in Vietnam. 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 61% of all researched external costs throughout the coffee 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 coffee cultivation in Vietnam, most impact can be realized by focusing interventions on (i) improving irrigation practices to reduce scarce water use, and (ii) improving fertilizer application rates to reduce water pollution and energy use.

The focus of both of these interventions would be on optimization of water and fertilizer use, without affecting yields. A specific intervention for water use would be better irrigation scheduling and more efficient application techniques. By implementing good agricultural practices farmers can reduce water use by 32%, which in turn can reduce the external costs per kg of coffee beans and also create more income as

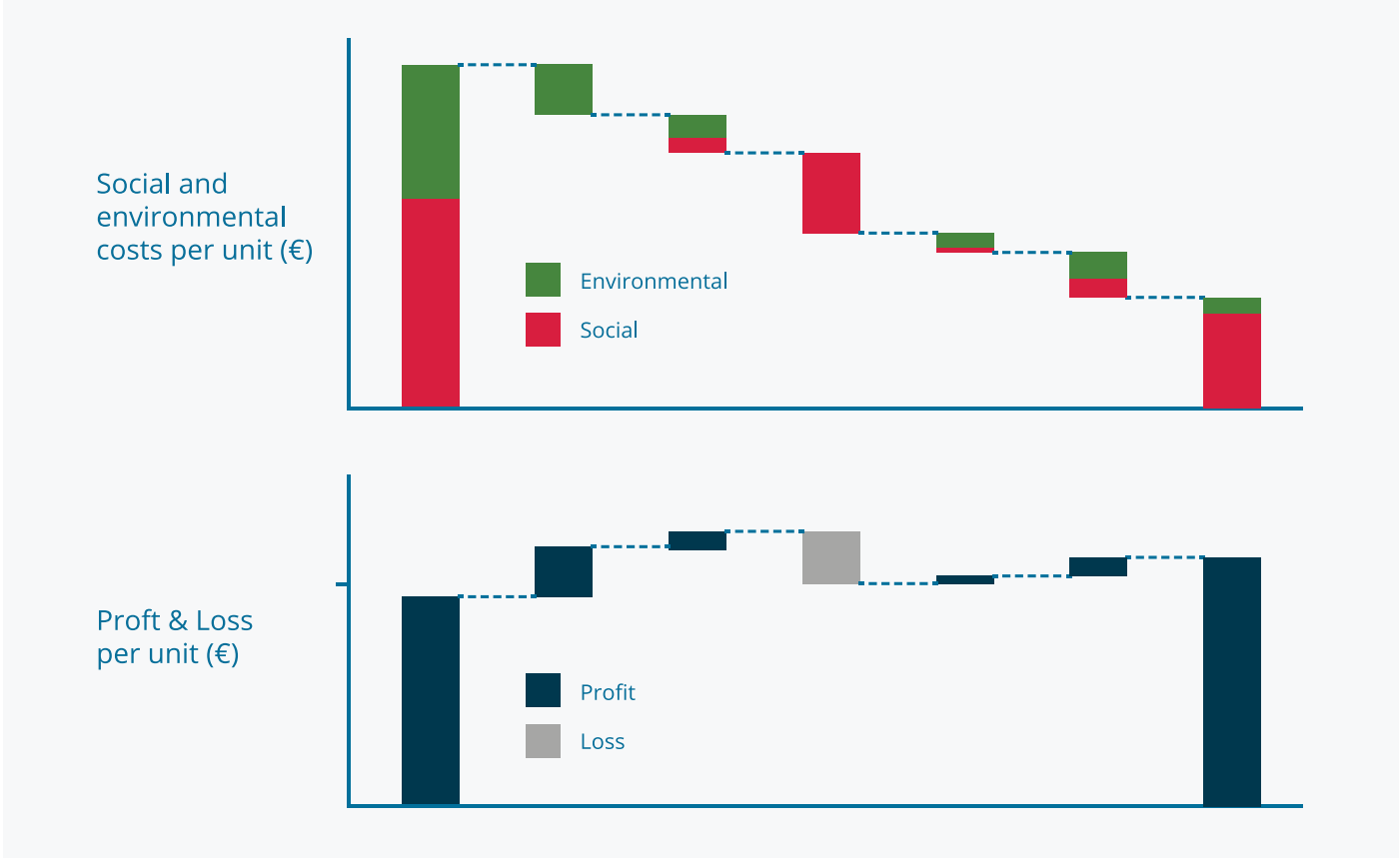


Figure 12 Hypothetical business case analysis of possible interventions

irrigation pumps will use less energy. Secondly, an intervention aimed at applying optimal levels of fertilizer and pesticide can reduce the use of these agro-chemicals by 34%. This will not only reduce water pollution and energy use but can also reduce input costs due to lower fertilizer and pesticide application, providing another way to increase income. If these interventions were to be executed successfully, lowering water use has the potential to further reduce the external costs of certified coffee by 10% (€0.10/kg green beans), while lowering fertilizer and pesticide application has the potential to further reduce the external costs by around 15% (€0.15/kg green beans). In total, environmental costs of certified coffee would be 25% lower. The possible interventions are based on suggested figures found in literature (KUIT, 2013; IWMI, 2013).

Figure 13 shows how these interventions potentially result in a reduction of the external costs to €0.75/kg green beans. 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.

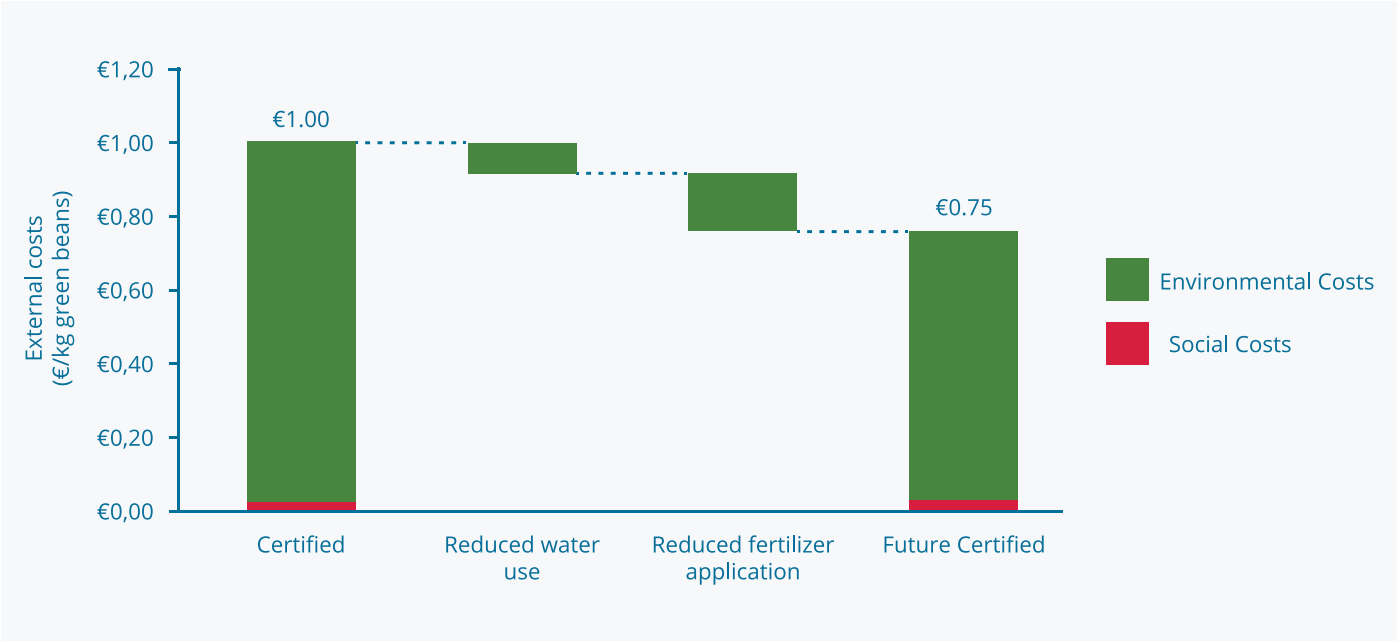
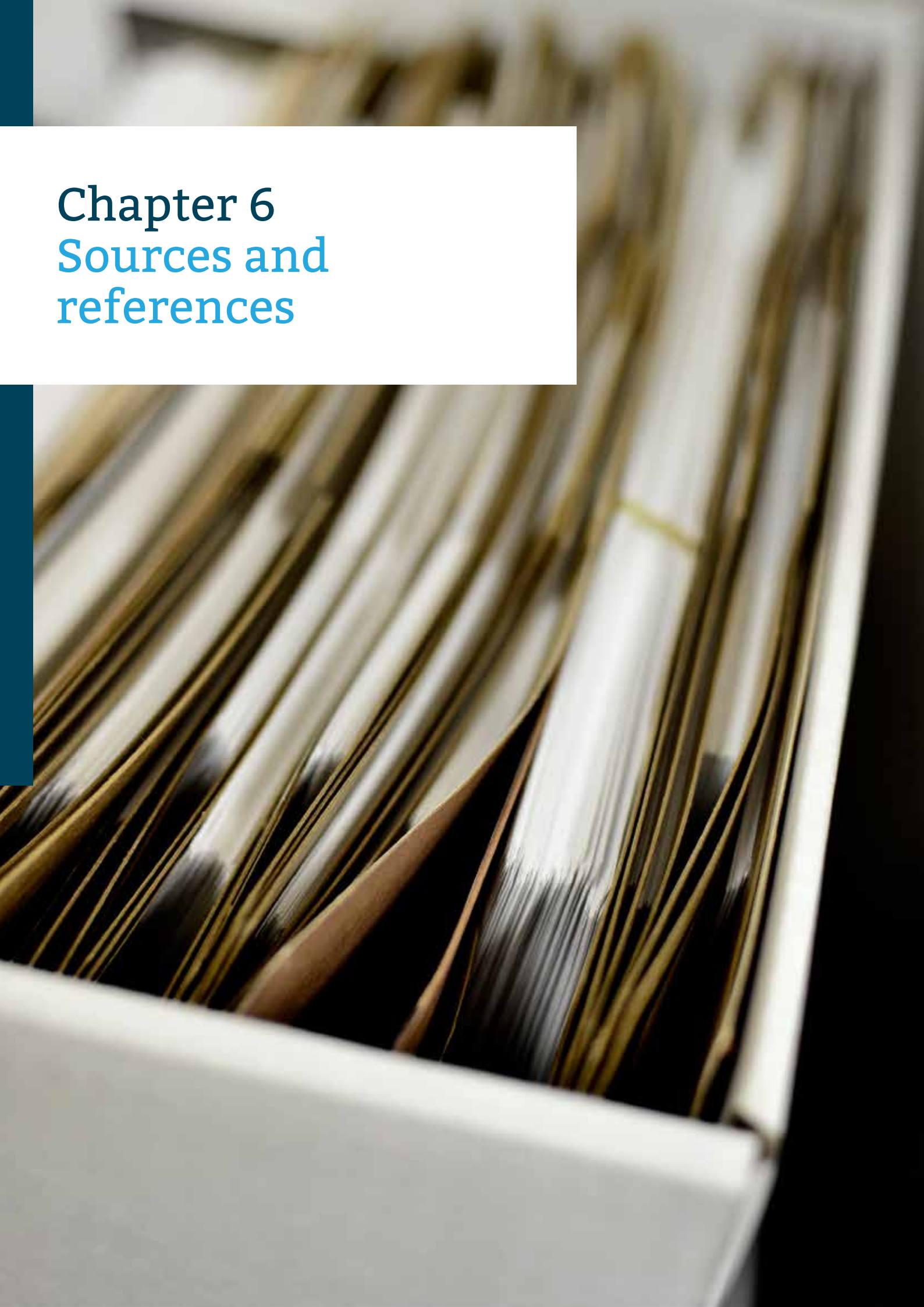


Figure 13 Possible interventions to reduce external costs



Chapter 6
Sources and references

Key data Sources

The calculations are based on a database of over 30 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 & social)	COSA. (2013). *Vietnam Coffee: A COSA Survey of UTZ Certified Farms*. Committee on Sustainability Assessment. Philadelphia, USA. FAO. (2007). *Diversification by smallholder farmers: Viet Nam Robusta Coffee*. Agricultural Management, Marketing and Finance Service. IDH. (2013). A Business Case for Sustainable Coffee Production. Technoserve. Kuit Consultancy. (2013). The Sustainable Coffee Conondrum. A study into the effects, cost and benefits of implementation modalities of sustainable coffee production in Vietnam. Nestle, IDH. (2014). The Rural Development Framework Analysis. Vietnam. Potts, J., Lynch, M., Wilkings, A., Huppé, G., Cunningham, M., & Voora, V. (2014). *The State of Sustainability Initiatives Review 2014. Standards and the Green Economy.* Winnipeg and London: International Institute for Sustainable Development (IISD) and the International Institute for Environment and Development (IIED). USDA GAIN. (2009-2014). Vietnam Coffee Annual Report.
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Figure 14 Overview of key literature

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