Master Thesis

Aligning Climate Change Mitigation and Adaptation in Coffee Production: Insights from Nespresso's Strategy and Smallholder Farmers' Actions in Uganda

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0. Abstract

Climate Change presents a dual challenge for coffee production, particularly for smallholder farmers in the global south as they are both key contributors to and at the same time highly vulnerable to climate change and its impacts. This thesis investigates the intersection of climate change mitigation and adaptation, which are central concepts to the resolution of this challenge, in the coffee sector by examining the actions of smallholder coffee farmers and the decarbonisation strategy of Nespresso in Uganda. In a qualitative case study which combined semi-structured interviews and a document analysis, the study identified a range of practices, including agroforestry, soil and water conservation, and organic fertilization, that can help coping with climate impacts while at the same time having potential to reduce greenhouse gas emissions. In the research an analytical framework that distinguishes between mitigation, adaptation, synergies, and trade-offs was applied. This helped revealing how certain practices, such as agroforestry, serve dual functions, while others may lead to trade-offs depending on implementation and context. The study finds that although Nespresso and smallholder farmers implement/support several overlapping practices, their motivations often differ. While Nespresso is mainly driven by decarbonisation goals, farmers main motivation lies in enhancing their livelihood resilience. The findings contribute to the broader scientific discussion on integrating mitigation and adaptation in agricultural supply chains focusing on production and highlight the importance of inclusive, context-specific strategies. They also point to opportunities for companies to learn from local practices and to design climate strategies that equitably support smallholder farmers.

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List of figures/tables, abbreviations/definitions

EU CSRD: European Union Corporate Sustainability Reporting Directive

IPCC: International Panel on Climate Change

UNFCCC: United Nations Framework Convention on Climate Change

GHG: Greenhouse Gas Emissions

WWF: World Wildlife Fund

CSV: Creating Shared Value

CSR: Corporate Social Responsibility

IP: Interview Partner

SBT: Science Based Target

SBTi: Science Based Targets Initiative

NBS: Nature-Based Practices

1.Introduction

1.1 Context/ Background

Coffee is one of the most valuable globally traded agricultural commodities and also one of the most widely consumed beverages in the world (Pancsira, 2022) and the IPCC AR 6 identifies agricultural emissions as one of the main drivers of global climate change (Calvin et al., 2023). A meta-analysis by (Cornelius et al., 2024) identifies the large impact emissions from coffee production have on global warming as a concern for both producing countries and corporate and other actors. With coffee as an agricultural product being, after petroleum, the second largest traded commodity in the world and nearly 100% of the global coffee production happening in countries of the Global South (Mussatto et al., 2011), coffee production has the potential to becoming an important component in the context of climate mitigation. This means it is also crucial for the economies of many developing countries and therefore influences the lives of millions of peoples. To be more precise, (Jha et al., 2011) state that between 20 and 25 million families worldwide are involved in coffee production and of those, around 70% are considered smallholder farmers positioning them as key actors in global coffee production. A study conducted in Kenya suggests that farmer level production has a highly significant negative impact on the carbon footprint of the coffee supply chain, particularly in the case of smallholders as the carbon footprint decreases with the increase in production level (Maina et al., 2016). This is explained by the carbon footprint being calculated per unit of production and with increased production, total emissions are distributed over a larger output. However, this effect is not only attributed to farm size but also to efficient management, meaning that with more efficient management, smallholder farmers can increase their production per unit and decrease their carbon footprint. Therefore smallholder farmers could play a significant role in climate mitigation efforts while at the same time being particularly vulnerable to the effects of climate change as the IPCC AR 6 report mentions that

> "*increasing weather and climate extreme events have exposed millions of people to acute food insecurity and reduced water security, with the largest impacts observed in many locations and/or communities in Africa, Asia, Central and South America, LDCs, Small Islands and the Arctic, and for small-scale food producers, low-income households and Indigenous Peoples globally (high confidence)*" (Calvin et al., 2023, p. 50).

1.2 Problem statement

The scientific literature identifies several direct negative impacts of climate change on coffee production. Among those are increased temperatures, drought stress and precipitation shortages, declined crop yields and quality and indirect impacts on coffee production by an increase in pests and diseases that could lead to a loss of coffee-optimal areas and therefore a change of production sites to areas with higher altitude (Pham et al., 2019; Rahn et al., 2014). This would have a major impact on the economies of coffee-producing countries and of course on the smallholder farmers involved. To tackle those already existing direct impacts of climate change, there is a need for adaptation practices to enhance the resilience of a significantly large, and vulnerable population being smallholder farmers in the global south. Examples for adaptation practices that can help ensure the livelihoods of smallholders are enhanced water conservation, tree planting for shade and to enhance soil health, and other farming practices. This will be explained in more detail in chapter 2.1.

In addition to the need to adapt to climate impacts, there is also a need for mitigation strategies to be implemented to diminish negative future climate impacts. This links the environmental motives of climate adaptation and mitigation with social concerns regarding the livelihood of smallholders. With new international policies like the European Union Corporate Sustainability Reporting Directive (EU CSRD) and a general rise in awareness of climate change (Brans et al., 2024; Rajeev et al., 2017) an increased interest of large-scale coffee businesses to improve the environmental performance within their supply chain can be observed (Bager & Lambin, 2020; Cornelius et al., 2024). This is further underlined by the fact that Nespresso (whose supply chain is subject to the case study of this thesis) identified their coffee supply as having the most significant impact on their total carbon footprint and in their “net zero plan” acknowledged the need to implement measures to decarbonise their production while improving their farmers resilience (*Accelerating to Net Zero*, n.d.). Therefore, to ensure the subsistence of coffee smallholders while at the same time mitigating climate change there is a need for simultaneous adaptation and mitigation efforts. A systematic review of the impact of climate change on coffee production by (Pham et al., 2019) lists adaptation strategies like investing in agroforestry, irrigation and water management but identifies a potential research gap regarding the relationship between climate adaptation strategies in general and the mitigation of climate change impacts. In addition to that, the majority of existing studies is focused on the Americas and therefore a wider spatial distribution of research would be

desirable. The relationship between climate change adaptation and mitigation should be central when balancing the interests of farmers and larger businesses as it links the existential concerns and actions of smallholder coffee farmers to potential sustainability strategies of globally operating businesses in the coffee value chain.

1.3 Research aim(s) and objectives

It would be very useful for smallholders as well as larger coffee businesses that aim to decarbonize their supply chains to identify best practices that are feasible, help smallholders to react to negative climate impacts and ensure their subsistence and at the same time emit less carbon than current practices to lessen future negative climate impacts. This thesis aims to map the current field of climate change adaptation and mitigation strategies that are used in coffee production and analyse how those are applied in a case study. Through the analysis of the decarbonisation strategy of a larger-scale coffee business and the actions by smallholder coffee farmers and comparison of those, trade-offs and synergies might be identified. This could lead to valuable insights helping to identify practices that help achieve successful climate change adaptation and mitigation, and are beneficial for all stakeholders involved. An important consideration for this research are especially the potential synergies between adaptation and mitigation strategies. For instance, adaptation practices such as improved water management or agroforestry can also contribute to carbon sequestration and reduced emissions (Rahn et al., 2014) which creates a win-win scenario for both smallholder farmers and coffee companies when adopted successfully. The case study will take into account contextual factors like local climate conditions, socio-economic factors and cultural practices to make the results usable for stakeholders directly involved. Academically, this research is supposed to contribute to the discussion on climate change adaptation and mitigation in global agricultural supply chains, contributing to fill the research gap identified by Pham et al. (2019) regarding the relationship of those concepts. While adaptation is often seen as a reactive measure to address existing climate impacts and mitigation as a proactive endeavour to address sources of climate change they are not necessarily distinguishing concepts as certain practices can contain elements of both concepts. However some other practices might contribute to climate change adaptation, while interfering with mitigation or vice versa. Therefore, this study aims to offer empirical insights into how certain practices can simultaneously contribute to emissions reduction in coffee production and adaptation to negative climate impacts, and which practices might lead to trade-offs. By examining the trade-offs and synergies between those different climate strategies,

this study contributes to the ongoing academic discussion on how to optimize agricultural practices to both enhance climate resilience and emission reduction. It could consequently help inform the scientific understanding needed to develop more resilient and low-carbon food systems enhancing the local livelihoods of farmers. This links the scientific motivations of this thesis directly to societal/practical considerations. Findings could ideally be used to help decrease GHG emissions of a significant contributor to climate change (the agricultural sector) and at the same time helping vulnerable communities to sustain themselves despite increasingly difficult climate conditions for farming. Lessons from the coffee supply chain might be transferred to other agricultural commodities.

1.4 Research question

The concepts of climate change adaptation and mitigation take a central part in this thesis. These concepts will guide the literature review and help frame the analysis of the strategy and actions in coffee production that are currently used and their potential to mitigate and adapt to climate change. For the case study of this thesis it was decided to frame the research along the general practices coffee farmers and companies are implementing (or trying to implement) in reaction to climate change. This way it is possible to acquire a more holistic understanding of the actions taken by smallholder coffee farmers and the strategy of a company such as Nespresso, and at the same time it could provide more usable insights as the focus is rather on specific actions than abstract concepts. After collecting information on those practices and analyzing them regarding their relationship to each other they can be linked to the concepts of climate adaptation and mitigation to help assess their effectiveness when it comes to tackling climate change. Therefore, the following main research question was formulated:

"In what ways can the strategy employed by Nespresso and the actions of smallholder coffee farmers in Uganda be classified as climate mitigation, adaptation, or both, within the context of coffee production?"

1.5 Outline of remaining thesis

Chapter 2 will provide a review of relevant literature on climate change mitigation and adaptation, defining those concepts and describing their implementation in the agri-food industry in general before focusing on coffee production in specific and also linking them to an economic and social perspective. This will help provide the theoretical background for this study and establish a framework. Chapter 3 will outline and justify the research methodology regarding the case study of Nespresso's decarbonization strategies in Uganda and smallholder farmers' actions linked to climate impacts. Chapter 4 will present the results from the conducted interviews and document analysis, describing key actions taken by the actors. Chapter 5 will integrate the findings with the previously conducted literature review to discuss synergies and trade-offs between corporate (mitigation) strategies and smallholder (adaptation) practices. A reflection on the analytical framework is also part of this chapter. Lastly, Chapter 6 will provide a brief recap of the thesis, summarize key findings, present answers to the research questions, and mention recommendations for practitioners. The chapter will also reflect on the limitations of the results and the overall research approach. Finally, it will suggest directions for further research to build on the study's insights.

2. Theory and Analytical Framework

2.1 Climate change mitigation and adaptation at coffee farm level

The International Panel on Climate Change (IPCC) defines climate change mitigation as "a human intervention to reduce the sources or enhance the sinks of greenhouse gases" (*AR5 Climate Change 2014*, n.d., p. 4). Climate change adaptation is defined by the IPCC as:

> "*adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes,*

practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change" (*TAR Climate Change 2001*, n.d., p. 879)

According to the IPCC, those two concepts together contribute to the objective formulated by the United Nations Framework Convention on Climate Change (UNFCCC):

> "*[...] to achieve, [...], stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manne*r" (*United Nations Framework Convention On Climate Change*, n.d., p. 9)

Thus, climate change mitigation can be seen as a way to decrease human made climate change and therefore future impacts of it, while climate change adaptation can be understood as a means to cope with the climate impacts that can already be observed and won't be prevented in the future. The possible strategies and actions linked to those two concepts can be seen as the main solution approaches humanity has to battle anthropogenic climate change and its negative effects.

The relationship between Agriculture and Climate Change was described as a Two-Way Association by Pal et al. (2019) as agriculture is a significant contributor to global greenhouse gas emissions (GHGs). At the same time it is strongly impacted by climate change due to being highly vulnerable to climate variability and extreme weather events.

The agricultural sector is directly (emissions coming straight from agricultural activities) and indirectly (emissions linked to agriculture like fertilizer production and food processing) responsible for ⅓ of global GHGs (Smith et al., 2008). The highest contributor within agriculture is crop (like coffee) and livestock production (e.g. fertilizer use and use of fossil fuels) followed by deforestation through forest-conversion to farmlands (Pal et al., 2019).

Simultaneously, agriculture already has been strongly affected by global warming and there are projections that by 2080, global agricultural productivity is going to decline significantly, particularly in developing countries (like Uganda) by 10-25% (Pal et al., 2019). This is due to increasing temperatures, shifts in precipitation patterns, and an increase in extreme weather events impacting crop productivity and water availability (Calvin et al., 2023). Sub-Saharan

Africa is seen as one of the most vulnerable regions in the world because “it has the highest proportion of malnourished populations in the world; a significant portion of its national economies are dependent on agriculture and most of its available water resources (85%) are used for agriculture” (Pal et al., 2019, p. 4).

Smith et al. (2008) classify the opportunities for mitigating GHGs in agriculture into three categories:

- *Reducing emissions:* reduction of (out)fluxes of greenhouse gases (into the atmosphere) by managing their flows more efficiently in agricultural ecosystems. An example would be increasing the efficiency of fertilizer use to suppress the emission of nitrous oxide.
- *Enhancing removals:* increasing stored carbon by either increasing photosynthetic input of carbon or slowing down the return of stored carbon. For example carbon sequestration can be enhanced by incorporating agroforestry systems or other perennial plantings on agricultural land.
- *Avoiding (or displacing) emissions:* This can be achieved by using biofuels from crops and residues which releases CO_2 that was recently absorbed through photosynthesis, unlike fossil fuels, which release carbon stored for millions of years. Another possibility are agricultural management practices that prevent the conversion of forests and grasslands into farmland.

While climate mitigation practices can be classified quite clearly into those categories due to being connected to influencing the biogeochemical cycles of greenhouse gases, the classification of climate adaptation strategies is more complex as it entails the multiple possible reactions to many different kinds of climate impacts towards different kinds of agricultural practices (Descheemaeker et al., 2016). Howden et al. (2007) categorize two different levels of adaptation practices in their review and synthesis paper on climate adaptation in the agricultural sector. One is a systemic change on local, regional, national and international levels entailing:

- Policies that integrate climate adaptation with existing risk management frameworks
- Investments in climate-resilient infrastructure, research, and governance
- Mainstreaming adaptation into broader sustainable development and economic planning

The other identified level is the “management unit level” which is more relevant to this thesis as it entails climate adaptation opportunities regarding changes in practices at farms and

other agricultural institutions (cropping, livestock, forestry, and fishery systems). Howden et al. (2007) identified a list of possible adaptation strategies that are relevant for cropping systems (such as coffee):

- Adjusting crop varieties, fertilizer use and irrigation to match changing climate conditions
- Enhancing water conservation and management to address drought or excess rainfall
- Modifying cropping schedules and locations for better climate resilience
- Diversifying farm activities, such as integrating livestock
- Strengthening pest, disease, and weed control through resistant species and monitoring
- Utilizing climate forecasting to minimize production risks

To describe adaptation measures Burnham & Ma (2016) have analyzed the empirical literature regarding smallholder climate change adaptation decisions and presented a seven-category typology in which specific measures can be categorized (the first two being the most common ones) including:

- **Environmental Management:** actions like soil and water conservation techniques or the use of drought-resistant, short-season or early maturing seeds
- **Diversification:** mainly in two forms by diversifying their livelihoods away from agriculture or by changing/ adding to their cropping mixes
- **Market Exchange:** closely linked to diversification, accessing new markets to sell crops
- **Labour Migration:** Some household members migrate seasonally or permanently to secure alternative incomes, reducing dependence on farming (can also be seen as a form of diversification)
- **Communal Pooling:** Farmers cooperating to share labour or support each other financially
- **Storage:** Use of food, seed and water storage systems to prepare for droughts or other climate variabilities
- **Mobility:** relocation of farming activities to more suitable areas

The adaptation choices of smallholders are affected by economic, social, and environmental factors including access to financial resources, knowledge, and institutional support (Atube et al., 2021). In addition to that, it is worth mentioning that many of the strategies outlined above are interconnected. For example, diversification often requires access to new

markets (Burnham & Ma, 2016). However, adaptation measures also come with trade-offs. For example, while diversification can increase resilience, it may require upfront investment (Burnham & Ma, 2016). The seven-category typology simplifies distinctions between coping and adaptation by framing all practices as risk-reduction strategies and enables cross-study comparisons, making broader generalizations on smallholder adaptation possible.

To put those possible adaptation strategies into perspective, it can be concluded that those kinds of actions at the farm level would work well under moderate climate change (under 2°) but would come to their limits if climate change intensifies, which would result in the need for a more systemic change on different levels of scale (Calvin et al., 2023; Harvey et al., 2018; Howden et al., 2007; *TAR Climate Change 2001*, n.d.).

Coffee as an agricultural practice has a dual relationship with climate change as it is both a driver of climate change and vulnerable to its impacts. With coffee being the fifth largest perennial crop in area in the world and the largest in seven of the 10 producing countries it is an important component of the significant emissions agriculture produces globally (Cornelius et al., 2025). There are already several changes in climate conditions affecting coffee production directly that can be observed, including increasing temperatures and droughts but also unpredictable rainfall and extreme weather events (Pham et al., 2019; Rahn et al., 2014). Those specific climate impacts can be observed globally but their severity can vary by region. A key finding is that there will be most likely a significant reduction in suitable coffee-growing regions, specifically at lower altitudes and that increased temperatures and reduced water availability negatively impact the coffee beans' quality (Harvey et al., 2018; Pham et al., 2019; Rahn et al., 2018). In addition to that, an increase in pests and diseases, like coffee leaf rust and coffee berry borer are expected to increase production risks (Pham et al., 2019). As coffee is mostly grown by smallholder farmers and highly sensitive to local climate, the smallholders can be described as extremely vulnerable to climate impacts and at the same time very dependent on this commodity to sustain themselves (Fridell, 2014; Pham et al., 2019).

The study by Rahn et al. (2014) identified 12 key adaptation strategies for coffee farms in Nicaragua to address climate change challenges. Those include agronomic practices like diversified shade management, soil and water conservation, and the use of adapted coffee varieties to enhance the resilience of the plants to temperature and water stress. Economic diversification of farms through alternative crops or livestock farming to help reduce farmers'

dependency on coffee was also mentioned. Other studies identified common climate adaptation strategies among smallholder farmers such as adopting soil conservation practices, increasing fertilizer or agrochemical use, and introducing new crops (Aryal et al., 2020; Harvey et al., 2018). The relocation of coffee farms to places with higher altitude is also an adaptation strategy mentioned in the literature (Pham et al., 2019).

When it comes to climate mitigation practices in coffee production, a focus on avoiding greenhouse gases and enhancing carbon sequestration can be observed. A key strategy regularly mentioned is afforestation and reforestation practices increasing or maintaining tree cover on coffee farms through for example agroforestry systems or boundary tree planting which can enhance carbon storage in both biomass and soil while also being able to increase soil health (Rahn et al., 2014; Verchot et al., 2007; Wollenberg et al., 2012). Avoiding deforestation and wastewater treatment are other possible mitigation options in coffee production. In addition to that, sustainable agricultural land management practices like soil conservation and optimal use of organic fertilizers are mentioned in the literature (Altieri & Nicholls, 2017; Rahn et al., 2014; Wollenberg et al., 2012).

Certain strategies provide climate adaptation and mitigation benefits as well as livelihood improvements for smallholder farmers. Rahn et al. (2014) identified afforestation of degraded areas with coffee agroforestry systems and boundary tree plantings as the activities with the highest synergies between those three purposes within coffee production. That agroforestry is a good strategy to link climate adaptation and mitigation can be described as a widely accepted hypothesis in the literature (Mbow et al., 2014; Taillandier et al., 2023; Verchot et al., 2007). In the case of agriculture in general (not just coffee production) other practices like integrated soil fertility management, irrigation and soil and water conservation also provide benefits across both climate mitigation and adaptation goals (Bryan et al., 2013).

Uganda, the case study of this thesis, is the first developing country to recognize the importance of agroforestry as an approach to sustainable agriculture and link agroforestry targets with international biodiversity conservation agreements (Fraser, 2024).

2.2 Decarbonisation of the coffee value chain by companies

As can be seen in Figure 1 the coffee supply chain involves a range of different actors, each with specific tasks. (Smallholder) Farmers as producers of coffee beans and cherries stand at the beginning of the supply chain. Farmers either work individually or as part of a cooperative which can make the marketing and bargaining process more economically viable. From the producing countries the product is transported to the consuming ones via Transporters, Exporters, Shippers, and Importers to Commodity Traders. This constitutes the Upstream value chain. As a next step the beans are sold to roasters. Those roasters have a very high power and influence in the market due to large financial resources, market intelligence and technological tools (Amar, 2024). This is also due to a very strong concentration of market shares with few and large companies, like Nestle (Nespresso being part of Nestle) as the leading company, dominating the market (Ghoshray & Mohan, 2021). Finally, the roasted coffee is packaged and distributed to retailers, coffee shops, or directly to consumers.

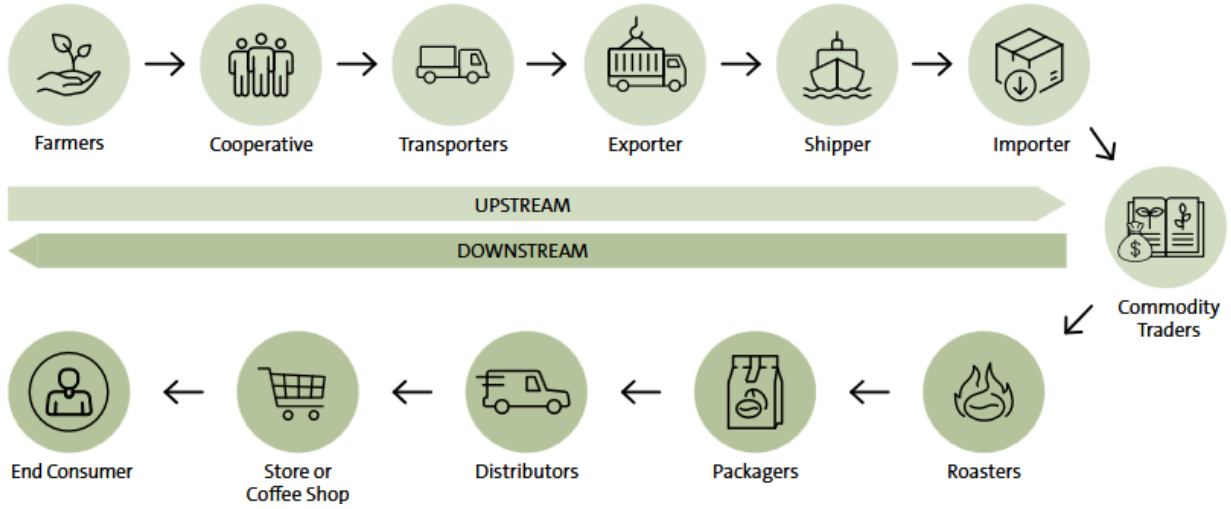

Figure 1: Coffee Supply Chain

Note: Adapted from : *Towards Better Living Conditions for Smallholder Farmers* by Amar, S. (2024). FSD Fair & Smart Data, p. 11

A report by the World Wildlife Fund (WWF) (*2022*) estimated the emission ranges for each step in the supply chain, identifying production/farming as the most impactful part of the supply chain when it comes to the emission of GHGs. This indicates, coffee production/farming can be an important field of intervention regarding climate mitigation actions. This can be seen in Figure 2 below.

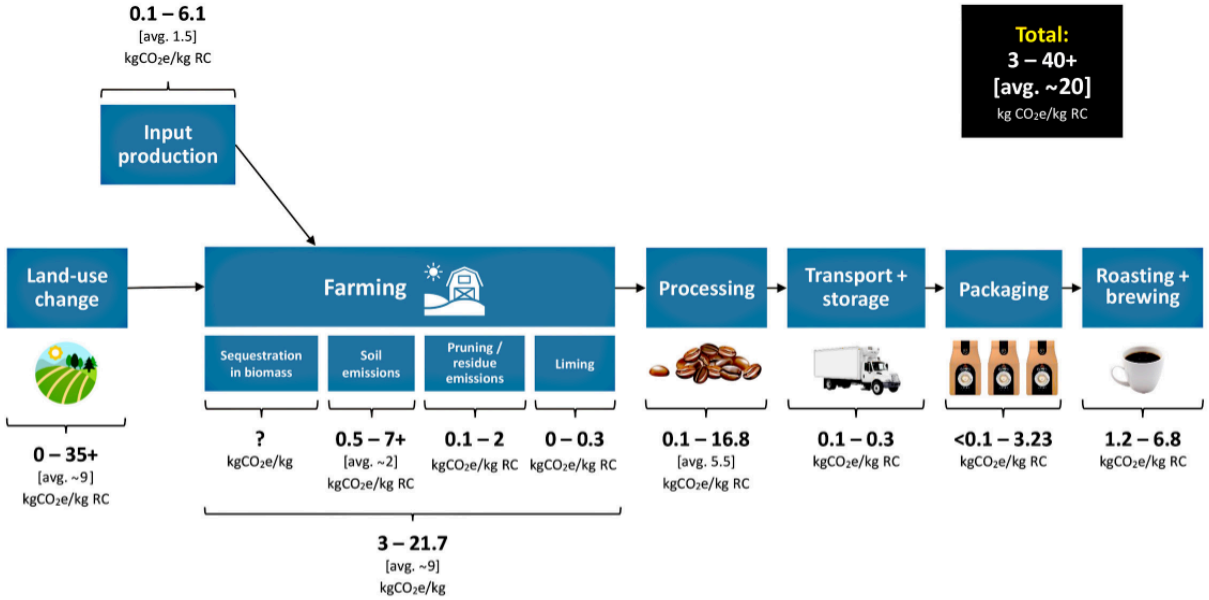

Figure 2: Range of GHG Emissions from coffee supply chains

Note: Adapted from *Measuring and Mitigating GHGs*: Coffee by Villagomez et al (2022), World Wildlife Fund, p. 3

In recent years the concept of decarbonisation of the value chain has become increasingly important for companies as general climate awareness rises and there is an increase in regulations regarding sustainability reporting/compliance (Bager & Lambin, 2020; Cornelius et al., 2025). Usually there is a distinction between three different types of emissions. Scope 1, which includes direct emissions from owned or controlled sources; Scope 2, covering indirect emissions from purchased electricity, heat, or steam; and Scope 3, which encompasses all other indirect emissions occurring throughout a company's value chain. For many companies Scope 3 emissions make up the largest part of their total emissions which is true for the coffee value chain as well, considering the estimates that can be seen in Figure 2. With Farming activities being the largest part of the estimated emissions in the coffee value chain, this can link the decarbonisation efforts of a company directly to coffee farmers.

For a large company like Nespresso, the decarbonisation strategy can focus on two different concepts (Banerjee et al., 2013):

- Carbon Insetting (reducing emissions within the supply chain)
- Carbon Offsetting (external compensation for emissions)

This thesis focuses on decarbonisation within coffee production and not outside the supply chain, and therefore insetting is relevant here. According to Banerjee et al. (2013) any carbon insetting project in an agricultural supply chain will include mitigation activities which can be kicked off by using a tool like the Cool Farm Tool to analyse the carbon footprint and gain an understanding of mitigation potential. This means that the efficacy of certain measures would be assessed by the carbon footprint of companies based on life cycle assessments that the companies themselves commission and results would be defined by a reduction of Scope 3 GHG emissions upstream (Scope 3.1: Purchased Goods and Services) in the case of coffee production (Acampora et al., 2023). This first step in which mitigation activities are defined would be followed by monitoring, training and compensation of farmers to make the project sustainable over a longer period and ensure funding (Banerjee et al., 2013). Here it is important to mention that insetting activities can not only have benefits for the environment but also have the potential of creating economic benefits for the company. “For example, the reduction of carbon and water footprints can lower a supply chain’s resource requirements, helping to avoid raw material scarcity and price increases while reducing pressure on the ecosystem. Likewise, improved farm management can increase productivity, thus improving supplies of agricultural raw materials” (Banerjee et al., 2013, p. 1). Additionally, regarding the compensation of farmers in the process of carbon insetting, many projects in the past have been funded through the generation of carbon credits from enhanced carbon sequestration on the farm but can also be financed through potential economic benefits farmers receive directly through the mitigation practice, creating value not only for the company but for the farmers as well (Banerjee et al., 2013).

One concept that can help highlight the benefits of climate adaptation and mitigation strategies and could be used to assess their combined impact is the concept of Creating Shared Value (CSV). It can even be seen as an overarching goal for both companies and smallholders. CSV as described by Kramer & Porter (2011) expands on the traditional concept of corporate social responsibility (CSR) which is used as an umbrella term to describe actions and strategies of companies related to sustainability and socio-economic aspects and sees social or sustainability action as of intrinsic value in itself independent of direct business strategy or profit motives. As opposed to CSR, CSV aims to strengthen the integration of social and environmental improvements into a company’s core business strategy with the goal of creating economic and societal benefits simultaneously. This way economic success and societal

benefits could reinforce each other rather than exist in opposition and give companies a motive to act responsibly beyond ethical considerations.

In the context of agricultural supply chains, Banerjee et al (2013) argue that carbon insetting, which involves mitigation activities within a company's supply chain, could be linked to shared value creation very well. They describe that unlike carbon offsetting, which compensates emissions outside the supply chain, insetting could involve businesses to invest in climate-smart agriculture that directly benefits both farmers and the company. To give an example, agroforestry practices can contribute to both carbon sequestration (mitigation) and enhancement of farm resilience (adaptation) while at the same time improving yields and securing long-term supply chain stability (Banerjee et al., 2013; Taillandier et al., 2023).

This approach matches with Kramer & Porters (2011) argument that businesses should not have the goal of just minimizing harm and instead actively contribute to solving societal challenges while ensuring financial sustainability. Adaptation strategies like environmental management have the potential to not only reduce farmers' vulnerability to climate risks but also create economic benefits for companies by ensuring a reliable, high-quality material supply (Bryan et al., 2013). At the same time, mitigation efforts like reducing Scope 3 GHG emissions through sustainable farming practices can lower a company's carbon footprint while simultaneously improving productivity and efficiency (Banerjee et al., 2013).

Therefore, climate adaptation and mitigation in the coffee supply chain should not be seen as separate efforts but as complementary strategies under the shared value creation framework. Investing in sustainable practices can lead to both smallholders benefitting through increased resilience and income and companies securing their supply chains while meeting decarbonization targets. This way climate action can be directly linked to business success.

2.3 Analytical framework

The theories and concepts described so far provide the basis for an analytical framework to analyse Nespresso's strategy to decarbonise its coffee value chain and the actions by smallholder coffee farmers in Uganda to cope with climate change, but also how those approaches may be connected and qualify as examples of climate mitigation and/or adaptation.

Key Concept	Definition	Category
Climate Change Mitigation	Strategies or actions that aim to reduce the sources or enhance the sinks of greenhouse gases	1. Reduce emissions 2. Enhance removals 3. Avoid/displace emissions
Climate Change Adaptation	Strategies or actions in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change	1. Environmental Management 2. Diversification 3. Market Exchange 4. Labour Migration 5. Communal Pooling 6. Storage 7. Mobility
Creation of Shared Value	Social and environmental improvements integrated into a company's core business strategy that generate both economic value for companies and farmers	–
Mitigation/ Adaptation Synergy	Strategies or actions that serve both climate mitigation and climate adaptation goals	–
Mitigation/ Adaptation Trade Offs	Trade-Offs that arise when strategies aimed at achieving either climate mitigation or climate adaptation undermine the effectiveness or feasibility of the other.	–

Table 1: Analytical Framework

3. Methodology

3.1 Research approach

In the previous chapters it has been outlined how coffee, as an agricultural product and one of the largest traded commodities in the world, plays a significant role in contributing to climate change. Here, particularly the production phase has been identified as an emission intensive part of the supply chain. Also the dual relationship between agricultural activities like coffee production and climate change has been outlined as coffee production is at the same time very vulnerable to impacts of climate change. Those circumstances highlight how the concepts of climate change mitigation and adaptation are very important in coffee production as it is necessary to diminish future climate change impacts and at the same time cope with already existing ones. Important stakeholders in relation to this topic are larger companies as powerful market actors and smallholder farmers as producers. With Nestle being the roasting company with the highest market share, Nespresso as a sub company of Nestle was chosen as an interesting and influential actor worth researching. Uganda was chosen as it is the 2nd largest coffee producer in Africa, the 4th largest Robusta producing country and the 10th largest coffee producer in the world (*Climate & Ugandan Coffee*, 2020). The relevance of Uganda for this research is further underlined by the fact that the meta analysis by Pham et al. (2019) comes to the conclusion that African countries as producers and specifically robusta coffee remains underrepresented in research. With smallholders being globally as well as in Uganda the main producers of coffee (Jha et al., 2011; *Mapping the Coffee Value Chain in Uganda | International Labour Organization*, 2024), they can be seen as central stakeholders for research regarding the decarbonisation of the coffee supply chain.

The research approach chosen for this thesis is qualitative, employing a single case study focusing on Nespresso and the coffee value chain in Uganda. This approach is chosen to explore the complex interactions between corporate decarbonization strategies and smallholder farmer actions in response to climate change impacts as those can be very context specific. The qualitative approach allows for an in-depth exploration of the strategies, actions, and perspectives of various stakeholders involved in the coffee production process. Through the utilization of multiple data collection methods, including a systematic literature review, document analysis and semi-structured interviews with different stakeholders, the research design

incorporates elements of triangulation which strengthens the validity and reliability of the findings. The literature review is mainly done before the case study and lays a theoretical groundwork for the case study discussing relevant theories and concepts from scientific papers and therefore relies on secondary data. The case study is based on primary data collection from document analysis and interviews. This approach makes a differentiated analysis of the synergies and trade-offs between corporate sustainability strategies and local farmer practices possible, while at the same time remaining flexible enough to adapt to emerging insights during the research process.

3.2 Methods for data-collection and analysis

The systematic literature review conducted in this thesis serves as a foundation for the case study in Uganda . The review employed a structured approach, using mainly Google Scholar as a search engine and utilizing the following specific keywords "climate adaptation", "climate mitigation", “decarbonisation”, "smallholder farmers", “agriculture”, “climate change”, “coffee production”, “coffee value chain” and "carbon insetting" to identify relevant academic articles. Used combinations of keywords: “decarbonisation AND coffee production AND climate change”, “climate change AND agriculture AND climate adaptation”, “climate adaptation AND smallholder farmers AND agriculture”, “decarbonisation AND coffee production”. Selection criteria to choose the used literature included markers like peer-review status, citation count and relevance to the research questions. The review itself followed a structure, beginning with broad definitions of climate adaptation and mitigation before narrowing the focus to agriculture and specifically coffee production. This approach allows for a comprehensive understanding of the concepts of climate adaptation and mitigation within the wider context before exploring specific applications of those concepts.

The literature review established connections between the core concepts of climate mitigation and adaptation and carbon insetting practices and also described criteria/types of climate adaptation and mitigation making insights from the case study categorizable. On top of that, the economic framework of Creating Shared Value (CSV) was introduced to provide a business perspective on sustainability practices. The different concepts and theories were synthesised to develop an analytical framework which is used to analyse the case study. This framework helps to examine, categorize and better understand the strategy employed by Nespresso and the actions of smallholder coffee farmers in Uganda, ensuring a structured

approach to identifying potential synergies and trade-offs between corporate decarbonization strategies and smallholder actions in response to climate change impacts.

The case study for this thesis is based on two methods of primary data collection: document analysis and semi-structured interviews.

In the document analysis documents like Nespresso's sustainability reporting, general reports on the coffee value chain and farmers in Uganda, and other relevant documents were analysed. Those were identified by researching Nespressos sustainability reporting on their websites and additionally searching for documents and reports using Google via the search terms: “Uganda coffee production”, “Uganda coffee value chain”, “Uganda climate change”, “Uganda coffee smallholder farmers”, “Uganda climate adaptation mitigation coffee”. Furthermore the document analysis was enhanced by specific research adaptively conducted for data needed to provide background information for topics that arose during the analysis of documents. Besides Google, Perplexity AI was used to find relevant articles in this step. For example this was done to contribute data on climate impacts Uganda faced in recent years, background information on the Science Based Targets Initiative, and information on the Fairtrade Minimum Price and Living Income Reference Price. This analysis provided insights into the sustainability strategy of Nespresso, coffee smallholders climate related actions in Uganda and other local circumstances relevant for coffee production which helps to understand the context in which the subjects of interest to this thesis exist.

The Semi-structured interviews were conducted to complement this document analysis. This method is well-suited for the research as it allows for flexible exploration of stakeholders' perspectives and experiences within the coffee value chain while at the same time ensuring that key topics and concepts are consistently addressed. A set of pre-formulated questions was prepared (which can be found in the appendix) which was used as an outline for the interviews and supplemented with additional questions depending on the course and contents of the specific interviews. The Interviews were conducted via online video calls and the audio was recorded and later transcribed. In this thesis, four interviews with different stakeholders connected to Nespresso's coffee value chain in Uganda were planned to be conducted being:

1. A local smallholder farmer

2. A representative of a local farmer cooperative

3. An expert from an NGO active in Uganda

4. A representative from Nespresso

The interviewees were chosen to ensure a differentiated insight into the topic making sure different perspectives along the supply chain and around coffee production in Uganda are considered. Unfortunately an interview with a representative from Nespresso could not be realised.

The Analysis of the semi-structured interviews involved a qualitative coding approach, using the software Atlas.ti systematically organizing and interpreting the content of interview answers. Through this method, the identification of key themes and relationships between them was achieved which enhanced the comparability across the collected data. The coding approach was mainly deductive, using codes derived from the research questions, literature review, and analytical framework, and also included inductive elements, deriving codes from the contents of the interviews. The codes can be found in the Appendix A.

The Results Chapter 4.1 then focused on three guiding questions to find out which actions farmers implement on their farms, what the decarbonization strategy of Nespresso entails, and where synergies and trade-offs are from an economic perspective applying the concept of CSV. The guiding questions are:

What climate actions do smallholder coffee farmers in Uganda implement on their farms?
What strategy does Nespresso have for decarbonising the coffee value chain?
What are possible synergies and trade-offs between these two approaches?

In Chapter 4.2 the main research question was answered and the strategies and actions were linked to the concepts of climate change adaptation and mitigation.

3.3 Reflections on data-gathering

When it comes to limitations it has to be mentioned that the primary data collected in this thesis is based on a single case study. Therefore results might be not or only partly

generalizable. Region specific environmental, cultural, social and other variables might play a significant role.

As applicability of results in different contexts therefore might only be possible to a limited extent, it is a possibility that the research could either be used as groundwork for future larger- scale studies or be used for comparative studies in other coffee-production areas.

Additionally, the method of interviewing stakeholders always relies on subjective perspectives of the stakeholders involved. Therefore it has to be considered that all answers received might be subject to a potential bias of interview partners.

4. Empirical Results

This chapter focuses on the three guiding questions of this research (see Chapter 3) and is organised in line with the analytical framework of this study.

Before outlining the specific results of the case study, the case of Uganda's coffee production is briefly described to make the position and role of the coffee farmers and Nespresso in this context clearer.

Uganda is the second largest coffee producer in Africa and the 10th largest in the world (Eyaaz, 2024; *World Coffee Research | Uganda*, n.d.). Coffee is also the highest value export of Uganda and contributes 2% of its annual GDP (Bunn et al., 2019). While around 12 million people in Uganda support their livelihoods with coffee which contributes to 15-17% of its exports (*Mapping the Coffee Value Chain in Uganda | International Labour Organization*, 2024), 99% of the coffee is produced by around 1.7 million smallholder farmers households which represents 10% of global coffee farms (*Climate & Ugandan Coffee*, 2020). This means that every 5th household nationwide produces coffee (*Climate & Ugandan Coffee*, 2020). It is mainly produced on diversified farms, with banana being the most popular crop coffee is intercropped with and for around 70% of coffee households farming is the main income source. Around 30% of coffee households sometimes don't have enough cash for food but only 14% report that their income is below the living minimum (Bunn et al., 2019). Poverty amongst coffee farmers is further underlined by the circumstance that "average per capita daily income was estimated to be 0.85USD which is about half of the international poverty line. Despite the fact that very few coffee households have a per capita income above the poverty line, they still have a 10% higher income than non-coffee rural households in Uganda" (Bunn et al., 2019, p. 5). The uneven value

distribution along the supply chain which can be seen as an explanation for those circumstances will be briefly described below.

Uganda has already experienced rising temperatures and increased rainfall variability, which have begun to reduce the suitability of crops like coffee and bananas. The mean temperature rise over the last four decades was 0.29°C (von Loeben et al., 2023). Looking ahead, climate models project that by 2050, up to 20% of Arabica-growing areas may become unsuitable, while Robusta will face gradual declines, threatening coffee-banana intercropping systems and requiring urgent adaptation measures (Bunn et al., 2019; von Loeben et al., 2023; Wichern et al., 2019). The following chart summarizes key findings of past climate trends and future projections:

Climate Impact		Past trend[1]	Future trend[1]	Certainty[2]
	Mean annual temperature	Increasing	Increasing	Very high
	Number of hot days & nights	Increasing	Increasing	Very high
	Mean annual rainfall sums	Increasing (not significant)	Increasing	High emissions: Medium Low emissions: Low
	Heavy rainfall intensity	Increasing	Increasing	High emissions: Very high Low emissions: Low

Figure 3: Summary of climate change trends in Uganda
Note: Adapted from von *Climate Risk Analysis for Adaptation Planning in Uganda's Agricultural Sector: Maize and Coffee Value Chains*, PIK: Potsdam-Institut für Klimafolgenforschung. Germany by von Loeben, S. et al., (2023), p. 19.

A report from the International Labour Organization (2024) describes Uganda's coffee value chain as being built on the work of approximately 1.8 million smallholder farmers, most of whom operate on very small plots with limited resources and sell their coffee through intermediaries. A minority (≅10%) are organized into cooperatives, which offer better access to inputs, training, and sometimes processing facilities. Coffee is pre-processed either by dry or wet methods, then hulled and graded before being sold to one of 112 export companies—10 of

which control around 80% of total exports. Exporters like Nespresso oversee quality control, sorting, and shipping logistics, with nearly all coffee exported as green beans through Mombasa. Despite coffee being Uganda's most valuable export, the country captures little of its final value, due to limited local roasting as 95% of coffee is exported as green beans and roasting accounts for a strong value addition. The report also comes to the conclusion that value in Uganda's coffee supply chain is unevenly distributed, with farmers capturing only a small share due to price volatility, limited bargaining power, and a reliance on intermediaries, while most profits accrue downstream among exporters, traders, and international roasters.
The following table from the same report visualizes the key players and their roles:

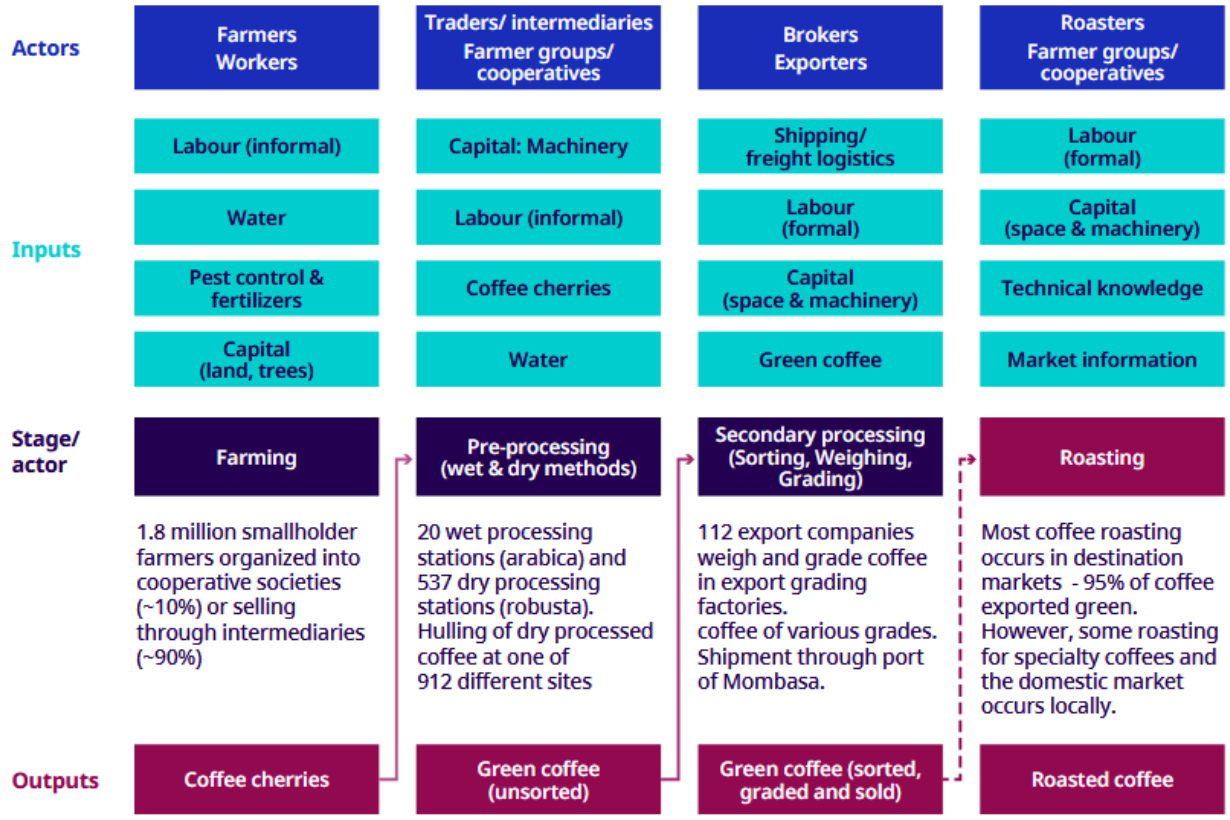

Figure 4: The coffee value chain in Uganda
Note: Adapted from *Mapping the coffee value chain in Uganda,* from the International Labour Organization (2024), p. 8.

4.1 Actions & Strategies

4.1.1 Climate actions by Smallholder Farmers

Before outlining the actions implemented by Smallholders to cope with climate change,

the observed climate change impacts on coffee production in Uganda that were identified in the research are briefly described.

As mentioned above, in the past decades, coffee production areas have become drier and hotter while distribution of rain has become more variable with more extreme weather events (Bunn et al., 2019; *Climate & Ugandan Coffee*, 2020; Eyaaz, 2024; Jassogne & Läderach, 2013; von Loeben et al., 2023; Wichern et al., 2019). While these documents describe the measured climate changes quantitatively, no specific numbers regarding climate impacts on coffee harvests could be found. This could be due to climate conditions being only one variable influencing coffee production amongst others like farm management and availability of fertilizers which makes it hard to attribute specific impacts to a certain cause. The document analysis identified the following climate change impacts:

- **Increased incidences in pests and diseases affecting farming activities** (*Climate & Ugandan Coffee*, 2020; *Ugandan Coffee Development Authority Report*, n.d.; Eyaaz, 2024; Jassogne & Läderach, 2013; Markandya, 2015; Nakazi, 2024; von Loeben et al., 2023)
- **Unpredictable rains causing coffee to flower at various times throughout the year** (Jassogne & Läderach, 2013)
- **Prolonged droughts causing flower abortion** (*Climate & Ugandan Coffee*, 2020; Eyaaz, 2024; Jassogne & Läderach, 2013; Markandya, 2015; Nakazi, 2024; von Loeben et al., 2023; Wichern et al., 2019)
- **Increased temperatures leading to premature ripening of beans and decreased quality and yield quantities** (*Climate & Ugandan Coffee*, 2020; Eyaaz, 2024; Jassogne & Läderach, 2013; Markandya, 2015; Nakazi, 2024; von Loeben et al., 2023; Wichern et al., 2019)
- **Increased water requirements due to draughts** (Eyaaz, 2024)
- **Hailstones or flooding/mudslides destroying coffee production sites** (Jassogne & Läderach, 2013; Markandya, 2015; *Ugandan Coffee Development Authority Report*, n.d.)

Together those impacts affect the quality and yield quantities of coffee negatively.

These results are in line with the interviews with two farmers, both being cooperative members while one is a member who represents the young farmers on the board (IP1) and the other is a chairperson (IP2), and a local NGO worker (IP3). Regarding climate impacts all 3

interview partners had matching insights to share. It was mentioned that increasing heat with prolonged droughts and irregular precipitation patterns with more excessive rainfall have affected farmers' crops negatively. Climate changes led to different impacts on the coffee plants in the past years. Excessive rainfall and hail storms led to flooding and landslides. On top of that due to the weather changes there was an increase in pests and diseases like the Black Coffee Twig Borer and fungal diseases like red blister. Those climate change impacts led to lower volumes of harvest for the farmers and a decrease of quality of the produce as beans were smaller and of lower quality.

The climate change impacts on coffee production lead to farmers implementing new practices on their farmland to cope with those impacts.

The main climate action that could be found in the document analysis (Arriens, 2019; *Climate & Ugandan Coffee*, 2020; *Resilient Beans*, n.d.; *Ugandan Coffee Development Authority Report*, n.d.; Eyaaz, 2024; Jassogne & Läderach, 2013; Markandya, 2015; Nakazi, 2024; Wichern et al., 2019) and was described in all three interviews conducted is agroforestry practices on the farms. The planting of trees (ideally traditional and native ones) on the farmland, provides shade for coffee plants and helps to moderate extreme weather conditions such as too much heat or heavy rain. Additionally, trees improve soil fertility. Farmers are trained regarding advantages of agroforestry practices by cooperatives (BIACE in this case), and NGOs (Solidaridad in this case), and are supported in implementing those practices through for example the provision of seedlings. Both the document analysis and the interview suggested that agroforestry practices in Uganda have the potential to increase coffee yields significantly. IP1 for example reported that even though his trees are still young, they already significantly improved the soil health on his farm which increased the growth of his coffee crops.

Another practice reported by farmers (IP1, IP2,) is the building of trenches and terraces. This reduces soil erosions and helps manage water runoff to retain water and preserve the soil essential for coffee farming. This practice is used especially in hilly regions. The document analysis also identified this practice (Arriens, 2019; *IDH-Baseline-Report*, n.d.; *Robusta Coffee Handbook - Ministry of Agriculture*, n.d.). Other water management techniques like rainwater harvesting and drip irrigation (adoption still under 1% of farmers) are also implemented (Nakazi, 2024; *Ugandan Coffee Development Authority Report*, n.d.).

Crop diversification is another method implemented in mainly central Uganda that helps coffee farmers cope with bad harvests by not making them reliant on one crop (Arriens, 2019; *IDH-Baseline-Report*, n.d.; Jassogne & Läderach, 2013). A farmer (IP2) highlighted the advantages of implementing fast-growing plants like coriander onto his farmland. Another

farmer (IP1) reported that he started to plant yams and is also farming bananas on top of producing coffee beans. Next to diversifying crops, switching to climate-resistant coffee varieties that are more resilient to temperature fluctuations and diseases is also a strategy implemented (Nakazi, 2024; Wichern et al., 2019). However with low adoption rates at only 9% so far (Nakazi, 2024).

The farmers (IP1, IP2) also reported avoiding chemicals. Instead of that, organic fertilizers are used (for example animal dung). This is also the case when it comes to pest management strategies. The NGO official reported that building traps for the coffee berry borer is a popular practice that avoids using harmful pesticides. A report states that 68% of Ugandan farmers make use of organic fertilizers and that only 30% of farmers use chemical pesticides (*IDH-Baseline-Report*, n.d.). Generally, chemical pesticides are known to have negative effects on human health, increasing antibiotic resistance in microbial communities, and posing risks to biodiversity and water quality (Zhou et al., 2025).

Another practice found in documents (*IDH-Baseline-Report*, n.d.; *Ugandan Coffee Development Authority Report*, n.d.) and reported by interview partners is mulching. Soil is covered with a layer of organic material to improve soil quality by providing nutrients, insulating soil by keeping it cooler, and improving water holding ability. As many farmers intercrop coffee with bananas, banana leaves are often used for this purpose. A barrier to implementing this technique is having organic material available. The NGO of the interviewed representative teaches farmers to grow grasses around their farmland boundaries as it regenerates quickly and provides sustainable mulching material.

The NGO representative stated that the NGO also introduced an innovation called biochar, which is black carbon made from biomass (like agricultural waste products) and enhances soil moisture and carbon storage. Besides enhancing soil fertility this technique sequesters carbon dioxide from the air. This is also the case for trees planted for agroforestry techniques. The interview partners (IP1, IP2, IP3) reported that through the usage of agroforestry as a carbon farming practice it is also possible for farmers to engage in carbon markets and receive payments for their generated carbon credits. The NGO representative described it as a helpful supplementary income source even though it does not have the potential to be a replacement for coffee income.

The Interviews (IP1, IP2, IP3) also suggested that the main motivation for farmers to implement new strategies and practices is to increase production but they can also benefit from carbon farming. Therefore financial incentives are the main driver. The main challenges regarding the implementation of climate-related actions and new farming practices reported by

interview partners (IP2, IP3) were education and access to resources. Farmers need to be aware of climate smart strategies and understand how new practices can help them increase production or avoid losses in production, before they will consider implementing those practices. Many of these “new practices” are traditional farming practices that were popular amongst farmers but have declined through the introduction of modern farming practices which rely on chemicals and fertilizers. Vanished farming practices are now being reintroduced. For example composting to produce fertilizers instead of relying on chemical fertilizers. Another example is the reintroduction of the “Ficus Natalensis“ as a shade tree (IP3, *Ugandan Coffee Development Authority Report*, n.d.). The tree is toxic for some invasive species and can therefore be seen as an organic pesticide. It also provides bark cloth which can be sold or used by the farmers' families. NGOs and Cooperatives play a significant role in educating farmers on climate-smart practices. Sometimes they can help farmers to acquire resources such as seedlings or support farmers to get access to carbon markets.

The findings show that smallholder farmers in Uganda implement a range of climate-related actions including agroforestry, organic fertilization, crop diversification, soil conservation like mulching and use of biochar, and water management techniques like the building of trenches and terraces. Those actions can contribute to the reduction of vulnerability to negative climate-impacts and therefore enhance resilience.

4.1.2 The decarbonisation strategy of Nespresso in Uganda

Nespresso is part of Nestlé, which is the largest food and beverage company globally, and Nespresso plays a big role in this success (*Nestlé’s Nespresso Sales Brew Success Amidst Coffee Segment Growth*, n.d.). A market research company identifies Nespresso as a global market leader in the coffee segment and attributes that partly to the (increasing) demand for premium coffee experiences which Nespresso is able to fulfill with their high-quality coffee and convenient capsule machines (Market Research Future, n.d.). Despite being a global market leader, Nespresso is not mentioned in the top ten exporters in Uganda (*Mapping the Coffee Value Chain in Uganda | International Labour Organization*, 2024). Following their own reporting, Nespresso positions itself as a specialty buyer and sustainability partner in Uganda. They launched a programme which aims to improve coffee quality and productivity to establish sustainable farming practices (*Nespresso Supports Ugandan Coffee through Reviving Origins Program | Nestlé Global*, 2020).

From Nespresso’s sustainability reporting (*Accelerating To Net Zero*, n.d.), it becomes

clear that Nespresso submitted a Science Based Target (SBT) to the Science Based Targets Initiative (SBTi), committing to reaching Net Zero by 2050. The SBTi is a globally leading corporate climate action organization that approves decarbonisation plans of companies in line with the Paris Agreement to reach Net Zero by 2050, meaning to decrease corporate emissions to zero through carbon insetting and offsetting. However, internally Nespresso aims to reach Net-Zero already by 2035 with a milestone to reduce GHG emissions in Green coffee supply (the raw seed of coffee cherries that have yet to be roasted) by 75% with base year 2018. A corporate carbon footprint calculation identified agriculture as having the most significant impact on the carbon footprint of Nespresso and therefore having the largest reduction opportunity. 39% of Nespressos total GHG emissions stem from coffee cultivation and cherry processing and are referred to as Scope 3 emissions (*Accelerating To Net Zero*, n.d.).

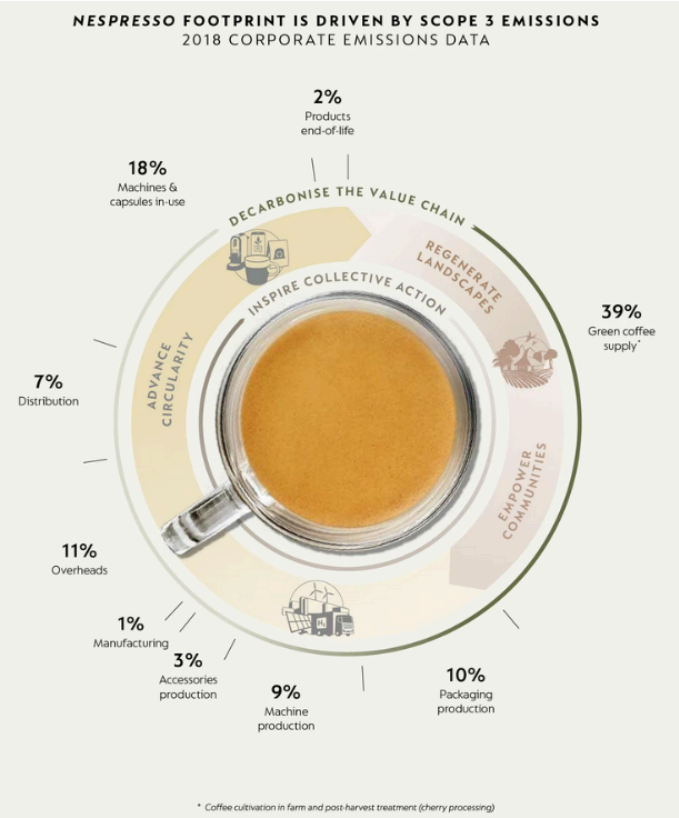

Figure 5: Nespressos' Carbon Footprint

Note: adapted from *Accelerating To Net Zero*, Nestlé Nespresso S.A. 2024, p. 2

The same report states that "accelerating the transition to regenerative agriculture " is

the number one goal of Nespresso regarding climate action which will be described in more detail through the case study of Uganda.

Nespresso's strategy in Uganda emphasizes direct farmer relationships through the AAA Sustainable Quality Program (*Accelerating To Net Zero*, n.d.). The Nespresso AAA Sustainable Quality Program is a coffee sourcing initiative launched in 2003 in cooperation with the Rainforest Alliance to secure high-quality coffee through long-term relationships with farmers, while promoting sustainable farming practices and improving farmer livelihoods. As a voluntary sustainability standard, it offers farmers technical assistance, training, and premium prices in exchange for meeting environmental, social, and quality criteria (*Discover The AAA Sustainable Quality™ Program*, n.d.).

In the case of Uganda the project is mainly based in the Rwenzori Mountain region. It was stated that in Uganda 15.494 farmers are involved which leads to 7.782 hectares being managed under the AAA program (*Nespresso - The Positive Cup Progress Report 2023*, n.d.). The Rwenzori project also adopts a landscape reforestation approach which focuses on reforesting around riverbanks to prevent floods and soil erosion (*Global Assessment Report*, n.d.).

The promotion of regenerative agriculture entails the promotion of nature-based practices (NBS) and agroforestry. There are also initiatives to plant trees for landscape restoration. Nature-Based Practices entail reducing the use of synthetic fertilizers and replacing them with nature-based solutions helping to maintain soil health and quality. Crop diversification and reduced tillage are also known as regenerative practices that can enable the soil to store a greater amount of atmospheric carbon. A particular focus is on the reduction of agrochemical fertilizers and replacement with nature-based practices as Nespresso identified it making up the largest percentage of their carbon footprint in coffee (that means within the 39% of Scope 3 emissions which are attributed to coffee production) (*The Positive Cup Report*, n.d.).

Agroforestry is described to be at the heart of Nespressos strategy in Uganda (*The Positive Cup Report*, n.d.). It is part of their farm redesign approach since 2014 and was introduced to Uganda in 2018 with 139.589 trees planted up until 2023. The deployment process of AAA Agroforestry starts with a feasibility study to assess the region's suitability for agroforestry, followed by socialisation where the project is introduced to local communities. Interested farmers receive a customised diagnostic analysis of their farms and a proposed agroforestry system tailored to local conditions. Farmers participate in regular training on tree management, sustainable farming practices, and long-term maintenance. Seedling production is managed through local nurseries to ensure sufficient supply, followed by tree distribution, where

farmers are responsible for planting and caring for the trees. The programme includes frequent monitoring to measure survival rates, growth, and carbon sequestration, with impact assessments verifying ecological and socioeconomic benefits, including soil health and species richness. There are three different models of agroforestry systems being promoted. Those are planting trees at the perimeter of the coffee field, intercropped with coffee trees, and in high-density areas, outside coffee plots. The trees planted on farmland are supposed to deliver environmental and socioeconomic benefits like "carbon removal from the atmosphere, improved soil fertility, reduced erosion, water replenishment and the establishment of habitats for certain species and diversified sources of income, such as from fruit trees" (*The Positive Cup Report*, n.d., p. 20).

Farmers that are part of the AAA programme also commit to zero deforestation. On top of that, they are trained to meet Fairtrade and organic standards, including chemical-free farming. Nespresso sources 95% of its coffee from AAA farms and over 40% from Rainforest Alliance Certified farms (global figures, no specific numbers for Uganda could be found), with plans to increase the latter and transition all AAA farms to regenerative agriculture using the Rainforest Alliance Regenerative Coffee Scorecard, a tool to evaluate producer performance against regenerative metrics ("Our Coffee Journey With Nespresso," n.d.).

The decarbonisation efforts of Nespresso in Uganda are supposed to go hand in hand with livelihood improvements for farmers. Nespresso aims to pay all AAA smallholder farmers the "Living Income Reference Price" by 2030 (*The Positive Cup Report*, n.d.). Clear numbers of how many farmers are receiving this price right now could not be found. However Nespresso states that as of 2020, 95% of the coffee they purchase globally is at or above the Fairtrade minimum price. No clear figures on exactly what Nespresso pays their farmers have been identified in this research. The Fairtrade Minimum Price and the Living Income Reference Price are both formally set by Fairtrade International: the Minimum Price is a mandatory floor that buyers of Fairtrade-certified products must pay to protect farmers from market downturns. The Living Income Reference Price is a voluntary benchmark that estimates the price needed for a typical farmer to earn a "decent standard of living". For both prices, Fairtrade publishes a table that helps calculate it (*LIRP*, n.d.). A landmark study concludes that the Fairtrade system is used to "fairwash" brands and does not deliver on its promised social and economic benefits (Johannessen & and Wilhite, 2010).

Nespresso also claims to engage in capacity-building initiatives that focus not only on sustainable agriculture but also on business skills and gender equality through specific training and learning activities that include for example exploring opportunities of joint decision-making

in farmers households and their farms (*The Positive Cup Report*, n.d.).

As a long-term vision, by promoting regenerative practices and zero deforestation, and creating economic incentives for sustainable practices, Nespresso is working towards reducing its carbon footprint while fostering resilient farming communities. In Chapter 4.2 the described strategies of Nespresso in Uganda will be categorized and the ones categorized as climate change mitigation contribute to carbon insetting and therefore the reduction of Nespressos emissions towards Net Zero. The SBTi and CSRD (which also applies to Nespresso because it is a Non-EU company with significant EU activity with a turnover of over €150 million) both only allow offsetting of up to 10% of the emissions from the base year of a Net Zero plan (Directive of the European Parliament and of the Council, 2022; *Standards and Guidance - Science Based Targets*, n.d.). Therefore it can be assumed that the described actions are at least planned to contribute to an absolute GHG emission reduction of 90% compared to the levels from 2018. While the Net Zero Plan of Nespresso explicitly includes carbon removals, a percentage of planned offsets is not disclosed (*Nespresso The Positive Cup 2024*, n.d.).

To conclude, Nespresso's decarbonisation strategy in Uganda is primarily implemented through the AAA Sustainable Quality Program and focuses on regenerative agriculture, agroforestry, reforestation, and zero-deforestation commitments. These measures are aimed at reducing carbon emissions across the supply chain and improving farmers' livelihoods.

4.1.3 Creation of Shared Value

The concept of Creation of Shared Value (CSV) as described in Chapter 2.2 is a business concept that companies may use to generate simultaneous benefits for both business and society. In this case it contains social and environmental improvements that are integrated into the company's (Nespresso) core business strategy that generate both economic value for companies and farmers. As this thesis has a focus on environmental sustainability, the social strategies of Nespresso in Uganda are not considered specifically. Only when there is a strong interlinkage with environmental action.

The concept of CSV is used to analyse Nespresso's decarbonisation strategy and the climate-related actions by smallholder coffee farmers in Uganda. Is shared value creation taking place?

Smallholder farmers engage in several practices such as agroforestry, crop diversification, and organic fertilization. These practices contribute to enhanced soil health, increased yields, and protection against climate variability which ultimately leads to more

economic stability. More specifically agroforestry helps provide shade for coffee plants, improving their resilience to climate stress but can also enable farmers to sell carbon credits which generates an additional income possibility. However, Nespresso does not help farmers to engage in the carbon market in Uganda. Crop diversification like intercropping coffee with banana and other crops can reduce economic risks by diversifying income sources. Organic fertilization and pest management practices with organic materials can have the economic benefit of lowering costs for chemicals that would be needed otherwise.

Nespressos decarbonization strategy in Uganda, in particular the AAA Sustainable Quality Program, is supposed to emphasize regenerative agriculture and agroforestry. The programme facilitates higher quality coffee beans that are more resilient to climate change. This can ensure a more stable coffee supply chain for Nespresso. The agroforestry initiatives under the program have the potential to sequester carbon which contributes to Nespressos Net Zero Goal. The practices can also improve soil health and increase bean quality which elevates the economic value of the coffee production. The planned support of living income standards and zero-deforestation commitments can enhance the long term economic stability of the supply chain. This would reduce the risks of supply disruptions linked to climate change.

The alignment between smallholders' climate related farming activities and Nespresso's decarbonisation strategy results in shared economic benefits.

Carbon insetting through agroforestry creates a dual benefit. Nespresso progresses towards its carbon reduction goals and increases the economic value of the produce by elevating quality and yield volumes. At the same time farmers can gain access to carbon markets and increase climate resilience.

Also soil conservation and organic practices enhance the productivity of the farmers and improve the bean quality for Nespresso which leads to economic benefits for both parties. Those practices also decrease the vulnerability of farmers to climate shocks and general long term negative impacts. This leads to a more stable supply chain for Nespresso and an enhanced economic security for farmers. The organic practices mentioned regarding fertilization and pest control also decreases the dependency on chemical inputs and are cheaper for farmers while Nespresso benefits from a more sustainable, lower-carbon supply chain.

However certain trade-offs are also identified that may pose challenges for both parties. The transition to sustainable farming practices, such as agroforestry and organic fertilization, requires upfront investments in seedlings, organic inputs, and training. For smallholder farmers with limited financial resources, these initial costs can be a barrier, even though the long-term benefits of improved soil health and carbon credits are acknowledged. For Nespresso, the

training and other costs that arise during the program can also be seen as investment costs that can pose a barrier.

Furthermore, shifting from conventional farming methods to organic and regenerative practices may lead to temporary yield reductions during the adjustment phase. Farmers face a short-term risk of income loss, while Nespresso's supply chain may experience minor disruptions as productivity stabilizes. For example, in the case of agroforestry, those short-term risks may last several harvests, especially for perennial crops like coffee where agroforestry systems can take 3-5 years to mature, temporary yield reductions might occur (*Advantages and Disadvantages of Agroforestry*, 2024). This poses severe risks for smallholders who depend on consistent yields for daily subsistence and do not have financial buffers to absorb such delays in returns.

The results show that several actions taken by smallholder farmers and strategies implemented by Nespresso overlap in ways that generate mutual economic benefits. For example practices like agroforestry, organic fertilization, and crop diversification can contribute to increased productivity and resilience of farmers while at the same time improving the supply chain resilience of Nespresso, reducing carbon emissions, and improving quality.
However trade-offs were also identified including initial financial and labor-related investment costs for the implementation of sustainable practices which can be a burden for farmers.

4.2 Adaptation & Mitigation

The climate-related actions by the smallholder farmers and Nespresso’s decarbonisation strategy are linked to the analytical framework of this study in Table 1. The purpose of this section is to systematically link observed practices to the theoretical categories of adaptation and mitigation in order to better understand how the actors approach climate action and whether overlaps, conflicts, or gaps can be identified. The table serves as a foundation for the following subchapter and helps visualise the different types of climate-related actions in Ugandan coffee production.

The results show that agroforestry is the most prominent strategy, as it is implemented by both Nespresso and smallholder farmers. Its dual function, contributing to both climate adaptation and mitigation, is reflected through that as for the farmers financial incentives like increasing yields through climate adaptation and for Nespresso decarbonization play a significant role.

A few adaptation categories such as storage, mobility, and labour migration were not identified within the observed practices.

The mitigation actions identified are mainly about avoiding emissions/enhancing removals through natural practices rather than using advanced technology or solutions that need heavy infrastructure relying on low-cost approaches.

The farmers' actions generally tend more towards climate adaptation practices while the emphasis of Nespressos strategy is more on climate mitigation.

Category	Subcategory	Smallholder Farmers' climate-related Actions	Nespresso's decarbonisation Strategy
Climate Adaptation	**Environmental Management**	**Agroforestry** → Shade trees protect coffee plants from excessive heat, reduce soil erosion, and maintain soil moisture, enhancing resilience to climate stress.	**Agroforestry initiatives** → Shade trees protect coffee plants from excessive heat, reduce soil erosion, and maintain soil moisture, enhancing resilience to climate stress.
		Building trenches and terraces → Prevents soil erosion and manages water runoff	
		Rainwater harvesting → Captures and stores rainwater for irrigation during dry periods, improving water availability for crops.	

		Drip irrigation → Efficiently manages water use, reducing waste and ensuring crops are hydrated during drought conditions	
		Organic Mulching → Conserves soil moisture, regulates temperature, and prevents weed growth, enhancing crop resilience.	**Reforestation projects around riverbanks** → prevents soil erosion, reduces flood risks, and improves water quality.
		Biochar application → Enhances soil moisture retention and improves soil fertility, making crops more resilient to climate variability.	
		Switching to more climate-resilient coffee varieties → Increases the ability of coffee plants to withstand drought and pests, reducing vulnerability to climate impacts.	

	Diversification	**Crop diversification (bananas, yams, coriander)** → Reduces dependency on a single crop improving economic security in case of climate shocks.	**Promotion of diversified farming practices** → reducing vulnerability to climate impacts and stabilizing farmer income.
	Market Exchange	**Selling carbon credits** → creating an income stream linked to sustainable practices, enhancing economic stability	—
	Communal Pooling	**Being part of a cooperative** → Farmers share resources, knowledge, and financial support, and pool harvests to enhance collective resilience against climate impacts	—
	Storage	—	—
	Mobility	—	—
Climate Mitigation	**Reducing Emissions**	—	**Reduction of agrochemical fertilizers** → cutting emissions linked to chemical production and application.

	Enhancing Removals	**Agroforestry** → Trees sequester carbon, capturing CO_2 from the atmosphere and storing it in biomass and soil.	**Tree planting** → Trees sequester carbon, capturing CO_2 from the atmosphere and storing it in biomass and soil.
		Biochar application → Biochar stores atmospheric carbon in the soil for long periods.	**Agroforestry projects** → Trees sequester carbon, capturing CO_2 from the atmosphere and storing it in biomass and soil.
		Crop diversification → Improves soil carbon storage	**Crop diversification & reduced tillage** → Improves soil carbon storage
		Organic Mulching → creates an organic layer that sequesters carbon.	
	Avoiding/Displacing Emissions	**Organic pest control** → Avoids the use of synthetic pesticides, reducing associated emissions and soil contamination.	**Zero-deforestation commitments** → maintains existing carbon sinks, avoiding emissions from land-use change.
		Organic fertilization → Reduces the carbon footprint associated with synthetic fertilizers by using natural alternatives.	

		Avoiding deforestation → Preserves carbon sinks and prevents emissions from land clearing for new farming plots.	

Table 2: Categorization of Climate Actions by Smallholders and Nespressos' decarbonisation strategy

4.2.1 Adaptation & Mitigation Synergies & Trade-Offs

Building on Table 1, in which smallholder farmers' actions and Nespresso's strategy are qualified in terms of climate adaptation and mitigation, possible synergies and trade-offs can be identified. The synergies describe areas where actions simultaneously contribute to climate change adaptation as well as mitigation. The trade-offs represent situations, where efforts to achieve one objective (climate change adaptation or mitigation) may limit or even conflict with the other.

The following actions or farming practices provide synergies:

- Agroforestry: Both smallholders and Nespresso employ agroforestry as a main strategy. Agroforestry trees sequesters carbon dioxide (mitigation) while at the same time providing shade which protects the coffee plants from climate stresses, decreases soil erosion, and improves soil health (adaptation).
- Soil Conservation and Organic Practices: Techniques like mulching, biochar application and organic fertilization improve the holding capacity of soil moisture and enhance soil fertility (adaptation). Additionally, mulching and biochar application enhance carbon storage while organic fertilization reduces chemical inputs that contribute to GHG emissions (mitigation).
- Crop Diversification: Farmers' practices of planting other crops in addition to coffee enhances their climate resilience as it spreads risks from climate impacts over several crops that can bring income (adaptation). At the same time, crop diversification enhances the carbon storage potential of the soil (mitigation).
- Reforestation projects around Riverbanks: Nespressos reforestation projects restoring cover along riverbanks can prevent soil erosion and reduce flood risk (adaptation). The reforested areas also enhance carbon sequestration (mitigation).
- Soil and Water Conservation: A common practice identified in the Interviews was trenching and terracing. It has adaptation functions like water management (reducing runoff, improving water retention) and soil conservation (minimizes erosions and at the same time has mitigation functions like carbon sequestration (improving soil structure which helps maintain soil carbon storage potential) and reducing land degradation.

Trade-offs are also identified:

- Zero Deforestation Commitments: Nespresso states that farmers that are part of their AAA program commit to a Zero Deforestation agreement. While the reduction of deforestation contributes to climate change mitigation it could reduce the adaptive capacity of farmers. In cases where farmers might otherwise expand cultivation into forested areas in response to climate stress on existing farmland conflicts might arise.
- Crop diversification: This activity was already mentioned under synergies due to its potential to enhance climate resilience while enhancing carbon storage potential of the soil. However this might not always be the case as it depends on the crops in question. Some crops might have higher carbon sequestration potential than others. Therefore while contributing to climate change adaptation of farmers there could be cases where crop diversification reduces carbon sequestration potential and therefore leads to trade-offs in climate mitigation.

The results show that certain adaptation and mitigation strategies employed by smallholder farmers and supported by Nespresso lead to synergies that address both objectives simultaneously, while specific trade-offs highlight areas where efforts to achieve one may constrain the other. More synergies were identified than trade-offs.

5. Discussion

5.1 Empirical Results and Theory

The findings show that both smallholder farmers and Nespresso implement strategies that overlap significantly. A good example for that is the implementation of agroforestry. It is used by farmers mainly to enhance climate resilience on their farms (adaptation) and promoted by Nespresso partly for its potential to sequester carbon (mitigation). This dual role was already acknowledged in the literature review (Mbow et al., 2014; Taillandier et al., 2023; Verchot et al., 2007) and therefore identified as a very promising action that is beneficial for both smallholders and corporate actors. The high prevalence of agroforestry in the conducted document analysis and the acknowledgement of all interview partners that it is a good strategy to link climate change adaptation and mitigation therefore confirm the theoretical findings.

Similarly, environmental management practices like mulching, biochar application, and organic fertilization are actions used by farmers to improve soil health leading to an increase in

productivity. At the same time, they reduce dependency on synthetic inputs, which can be of both financial benefit for the farmers and have environmental benefits as those organic practices are usually less carbon intensive as the use of chemical fertilisers as they contribute to carbon sequestration and emit less carbon in production. This also supports decarbonisation efforts and therefore can be beneficial to larger companies. The literature review also identified practices like integrated soil fertility management, irrigation and soil and water conservation to provide benefits across both climate mitigation and adaptation goals (Aryal et al., 2020; Bryan et al., 2013; Harvey et al., 2018; Rahn et al., 2014). While mulching, biochar application and organic fertilization can be categorized as soil fertility management, the identified practice implemented by farmers of trenching and terracing is a soil and water conservation practice. As described in chapter 4.2.1, it also contributes to both mitigation and adaptation goals. Out of the actions described in this paragraph, the use of organic fertilizers is the only action supported by Nespresso while all of them could be identified on the farmers side. This demonstrates the opportunity to include more practices with dual functions into corporate decarbonisation strategies and highlights how larger companies could learn about suitable local strategies from farmers if they interact with them more. While irrigation has been identified as an important practice with environmental benefits in the literature review, the empirical findings determined it as underutilized in Ugandan coffee production.

Crop diversification was another practice identified in both the literature review (Aryal et al., 2020; Harvey et al., 2018; Rahn et al., 2014) and primary data which has the potential to enhance household resilience by spreading income risks and at the same time may contribute to carbon storage. In the literature, it is mainly categorized as an adaptation practice however. Additionally, it has to be mentioned that the potential for carbon storage depends on the crop mix. Therefore it’s potential to either increase carbon storage or decrease it depends on the choice of crops. This means crop diversification can either provide mitigation and adaptation synergies or lead to trade-offs. To determine the outcome, factors such as the type of crops selected and the land-use changes involved must be considered in order to ensure dual benefits. This illustrates the complexity of designing effective climate strategies at the farm level and underlines the need for context-specific approaches. Additionally the literature review identified two main forms of diversification (Burnham & Ma, 2016). One being the adding to farmers crop mixes which was also observed in the research and the other one being diversifying livelihoods away from farming. This form of diversification could not be identified in the research. The same applies to “Labour Migration” which is closely linked to this form of Diversification. With more than 70% of Ugandan people working in agriculture this might be due

to limited opportunities outside agricultural practices (*The Smallholder Farmers of Uganda | FAO*, n.d.).

Reforestation along riverbanks is a strategy supported by Nespresso in Uganda which provides dual benefits by preventing soil erosion and sequestering carbon. While afforestation and reforestation practices on farmland was identified as an important mitigation strategy (Rahn et al., 2014; Wollenberg et al., 2012), this strategy was not identified in the literature review and therefore constitutes a new insight that came up during the research.

Generally the prevalence of environmental management practices and crop diversification as adaptation practices has been observed. This is in line with the seven-category typology presented by Burnham & Ma (2016) which was used for the analytical framework. The paper stated that those two categories are the most common ones which seems to hold true for the case of Uganda. Out of this typology, there were three categories that could not be identified in the research. As discussed above “diversification away from agriculture” and “labour migration” were not observed. Additionally “mobility”, the relocation of farming activities to more suitable areas was an adaptation practice that did not play a role in the research conducted.

Regarding the three climate change mitigation categories identified in the literature (Smith et al., 2008), there have been found prevalent examples in the empirical research for all of those categories.

When it comes to trade-offs, apart from the potential problems that could arise with crop diversification, potential constraints linked to zero-deforestation commitments have been identified. Those could constrain farmers from expanding to more suitable land for climate adaptation. Additionally the implementation costs for adaptation and mitigation actions in general have been identified as a serious hurdle. The danger of the financial burden of climate action falling disproportionately on producers and more specifically the influence of economic factors influencing adaptation choices was already briefly mentioned in the literature review (Atube et al., 2021) but became more clear over the course of the research. Most farmers in Uganda have very limited financial means (Bunn et al., 2019). Therefore it is crucial to come up with fair funding strategies to help farmers realise specific climate actions. This also applies to the risk of temporary yield reductions that may come with the implementation of a new farming practice. It would be fair and helpful to establish financial models that incentivise farmers to switch to certain sustainable practices without risking food security and income by reimbursing farmers for potential losses. The payment for carbon sequestration services has been identified

as a helpful model for farmers in this research and could play a role in solving those financial problems regarding adjustment phases.

5.2 Reflection on analytical framework

The analytical framework used in this thesis proved helpful for the analysis of the data overall.

The mitigation-adaptation distinction helped to systematically classify actions from both Nespresso and farmers and brought clarity to the environmental intent and function of specific practices. However, many practices (e.g. Agroforestry, biochar application) served both adaptation and mitigation purposes. Therefore an additional dimension, the concepts of synergies and trade-offs, were needed to reflect interactions between adaptation and mitigation goals that the core idea of the distinction between the two did not account for.

Additionally, as those implications are strictly from an environmental perspective, to add more depth it was helpful to include a more economic perspective with the concept of CSV. This helped reflect mutual gains for farmers and Nespresso. Combining technical (environmental) and value-based dimensions enriched the analysis.

While the core framework of adaptation and mitigation sets the foundation of the whole analytical framework I think adding synergies and trade-offs was equally important as it helped to reveal tensions and alignments which would not have been visible otherwise and are one of the main motivations of the research. The addition of CSV helped to add a new perspective but was not crucial for the research with an environmental focus.

6. Conclusion

6.1 Recap and Research Objectives

The thesis addresses the dual challenge coffee production faces. While on the one hand being vulnerable to climate change impacts, coffee production contributes significantly to carbon emissions and global climate change. Coffee farmers are facing negative climate impacts affecting the quality and quantity of their produce and therefore need to adapt to those impacts to keep coffee farming economically viable. At the same time there is a need to decarbonize coffee production to contribute to global GHG reduction efforts to lessen future climate impacts.

Companies are being pushed to decarbonize their supply chains to comply with environmental policies like the CSRD and to cater to customer demands. This leads companies to introduce strategies to achieve emission reductions. As described in the introduction a literature review identified a research deficiency regarding the relationship of the concepts of climate change adaptation and mitigation in coffee production, particularly coffee production in Africa being underrepresented in the research compared to other production areas in South/Latin America and Asia. Therefore a literature review was conducted to map the field of climate change adaptation and mitigation in coffee production in general and a case study was conducted providing primary data focusing on coffee production in Uganda examining both the decarbonization strategy of Nespresso as a larger company active in Uganda and the climate actions of smallholder farmers. The case study adds empirical data from East Africa to the debate which addresses the geographical imbalance of existing adaptation-mitigation studies. Consequently the thesis aimed to address this two-fold issue by analyzing corporate and farm-level climate actions of farmers and Nespresso as a company focusing on their potential synergies and trade-offs regarding climate change adaptation and mitigation. The guiding research question was:

In what ways can the strategy employed by Nespresso and the actions of smallholder coffee farmers in Uganda be classified as climate mitigation, adaptation, or both, within the context of coffee production?

This approach aims at identifying strategies and actions that contribute to both climate adaptation and mitigation and therefore benefit both farmers that try to sustain their livelihoods and help companies decarbonize their supply chains in a sustainable way, contributing to sustainable development. Also the identification of potential hurdles plays a significant role in determining best practices.

By mapping concrete actions onto an integrated analytical framework, this thesis offers empirical insight into how corporate climate strategies align, or fail to align, with smallholder climate actions. The empirical results show that the integration of adaptation and mitigation practices is possible but need to be considered carefully and context-specifically in order to work out successfully.

6.2 Answering the RQ

The central research question asking in what ways the strategy employed by Nespresso and the actions of smallholder coffee farmers in Uganda can be classified as climate mitigation, adaptation, or both, within the context of coffee production could be answered with the help of Table 2. All climate related actions and strategies implemented by smallholder farmers and Nespresso that were identified in the research, could be categorized as either climate change mitigation or adaptation, or both.

6.3 Recommendations to practitioners / policy makers

A central insight of the study was that while there are synergies regarding climate action in coffee production in Uganda the alignment of multiple levels of action and stakeholders would be helpful for the successful integration of those. On the corporate level, companies like Nespresso should design climate strategies that are flexible enough to accommodate farmers' context-specific needs. For example, carbon insetting programs should allow for adaptive land-use strategies as highlighted by the potential trade-off between zero-deforestation commitments and adaptation needs of farmers. Also Farmers need access to knowledge and financial resources to implement climate-smart strategies successfully. Training could become part of certification schemes, just as the AAA program already partly implements. On the policy level, governments and other stakeholders like NGOs can take a supporting role by incentivizing climate action and providing an infrastructure for example for ecosystem service payments like carbon sequestration. Therefore the enhancement of knowledge transfer between those different stakeholders at different levels is recommended to make sure local circumstances and farmers needs are accounted for.

As mentioned above financial assistance or carbon finance mechanisms can play a significant role in easing the adoption of climate smart practices. Therefore it would be advisable to enhance existing carbon credit schemes and look into other options of financing to support farmers.

6.4 Limitations

Regarding stakeholder representation in the interviews conducted for the case study it was initially planned to interview a representative from Nespresso. Despite efforts, a direct Interview with Nespresso was not conducted. This limits the insights into the decision making

behind the published climate strategy of Nespresso in Uganda and could have led to additional in-depth insights that have been missed in the analysis of Nespresso sustainability reporting. However, with Nespressos sustainability reporting being very comprehensive this did not constitute a large problem regarding the data collection.

Additionally, there was only one person per group (farmer, cooperative representative, NGO) interviewed. This limits the information gathered, does not make comparisons between statements of different members of the same group feasible, and leads to an increased danger of collecting subjective data that does not reflect nationwide circumstances.

Another limitation regarding the conducted interviews is that the interviews were clustered around stakeholders associated with the same NGO, which may have influenced the homogeneity of responses. A more comprehensive study would ideally involve various stakeholders from different areas of the country.

Those limitations are all partly linked to the general limitations that a Master's Thesis brings. There were severe time constraints and limited resources that did not make a larger scale and more comprehensive study of the topic possible.

6.5 Recommendations for further research

For further research the single case study that was conducted could be used for comparative studies across different coffee-producing regions. As mentioned above the results of this study might only be partly generalizable and conducting a comparative study might lead to insights on how contextual factors affect mitigation and adaptation and lead to more universally applicable results.

The research regarding direct climate related impacts on farm yields that was conducted as part of a document analysis failed to come up with specific numbers regarding climate impacts on yields. This showed that it would be very interesting to conduct quantitative studies that measure actual impacts climate change has on yields and quality of produce. On top of that it would be very interesting to conduct quantitative studies measuring actual carbon sequestration and yield effects specific agricultural practices have.

Also assessing outcomes of specific adaptation and mitigation practices over a longer period of time would add valuable information to the discourse of which practices are most suitable.

Finally, with financial and educational hurdles having been identified as a main barrier regarding the implementation of practices on the farm-level, research on affordability of

implementation of practices for farmers and finding suitable financial models to support farmers is recommended. On top of that the exploration of suitable educational models for knowledge sharing between farmers and other stakeholders would be beneficial.

Consequently, while this study focused mainly on the environmental implications, the synergies and trade-offs between climate-actions by smallholders and companies, it would be interesting to conduct research focusing more on the economic and social aspects of the topic. This could be done in studies focusing on one of the pillars of sustainable development or a larger study integrating all three pillars.

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Appendices:

Appendix A - Interview Questions:

Smallholder Farmer

- Have you observed changes in the weather/climate in the past 5 years? (If yes, which one? If not, please explain.)
- Has climate change/weather affected your coffee farming in the past 5 years? (If yes, how? If not, why not.)
- Have you adapted your farming practices because of climate change? (If yes, which ones? If not, why not.)
- Follow-up questions in case of adapted/new farming practices:
    1. Why did you choose these adaptations?
    2. What impact did these new practices have?
    3. What are the benefits and/or risks of the new practices?
    4. Did you receive any support to adopt new farming practices? If yes, what kind of support, and from whom?
- Does climate change have an impact on your:
    1. Income?
    2. Workload
    3. Long-term plans?
- Are/were you part of any climate-related project? If yes, please explain.
- Are/were you part of any climate-related project facilitated by Nespresso? If yes, please explain.
- Are there any climate-related requirements set by others you need to meet in your coffee farming/production? If yes, please explain.
- In climate action for coffee production, is the main focus on climate mitigation (e.g., reducing carbon emissions) or climate adaptation (e.g., planting trees in agricultural fields)?
    1. From you?
    2. From others?

Cooperative Representative

- Are the coffee smallholders you work with affected by climate change? (If yes, how? If not, why not?)
- Have the smallholder coffee farmers implemented farming practices for climate change adaptation? If yes, what are the most common strategies/practices?
- Does your cooperative support farmers in adapting to climate change? If yes, how? What kind of support do you provide?
- Is your cooperative involved in climate-related projects initiated by others? If yes, please explain.
- Is your cooperative supporting climate-related requirements for coffee production set by Nespresso? If yes, please explain. If not, why not.
- What kind of climate-smart practices for coffee production are promoted, and how widely are they adopted?
- In climate action for coffee production, is the main focus on climate mitigation (e.g., reducing carbon emissions) or climate adaptation (e.g., planting trees in agricultural fields)?
    - From you as a cooperative?
    - From the coffee farmers?
    - From others such as Nespresso?
- What are the biggest challenges in implementing climate adaptation or climate mitigation practices for the coffee smallholders you work with?
- What are the main drivers for coffee farmers to adopt new farming practices?

NGO Expert

- Are the coffee smallholders you work with affected by climate change? If yes, how? If not, why not?
- Have smallholder coffee farmers in Uganda implemented farming practices for climate change adaptation? If yes, what are the most common strategies/practices?
- Does your organisation support farmers in adapting to climate change? If yes, how? What kind of support do you provide?
- Is your cooperative involved in climate-related projects initiated by others? If yes, please explain.
- Is your organisation involved in climate-related projects facilitated by Nespresso? If yes, please explain. If not, why not.
- What is your opinion on climate-related requirements for coffee farmers set by parties such as Nespresso?

- In climate action for coffee production, is the main focus on climate mitigation (e.g., reducing carbon emissions) or climate adaptation (e.g., planting trees in agricultural fields)?
    - From you as a NGO?
    - From the coffee farmers?
    - From others such as Nespresso?
- What kind of climate-smart practices for coffee production are promoted, and how widely are they adopted?
- What are the biggest challenges in implementing climate adaptation or climate mitigation practices for the smallholders you work with?
- What are the main drivers for coffee farmers to adopt certain new farming practices?

Codes

In the qualitative analysis of the conducted interviews and the identified documents the following codes have been applied:

- Adaptation & Mitigation
- Actions
- Adaptation
- Climate Changes
- Climate Impacts
- Mitigation
- Nespresso engagement
- Strategies
    - Area of Action
    - Economic
    - Net-Zero Target
    - Specific Actions
- Support for Farmers
- Synergies
- Trade-Offs

Appendix B: Formalities

Official statement of original thesis

By signing this statement, I hereby acknowledge the submitted thesis (hereafter mentioned as “product”), titled:

Aligning Climate Change Mitigation and Adaptation in Coffee Production: Insights from Nespresso's Strategy and Smallholder Farmers' Actions in Uganda

to be produced independently by me, without external help.

Wherever I paraphrase or cite literally, a reference to the original source (journal, book, report, internet, etc.) is given.

By signing this statement, I explicitly declare that I am aware of the fraud sanctions as stated in the Education and Examination Regulations (EERs) of the SBE.

Place:Lanaken, Belgium

Date: 12.06.2025

First and last name: Tom Rost

Study programme: Sustainability Science, Policy and Society

Course/skill: Masters Thesis

ID number: 6403585

Signature:

Sustainable Development Goals (SDG) Statement

Name	Tom Rost
ID	6403585
Supervisor	Ron Cörvers
Date	19.03.2025

Through the research conducted for this master's thesis, I seek to contribute to one or more of the 17 SDG(s) set forth by the United Nations (https://www.undp.org/sustainable-development-goals). Specifically:

SDG Code(s): 1; 2; 10; 12; 15
Explanation:

This thesis aims to contribute to SDG 1: No Poverty and SDG 2: Zero Hunger by supporting smallholder farmers through identifying strategies to enhance their climate resilience and therefore helping to secure livelihoods. At the same time those strategies could improve food security by maintaining yields in spite of increasing negative climate impacts on agriculture, particularly in the global south.
The thesis also aims to contribute to SDG 10: Reduced Inequalities by analyzing whether mitigation and adaptation efforts by larger companies are also beneficial for vulnerable communities like smallholder farmers in the global south.
By analyzing mitigation practices in the agricultural sector it also aims to contribute SDG 12: Responsible Consumption and Production as those would contribute to implementing more sustainable practices in the coffee production which reduce environmental impact. By identifying ways of sustainable land management which contributes to preventing deforestation and maintaining soil health, the thesis also aims to contribute to SDG 15: Life on Land.

Statement on the use of Generative AI (GenAI) in the master thesis

I hereby certify that I adhered to the SBE guidelines on the use of GenAI tools such as ChatGPT in the master thesis. In the box below, I document how and for what purposes I used GenAI.

During the preparation of this work, I used GenAI for the following purposes:

- Search engine: Perplexity AI, ChatGPT
  I used Perplexity AI to search for relevant academic articles, policy documents, and reports on topics such as agroforestry, coffee value chains, and climate adaptation/mitigation strategies. ChatGPT was also used occasionally to clarify what types of sources or keywords could be useful for literature searches.
- Ideation helper: ChatGPT
  ChatGPT supported brainstorming research questions, setting up the analytical framework , and structuring the thesis (e.g., SCQA format for the introduction, possible synergies/trade-offs in the discussion).
- Text summarizer: –
- Explanation provider: --
- Language assistant: –
- Table editor: –
- Translator: –
- Other: –

After using any tool, I reviewed, quality-checked, and edited the content as needed and take full responsibility for the content of the thesis.

By signing this statement, I explicitly declare that I am aware of the fraud sanctions as stated in the Education and Examination Regulations (EERs) of the SBE.

Place: Lanaken, Belgium

Date: 12.06.2025

First and last name: Tom Rost

Study programme: Sustainability Science, Policy and Society

Course/skill: Masters Thesis

ID number: 6403585

Signature: